Current Account and External Financing

Kevin Cowan
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Series on Central Banking, Analysis, and Economic Policies

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Current Account and External Financing: An Introduction

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Economic analysts were surprised by the collapse of the Thai baht in July 1997. In the months that followed, most of the so-called East Asian Tigers faced severe balance-of-payments crises, and a year later, in August 1998, the Russian ruble was devalued. As a result of this succession of crises, the economics profession rethought many of its views on macroeconomic management. Lessons were drawn from the experience, and policy blueprints for avoiding future crises were developed. One of the key issues that emerged from the discussion is whether international capital markets are a source of stable and reliable financing, reacting optimally to changing global saving and investment patterns and conditions in emerging market economies, or whether they are a source of instability for these economies. The fact that many emerging economies with prudent macroeconomic policies have been hit by crises suggests that financing may be a source of instability. Further support of the "erratic finance" view is a historical pattern in emerging markets of current account deficits that grow when output is high—in apparent contradiction to the standard textbook model of the current account. Moreover, the question remains as to whether individual agents in emerging market economies will behave optimally in this erratic world, limiting their borrowing in anticipation of the next sudden stop, or whether they will act as if every

We would like to thank Norman Loayza and Klaus Schmidt-Hebbel for valuable comments and suggestions.

crisis is the last one, assuming that their countries fundamentals or global financial markets have evolved sufficiently to avoid the next round of turbulence.

In the decade since the eruption of the East Asian crises, a number of additional developments related to the current account and external financing have taken place, many of which contradict received wisdom. First, most emerging countries have been running large current account surpluses. Second, many advanced countries have been running large deficits—the United States is the most important case, but it is certainly not the only one. The combination of these two facts implies that capital has been flowing from poor to rich countries. Whether this pattern of capital flows is sustainable, and how adjustment will take place (if it is not) are key questions for policy makers in emerging economies. Another recent development is that several emerging market economies (including Chile) have seen growing gross international asset and liability stocks. For these countries, the current account is only one aspect of international financial integration, with gross flows and valuation effects playing an increasingly important role. The effect of these growing stocks of gross assets and liabilities on external adjustment in these economies is also a pressing policy concern. Closely related issues are: what is the optimal degree of capital account opening – both for inflows and outflows? Should taxes (or subsidies) be put in place to shift the composition of gross international assets and liabilities –towards FDI for example? Should small emerging economies actively try to issue external liabilities in domestic currency?

In addition to these global trends, several important policy issues for a small open economy (like Chile) remain open to discussion. What is the optimal exchange rate regime? And more specifically, should policy makers aim at a stable and depreciated exchange rate to foster growth? The ranges of policies in place (and recent experiences) suggest that we are far from a consensus on this issue. A closely related topic is the optimal level and composition of international reserves. Is it necessary to hoard reserves as a form of insurance against sudden stops? And if this is the case, how do optimal reserve levels vary with the level of gross international assets? Another key set of policy issues is whether the current account should be a policy target, the level of such a target, and the set of policies that should be implemented to pursue it.

This volume presents a group of papers that were presented and discussed at the Tenth Annual Conference of the Central Bank of Chile, "Current Account and External Financing," held in Santiago on

9–10 November 2006. The objectives of this conference were to further understand the causes and consequences of recent patterns in global capital flows, to further understand the determinants of external financing for emerging market economies, and to provide insight into some of the main policy issues relating to external financing mentioned above. In this introduction, we discuss the most salient issues related to current account imbalances and present a reader's guide to the volume.

1. Global Imbalances and Adjustment

In the last few years, the United States and other advanced Anglo-Saxon countries (including Australia, New Zealand, and the United Kingdom) have run large current account deficits. This unprecedented situation has generated concern among analysts and policymakers. Many argue that this situation is unsustainable and that, at some point, an adjustment will have to take place. Much of the recent research on the area explores whether the U.S. external adjustment will be gradual or abrupt, and how it will affect the (real) value of the dollar.[1] Three broadly defined camps have developed among policymakers. The first group comprises those who believe that some adjustment is indeed required but that it will be gradual. Scholars such as Blanchard, Edwards, Eichengreen, Feldstein, Frankel, Mussa, Obstfeld, and Rogoff fall into this group. The second group encompasses those who think that a substantial adjustment will not be necessary and that the large U.S. deficit reflects a new reality in the international financial architecture. The most forceful representatives of this group are Dooley and Garber; other academics in this group include Caballero, Cooper, Gourinchas, Hausmann, and Sturzenegger. The final group is made up of those that believe that major, and possibly catastrophic, adjustment will have to take place in the short run. The chief representative of this view is Roubini.

Most analyses of global imbalances focus on the behavior of large deficit countries, such as the United States. However, a full discussion on the topic—or at least a discussion that takes into account general equilibrium aspects—has to address the other side

1. See, for example, recent papers published in the 2005(1) issue of the *Brookings Papers on Economic Activity*; see also the articles in the September 2006 issue of the *Journal of Policy Modeling*.

of deficits: namely, surplus countries. Ben Bernanke made this point forcefully in a March 2005 speech (before he became Chairman of the Federal Reserve Board), in which he argued that the main cause of the U.S. external deficit was a major savings glut in the rest of the world. Bernanke's words generated significant controversy, and many newspaper pages and blogs were filled with commentary on the future Chairman's views.[2]

A number of scholars involved in the current debate argue that regional growth differentials are at the heart of global imbalances. The argument can be summarized as follows. Rapid growth in the United States has been associated with an increase in domestic investment (over savings), while slower growth in Europe and Japan has been associated with higher savings (relative to investment).[3] Global imbalances, the argument goes, are a reflection of regional growth differentials. An implication of this view is that, far from reflecting a serious problem, the large current account deficits in the United States are a sign of strength; they reflect the fact that the United States has been the engine of global growth over the last few years. According to this view, a realignment of growth—with an increase in growth in Europe and Japan and a slowdown in the United States—would play an important role in correcting global imbalances. In a recent interview, U.S. Secretary of the Treasury Hank Paulson "acknowledged to reporters that… he saw the problem of [U.S.] deficits as… part of the problem of other imbalances in other countries." The secretary went on to say that the United States "has for a good number of years now been growing much faster than the major developed trading partners, Europe and Japan." He then added that for the imbalances to be corrected, Japan and Europe had "to get the kind of growth on the consumption side that is going to make the difference."[4]

2. See Bernanke (2005). Some recent theoretical papers investigate this issue, inquiring under what conditions the large U.S. deficit could be maintained over time. See, for example, Dooley, Folkerts-Landau, and Garber (2004). See also Caballero, Fahri, and Gourinchas (2006), Loayza, Schmidt-Hebbel, and Servén (2000), and De Gregorio (2005). On the global savings glut, see Clarida (2005a, 2005b) and Hubbard (2005). One of the few empirical papers on the savings glut is Chinn and Ito (2005). See Chinn and Lee (2005) for a vector autoregression (VAR) analysis of two surplus countries; see also Gruber and Kamin (2005). Two important volumes with papers on the U.S. deficit and global adjustment are Bergsten and Williamson (2004).

3. This argument is very general and refers to the relationship between investment, saving, and growth; no causality is implied in the above statement.

4. Steven R. Weisman, "Paulson Shows Talent for Reflecting Criticism," *International Herald Tribune*, 27 September 2006; emphasis added.

In his paper in the current volume, Sebastián Edwards addresses the issue of the relationship between growth differentials and global imbalances. He uses historical data to investigate whether large surpluses are persistent, and he analyses the process and speed through which large surplus countries have reduced their imbalances in the past. A particularly important question within the current debate is whether current account surpluses have historically led to large and abrupt declines. This issue is relevant given that such abrupt surplus adjustments would be required if, as some fear, the United States and other Anglo-Saxon countries experienced a sudden stop of capital inflows and a rapid current account reversal. Edwards also investigates the connection between large surpluses and the business cycle, and he asks whether acceleration in the growth rates of the non-Anglo-Saxon advanced countries is likely to result on a decline in their surpluses and, thus, in global imbalances.

The paper documents several stylized facts regarding current account adjustments. First, very few large countries have had persistently large surplus-to-GDP ratios. Surpluses are most persistent in the Middle East, which mostly reflects the role of oil-exporting countries. Second, large and abrupt reductions in surpluses—what Edwards calls surplus adjustment episodes—are rare. Their incidence fluctuates between 3.0 percent and 6.6 percent of all country years. Third, these surplus adjustment episodes have been associated with real exchange rate appreciations and with deterioration in the terms of trade. Fourth, the econometric results reported in the paper indicate that the behavior of the current account balance can be explained by parsimonious models based on economic theory. Finally, the results obtained suggest that a decline in growth relative to long-term trend of 1 percentage point results in an improvement in the current account balance (that is, a higher surplus or a lower deficit) of one quarter of a percentage point of GDP.

These results indicate that a realignment of global growth, with Japan and the Euro zone growing faster and the United States moderating its growth, would only make a modest contribution toward the resolution of current global imbalances. The world is thus likely to require significant exchange rate movements even if global growth does realign. The analysis also suggests that a reduction in China's very large surplus will be needed if global imbalances are to be resolved.

2. External Adjustment in Emerging Market Economies: Reversals and Crises

One of the characteristics of emerging market economies that access voluntary international capital markets is the occurrence of large reversals of the current and capital accounts—events that Rudi Dornbusch termed sudden stops.[5] Until the mid-1990s, conventional economic wisdom placed the blame for these reversals on the domestic policies of the emerging economies, whether deficit fiscal spending (as in Krugman, 1979) or noncredible macroeconomic policies (as in Obstfeld, 1994). Many of the third-generation crisis models developed to explain the Asian and Russian crisis, however, allowed for imperfections in international capital markets that, when combined with domestic vulnerabilities, can lead to large capital account reversals.[6]

The chapter by Guillermo Calvo on the causes and consequences of sudden stops takes this view, arguing that events in international financial markets shift the supply of net saving available for emerging market economies. The surge in inflows to emerging markets in the 1990s is thus due partly to developments in U.S. corporate bond markets and partly to the Brady plan, which converted defaulted bank debt into tradable bonds. Likewise, according to Calvo, the sharp collapse in net capital flows to emerging market economies in the late 1990s largely resulted from the impact of margin calls on leveraged investors and changes in investor perceptions regarding International Monetary Fund (IMF) bailouts after the Russian crisis in 1998. The immediate implication is that emerging economies will be exposed to capital account volatility no matter how prudent their macroeconomic policies were, simply because they fall into a specific asset class.

This does not mean, however, that domestic policies do not matter. Calvo argues that several features of the domestic economy affect the extent to which this capital account turbulence translates into a full-fledged sudden stop, with the associated output and investment costs. Key among these features are the size of the current

5. See Milesi-Ferretti and Razin (1998) and Edwards (2005) for a discussion of the causes and consequences of current account reversals. On the causes and consequences of sudden stops, see Calvo, Izquierdo, and Mejía (2004) and Guidotti, Sturzenegger, and Villar (2004).

6. See Aghion, Bacchetta, and Banerjee (2001); Céspedes, Chang, and Velasco (2000); Corsetti, Pesenti, and Roubini (1999); Krugman (1998, 1999a, 1999b); McKinnon and Pill (1996); Schneider and Tornell (2004); Radelet and Sachs (1998).

account deficit and the size of the tradables sector. Combined, these two variables determine the exchange rate depreciation required to adjust the current account once capital markets close for emerging market economies. Domestic liability dollarization, in turn, affects the extent to which the resulting depreciation will lead to domestic financial distress.[7]

Emerging market economies can thus potentially avoid the dangers of capital market turbulence, but changing the level of openness and liability dollarization is likely to be a gradual process. In the meantime, Calvo proposes moving forward with reforms to international financial markets, perhaps by creating a fund that stabilizes the price of emerging market debt. A closely related issue is the capacity of countries to self-insure against sudden stops, an issue discussed by Aizenman (in this volume), Caballero and Panageas (2004), García and Soto (2005), and Jeanne and Rancière (2006).

Whereas Calvo's chapter focuses on the levels and changes of capital and current accounts (net flows), chapters 4 to 7 extend this analysis to include additional aspects of international capital flows and reversals. All four contributions are motivated by the fact that gross capital flows have grown rapidly in recent years, in both developed countries and emerging market economies. The chapter by Fostel and Kaminsky and the chapter by Cowan, De Gregorio, Micco, and Neilson focus on gross capital flows—that is, the changes in international liabilities and assets. The chapters by Pistelli, Selaive, and Valdés and by Gourinchas, on the other hand, discuss the impact of stocks of international assets and liabilities and their valuation on international adjustment. The paper by Fostel and Kaminsky focuses on one component of gross capital inflows: namely, primary issuance by Latin American economies in international markets[8]. The paper builds a data set that assembles information on the issuance of bonded debt, equity, and syndicated loans from 1980 to the present. Using this data set, the authors characterize the access of emerging market economies in Latin America and the Caribbean to international financial markets. In some aspects, the pattern that emerges is very similar to that of

7. Several recent papers address the risks of liability dollarization. For a survey of the macroeconomic evidence, see Levy-Yeyati (2006); for a survey of the microeconomic evidence, see Bleakley and Cowan (2007).

8 Net capital flows are made up of inflows (changes in the liabilities of residents) and outflows (changes in the international assets of residents). Inflows, in turn, equal the primary issuance of liabilities minus the repayment of existing liabilities. For example, a bond issued by PEMEX will increase inflows. Repayment of this bond will reduce inflows.

net capital flows: a boom in the early 1980s, followed by a closure of markets in the wake of the debt crisis, followed by a new boom in the early 1990s. The patterns diverge in the late 1990s, however. Whereas net flows indicate a complete closure of capital markets, gross primary issuance shows that the private and public sectors were accessing markets even in the midst of the crisis in 1998 and 1999. Issuance did fall, but this was not a full closure of markets. This view stands in contrast to Caballero and Krishnamurthy (2002), who suggest that sudden stops are the result of a full closure in capital accounts.

More generally, Fostel and Kaminsky seek to identify the extent to which primary issuance for the largest Latin American countries is driven by domestic or global factors. The answer is mixed. Although domestic macroeconomic variables are uncorrelated with issuance, domestic political variables do matter. At the same time, global factors measuring global liquidity or risk appetite (namely, the term structure of U.S. rates and the high-yield spread) and crisis events in other emerging market economies are correlated with gross issuance, with higher liquidity and less risk appetite leading to higher gross issuance. Indeed, the authors find that the boom-bust cycle that started in the early 1990s was largely driven by global events.

Cowan, De Gregorio, Micco, and Neilson emphasize that sudden stops may be less frequent than many authors argue. The authors categorize large capital account reversals according to the importance of changes in gross inflows in the net change.[9] At one extreme—and closest to the view that international markets are the source of vulnerability—are sudden stops driven fully by reversals in inflows. At the other are sudden stops triggered by domestic agents running for the door, as was the case in Chile in 1998.

The results presented by Cowan, De Gregorio, Micco, and Neilson do not imply that international financial imperfections do not play a role. Most sudden stop episodes are indeed driven by inflow reversals. The authors suggest, however, that the role of these external shocks may be overstated, and that closer attention needs to be paid to domestic variables that lead to large outflows by residents. The authors further argue that the key difference between developed and emerging economies is not the fickleness of international capital inflows, but the response of outflows to these changes. In developed economies, inflows and outflows covary closely, so that inflow stops are usually matched with a reduction in foreign assets (and vice versa). This result

9. Faucette, Rothenberg, and Warnock (2005) pursue a similar line of research.

has interesting policy implications. It suggests that countries have several lines of defense against international financial shocks. The first involves assets and liabilities themselves. A highly integrated country can accommodate an inflow shock by running down foreign assets. Reserve accumulation is one (centralized) way of doing this. Lacking reserves or other foreign assets, a country must move to its second line of defense—that is, its ability to generate foreign liquidity from its productive assets. This point is emphasized by Calvo (in this volume), when he argues that the ratio of the current account deficit to the size of the tradables sector is key in explaining resilience to international financial shocks.

The growing gross flows that motivate chapters 4 and 5 go hand in hand with the growing stock of international assets and liabilities that motivates the contribution by Pistelli, Selaive, and Valdés. The sum of gross international assets and liabilities over GDP in developed economies increased from 0.45 to 3.0 between 1970 and 2005. For emerging markets, the ratio rose from 0.15 to 1.20 in the same period. The chapter explores the impact of these stocks of international assets and liabilities on several aspects of international adjustment. It analyzes how current account deficits (flows), gross international asset and liability positions (stocks), and valuation effects (prices) influence the likelihood of current and capital account reversals, movements in the exchange rate, and country risk ratings. The key finding by Pistelli, Selaive, and Valdés is that both flows and gross stocks matter for the likelihood of current account reversals and sudden stops. They also find that a larger current account deficit in the previous period increases the likelihood of both forms of reversals, which is line with the findings of Milesi-Ferretti and Razin (1998) and Edwards (2002, 2004). More interestingly, however, they report that the composition of gross assets and liabilities (but not their level) matters for the likelihood of reversals: larger shares of portfolio equity in gross assets and larger share of foreign direct investment (FDI) in gross liabilities reduce the likelihood of these crises. These findings support the work of Levchenko and Mauro (2006) on FDI liabilities. Moreover, taken together with the results from Cowan, De Gregorio, Micco, and Neilson (in this volume), they paint a broad picture in which stocks of (liquid) international assets play an important role in reducing the probabilities of current account or financial account closures.

The chapter by Pistelli, Selaive, and Valdés also provides evidence on the effect of changes in the prices of assets and liabilities in country portfolios on external adjustment. Although the impact on crisis probabilities is smaller than the effect of the current account deficit, positive valuation effects (that is, rising prices in gross assets vis-à-vis liabilities) make current account reversals and exchange rate crisis less likely.

Because of the rising stocks of gross assets and liabilities, changes in the value of these assets and liabilities (stemming from individual asset price or exchange rate fluctuations) are playing a growing role in the international adjustment process. These valuation effects are often larger than current account deficits. The chapter by Pierre-Olivier Gourinchas summarizes recent research on the implications of these valuation effects for international adjustment in developed and emerging economies.

The bottom line of this chapter is that the simple intertemporal approach to the current account is incomplete, because current accounts do not include the unrealized capital gains that arise from valuation effects. The most recent example of this is the U.S. current account deficit. The United States earns systematically different returns on its foreign assets and liabilities, which allows for sustainable current account deficits. Possible explanations for these persistent return differences include the use of the U.S. dollar as a reserve currency, the maturity differences in U.S. assets and liabilities, and the premium on the high liquidity of U.S. asset markets.[10] Hence, no adjustment may be needed to the current deficit. The flip side is that emerging market economies need to generate long-run current account surpluses in order to pay the United States for the liquidity of their assets and other services of the dollar and U.S. financial markets.

Valuation effects also have important implications when adjustment is needed (for example, in response to adverse terms-of-trade shocks). Here the key variable is the currency composition of gross assets and liabilities. Consider the case of the United States, with liabilities in U.S. dollars and assets in foreign currency. In the face of a negative terms-of-trade shock, the required adjustment of the real exchange rate for the United States will be reduced by its liability and asset structure. A currency depreciation has two effects. On the one hand, it increases exports and decreases imports. On the other, it increases the dollar value of foreign assets (and the gross factor payment for these assets). The picture is different for most emerging market economies.

10. These persistent differences have variously been termed the exorbitant privilege (Gourinchas and Rey, 2005) and dark matter (Hausmann and Sturzenegger, 2006). See also Caballero, Farhi, and Gourinchas (2006).

Emerging markets often only have international liabilities, which are denominated in dollars (or other international currencies). In this case, valuation effects hinder adjustment, as the trade effects of an exchange rate depreciation are offset by a higher local currency value of foreign liabilities. The empirical relevance of this channel in emerging market economies remains untested, however, given the lack of data and, especially, good measurements of the currency composition of assets and liabilities. Hence, a first implication is the urgent need to expand the available information on the currency composition of gross assets and liabilities in emerging economies.

3. External Adjustment in Emerging Market Economies: Current Account and Exchange Rate Dynamics

In addition to being subject to large reversals, current accounts are more pro-cyclical in emerging markets than in developed economies (rising with positive output or terms-of-trade shocks). Many observers interpret this as additional evidence of international financial imperfections. The next two chapters of the volume explore this aspect of international adjustment using dynamic stochastic general equilibrium (DSGE) models. One advantage of this approach is that it allows the analyst to evaluate not only whether certain frictions can generate changes in the direction observed in the data, but also whether they can match the size of the changes.

DSGE models have become the workhorse of macroeconomic analysis in the last few years. They have proved particularly useful for understanding how advanced economies react to a number of shocks. A limitation of this approach, however, is that most models are not particularly well suited for analyzing the behavior of emerging economies. They tend to predict too much consumption smoothing, counter cyclicality of key variables, and relatively low volatility. A number of authors have recently modified some of the key assumptions of the standard DSGE in an effort to better capture the peculiarities of middle-income and emerging economies. Although these efforts represent important contributions toward a better understanding of the dynamic behavior of emerging markets, they do not fully capture the specificities of nations with strong commodity export bases, such as Chile.

In his contribution to this volume, Jaime C. Guajardo develops a DSGE model for the Chilean economy. He makes a number of adjustments to the standard model in order to capture the most important features of the actual economy. First, he considers the existence of capital market imperfections; in particular, he assumes that the country in question has limited access to the international capital market, identified as an external borrowing constraint. Second, he assumes that domestic firms have differing abilities (capacity) to tap capital markets, with firms producing tradable goods having an advantage over firms producing nontradables. These types of asymmetry have been considered by scholars such as Caballero, Tornell, and Westermann. Guajardo's main result is that both financial constraints and sector-specific financing wedges are needed for the model to replicate the Chilean data. This sector-specific component is one possible explanation for the apparently contradictory results obtained in the second DGSE model in the volume, in the contribution by Aguiar and Gopinath.

After discussing the most salient features of emerging market business cycles, Aguiar and Gopinath develop a model in which middle-income countries may default on their debts. Their formulation is based on early work by Eaton and Gersovitz (1981) on sovereign borrowing. Shocks to interest rates are introduced in the Euler equations.[11] An important characteristic of this model is that interest rate shocks are related to productivity shocks. This allows for a richer response of both consumption and investment.

The authors then use the model to analyze the case of Mexico. They consider two cases. In the base case, they only allow for productivity shocks, and they find that the random walk component of the Solow residual is twice as high as that of Canada. This is in line with previous work by the authors, in which they argue that the main difference between emerging and developed economies is not their access to financial markets, but the persistence of their productivity shocks. In the second exercise, the authors incorporate interest rate shocks, and they find that the random walk component of total factor productivity (TFP) growth remains almost at the same level as before. This leads the authors to conclude that the addition of interest rate shocks at the level of the Euler equations "add[s] little to matching the facts in the data for emerging markets." Finally, Aguiar and Gopinath analyze Chile's macroeconomic data and find a pattern of behavior similar to that of other emerging economies.

11. Other authors introduce stochastic disturbances directly into interest rates (Neumeyer and Perri, 2005).

Taken together, two lessons emerge from the chapters by Guajardo and by Aguiar and Gopinath. The first is that it is a mistake to focus exclusively on international financial imperfections (or restrictions) in explaining macroeconomic patterns in emerging market economies. The second is that simple (symmetric) financing constraints do a poor job in replicating emerging market dynamics. The immediate implication is that the profession needs to start thinking beyond models of aggregate external financing restrictions. How international saving is intermediated in the domestic financial system (and among domestic agents) therefore becomes an important research question (an issue raised in Caballero and Krishnamurthy, 2002).

Medina, Munro, and Soto, in turn, develop a stochastic general equilibrium model to analyze the dynamics of current account behavior in two commodity-producing countries: Chile and New Zealand. By considering two commodity-exporting nations at different stages of economic development and with different institutional and market structures, they are able to provide a rich discussion of the role played by different factors in current account behavior. They find that foreign financial conditions, foreign demand shocks, and commodity price shocks account for more than half of current account variations in both countries at horizons of up to four years. The most important external shock is the change in foreign financial conditions. The most important domestic shock in both countries was the domestic investment shock, whereas monetary and fiscal shocks (defined as deviations from estimated policy rules) played a minor rule.

One important difference between the two countries is that commodity prices have a larger impact in New Zealand than in Chile. The authors interpret this as reflecting differences in ownership structure: while the export sector is domestically owned in New Zealand, foreign companies and the public sector are most important in the Chilean copper industry. A second difference is in the currency composition of foreign debt, an issue addressed in detail below.

4. Policy Issues

Several of the papers in this volume directly address the policy issues listed at the beginning of this introduction. We summarize the main results of these chapters in this section.

An interesting recent development in emerging market economies is the growing stock of international reserves. Despite the common trend, however, reasons given by countries for holding these reserves vary. A first set of countries hold reserves as self insurance against shocks, which ideally implies reducing the volatility of the economy (see, for example, García and Soto, 2005; Caballero and Panageas, 2004; Jeanne and Rancière, 2006). A second set of countries use reserve accumulation as a mechanism for fostering GDP growth by limiting real exchange rate misalignments or, more actively, by implementing a mercantilist motivation (see, for example, Aguirre and Calderón, 2006). The chapter by Joshua Aizenman addressees the benefits of reserve hoarding as a means of reducing volatility. The author revisits the empirical evidence of Aizenman and Riera-Crichton (2006) on the impact of international reserves on the real exchange rate's sensitivity to terms-of-trade shocks. The main finding is that reserves affect the elasticity of the real exchange rate to terms of trade in emerging economies. Aizenman rationalizes this finding by presenting a theoretical model in which maintaining and using international reserves is a way of avoiding early liquidation in a world of banking intermediation (à la Diamond and Dybvig, 1983) and shocks to project returns. Terms of trade would be, in his view, an important determinant of project returns.

Aizenman also presents evidence that, for developing countries, a larger stock of international reserves is positively associated with higher persistence of the current account. Aizenman first measures the persistence of the current account ratio country by country and then seeks to explain the variation in cross-country persistence with different covariates, including international reserve holdings. He concludes that, insofar as a more persistent current account signals a lower likelihood of sudden adjustments, international reserve hoardings provide a clear benefit by lowering volatility. This finding is broadly in line with the policy prescriptions of Calvo's chapter, where reserves play a role in self-insuring against global financial turbulence.

The insurance motive provides a powerful rationale for international reserve accumulation. However, hoarding international reserves also entails costs in terms of financial expenses and moral hazard (including the dollarization of liabilities if reserve accumulation is taken to signal low exchange rate volatility).[12] These

12. Soto and others (2004) undertake precisely that type of evaluation for the case of Chile for the early 2000s; they conclude that the country's stock of reserves at that moment was excessive.

costs, as well as the costs arising from international coordination and competition, are behind Aizenman's conclusion that reserve accumulation is no panacea.

With regard to the role of international reserve accumulation in promoting growth (either by stabilizing the exchange rate or through an undervalued currency), the chapter by John Williamson defends the idea that central banks should include an active intervention policy to avoid exchange rate misalignments within a flexible exchange rate regime. He argues that this policy does not compete with price stability—the primary goal—but is crucial to avoiding the detrimental effect of misalignments on growth (see Aguirre and Calderón, 2006; Prasad, Rajan, and Subramanian, 2007). Drawing on evidence of imperfect exchange rate markets, he argues that central banks should not commit to being on the sideline of the market. As a concrete approach, he proposes that the monetary authority regularly publish an exchange rate zone (based on effective real exchange rate calculations) within which it would not intervene. Outside that zone, the authority would have the right (but not the obligation) to intervene. This approach is different from actual practice, even in countries that have heavy intervention policies in place, but it is an interesting idea to asses.

Williamson and Aizenman both discuss the merits of using international reserves to persistently undervalue the local currency, foster competitiveness, and thus promote export-led growth. Both conclude that the strategy is dubious. Williamson argues that even if there is a growth-maximizing real exchange rate, and that this rate is different from the one determined by economic fundamentals, the reserve-hoarding strategy poses two practical problems. First, the value of that optimal real exchange rate level is unknown, and, second, foreign exchange market intervention policies are not able to sustain a persistent undervaluation. If policymakers do engage in trying to undervalue the currency, they should adjust fiscal policy, use capital account regulations, save abroad, or impose taxes on exports. He warns, however, that all of these practices are politically complex and have important side effects.

Aizenman's argument runs on somewhat different grounds. First, he claims that the precautionary motive better describes current reserve policies than the mercantilist motive (Aizenman and Lee, 2005). Second, he argues that what really matters in Asia (the region where this strategy could have been played out more clearly) is not the exchange rate effect of international reserve accumulation, but its role in financial policy more broadly, particularly as a buffer for financial distress. What Japan and Korea had in the past and China has today is financial, rather than monetary, mercantilism. Nevertheless, it is quite difficult to empirically disentangle the motives behind reserve accumulation. Standard economic fundamentals do appear as statistically significant determinants in estimates of demand for reserves (see Soto and others, 2004; Redrado and others, 2006), but they explain a very small portion of the total variance. Country fixed effects continue to be the dominant variable, by far.

Another policy issue discussed in the volume is the effect of the currency composition of financial liabilities on the economy's behavior under different shocks. In this regard, Calvo discusses the dangers of domestic liability dollarization and the merits of alternative policies that help attenuate it. Taxes to discourage dollar borrowing are difficult to implement and may be costly for growth. Exchange rate volatility, which would make exchange rate risk more obvious to the private sector and thus limit liability dollarization, has other disadvantages, such as hindering trade. In Calvo's view, issuing public debt in a country's own currency is a valuable first step to avoiding domestic liability dollarization. However one should not ignore the traditional moral hazard arguments (time inconsistency) associated with peso-denominated public debt.

Aizenman also addresses the issue of domestic liability dollarization, emphasizing the moral hazard effects of an active reserve management policy that artificially lowers the perception of exchange rate risk to the public and thus exacerbates dollarization. Moreover, one could argue that the larger the foreign exchange rate position of a central bank (that is, the mismatch between dollars and pesos), the larger must be the liability dollarization of the rest of the domestic economy if foreigners are not holding more pesos in their portfolios. Thus, the simple aggregation of the different sectors' balance sheets shows that higher reserve accumulation can yield higher liability dollarization for the private sector.

The issue of liability denomination is again taken up in the chapter by Medina, Munro, and Soto, who analyze how the Chilean economy would respond to different shocks if its external debt was denominated in pesos rather than dollars. For the exercise, they use their DSGE model estimated for both Chile and New Zealand to study the dynamics of the current account. The differences found between the parameterizations of peso-denominated debt and dollar-denominated debt are moderate, which is not surprising given that their model does not have balance sheet effects with real effects through financial frictions, although they do consider standard valuation effects arising from currency mismatches. In general, GDP, consumption, and investment are less sensitive to external shocks if the debt is denominated in pesos instead of dollars. Monetary policy has less of an effect on the current account under peso debt than under dollar debt, mainly through higher net interest payments.

Another issue analyzed both directly and indirectly in some of the chapters of this volume has to do with the desirability and feasibility of targeting the current account. In this regard, the different countries' experiences documented throughout the volume provide a rich source of perspectives. Among the cases discussed in the volume, the policy framework in place in Chile in the 1990s (analyzed by Medina, Munro, and Soto) is at one extreme. A ceiling for the current account deficit was a declared policy target for the Central Bank (together with price stability), while an exchange rate band and active monetary policy accompanied by capital controls were the instruments used to achieve these objectives (see Massad, 1998).

At the other extreme is the case of Australia in the last decade and a half. As the chapter by Belkar, Cockerell, and Kent documents, the large and persistent current account deficit has been regarded as an equilibrium phenomenon—the Pitchford thesis—which should not be distorted by policy actions. Within a well-established inflation-targeting-cum-floating framework, Reserve Bank officials have stated that the current account deficit should not be an objective for monetary policy. Indeed, the most prominent dissenting views on the Australian policy choices have come from external institutions, particularly the IMF and the Organization for Economic Cooperation and Development (OECD), while both the government and the domestic academia hold the hands-off view. This was not always the case. In the early 1980s, for instance, fiscal policy was geared toward consolidation largely because of the external deficit, while structural reforms were also packaged as serving to close the external gap. New Zealand (which is revisited in Medina, Munro, and Soto's chapter) also has an inflation-targeting-cum-floating regime and similarly does not regard the current account as a policy objective.

The experience of the Asian countries, as analyzed in Ramon Moreno's chapter, lies in between the cases of Chile in the 1990s and Australia. Although the current account deficits in the 1990s were considered too large in some countries and policy measures were designed to moderate them, the authorities faced severe constraints to achieving this as a target. In the first place, policymakers focused on fostering private savings rather than moderating investment, because high GDP growth was a priority. In addition, monetary policy was not used mainly because of exchange rate constraints. Hence, although the current account was a target, the lack of instruments precluded its control.

From the perspective of desirability, one could argue that the evidence discussed in the chapters by Calvo on sudden stops and Pistelli, Selaive, and Valdés on reversals implies that a large current account deficit is a variable to which policymakers should react. In the past decade, however, the discussion in several countries has shifted away from the view that the current account deficit should be considered as a leading indicator of vulnerability to external crisis. The chapter on Australia pushes this idea, arguing that both the details behind what is driving the current account and other supplementing indicators should be analyzed. In Asia, the approach seems to be similar: according to Moreno, current account deficits were not deemed extremely dangerous in the mid-1990s because they reflected an investment boom. Today, even if that were the case, policymakers would look at other indicators such as credit growth and investment ratios as signals of excess.

What is clear is that standard macroeconomic policies that exacerbate large external deficits should be avoided. Because episodes of large current account deficits are strongly correlated with episodes of domestic boom this is likely to be the case. Interestingly, Medina, Munro, and Soto report that external variables (both real and financial) and investment-specific shocks play a key role in explaining the path of the current account over the last couple of decades in both Chile and New Zealand. Neither fiscal nor monetary policy shocks have a prominent responsibility in explaining the large deficits.[13]

An additional instrument that some countries have used to influence the current account is capital controls. In his chapter Calvo discusses one specific type—namely, a tax on dollar debt—as a tool for limiting domestic liability dollarization and, therefore, for minimizing a structural vulnerability. Williamson also argues that capital controls

13. Permanent productivity shocks do not have an important role either, which contrasts with arguments in the chapter by Aguiar and Gopinath.

on inflows could, to some extent, limit an exchange rate overvaluation and even depreciate the currency persistently. Moreno, who focuses on the experience of Southeast Asian countries, concludes that the effectiveness of controls put in place varied and that, at any rate, they did not prevent the Asian crisis. Particularly interesting is his discussion of the experience of Malaysia in the mid-1990s, whereby controls appeared to reduce some vulnerability indicators relative to peer countries, but they did not prevent the build up of current account deficits.

The previous discussion is part of a broader question: whether restricting capital mobility reduces emerging countries' vulnerability to current account reversals or other shocks. Empirical evidence reported by a number of scholars—including some authors represented in the current volume—indicate that capital controls do not significantly reduce the probability of facing an external shock, such as a current account reversal.[14] In the current volume, the contribution by Cowan, De Gregorio, Micco, and Neilson suggests that financial integration has a stabilizing effect, by allowing countries to accommodate non fundamental shocks to gross inflows and outflows. Moreover, a number of papers document that restricting capital mobility results in non trivial distortions and microeconomic costs.[15]

Finally, Calvo argues that establishing a global fund to stabilize key international financial prices has the potential of helping stabilize emerging market economies. The basis for this claim is that foreign financial shocks, coupled with domestic vulnerabilities, are the main financial problems in these economies. The shocks would therefore be smaller if a fund was able to suppress, or at least limit, excess volatility in international financial markets, in particular key financial prices such as credit spreads. This role, according to Calvo, should go beyond providing information (or surveillance) and would require actual trading. Of course, a fund of this type would need strong international support[16]. Other shortcomings include the side effects that could arise in other markets not considered by the stabilization fund.

14. See De Gregorio, Edwards, and Valdés (2000).

15. See Forbes (2003) for an analysis of the Chilean case.

16. The fact that the fund would trade against private markets raises the potential for large losses that would require additional capital contributions from countries leaving the fund susceptible to strong political pressures.

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On Current Account Surpluses and the Correction of Global Imbalances

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The United States has run an increasingly large current account deficit over the last few years. J. P. Morgan forecasts that in 2007 the deficit will reach almost one trillion dollars, or 7 percent of GDP. This unprecedented situation has generated concern among analysts and policymakers. Many argue that this deficit is unsustainable and that, at some point, it will have to decline. Much of the recent research on the issue examines whether the U.S. external adjustment will be gradual or abrupt, and how it will affect the (real) value of the dollar.[1]

Of course, one country's current deficit must be another country, or countries, surplus. Any discussion of the decline of the U.S. deficit therefore implies a discussion of the reduction of the rest of the world's combined current account surpluses. Federal Reserve Chairman Ben Bernanke made this point forcefully in a March 2005 speech—before he became Chairman—in which he argued that the main cause of the U.S. external deficit was a major "savings glut" in the rest of the world. Bernanke's words generated significant

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1. See, for example, recent papers published in the 2005(1) issue of *Brookings Papers on Economic Activity*; see also the September 2006 issue of the *Journal of Policy Modeling*.

Current Account and External Financing, edited by Kevin Cowan, Sebastián Edwards, and Rodrigo O. Valdés, Santiago, Chile.

controversy, and many newspaper pages and blogs were filled with commentary on the future Chairman's views.[2]

Many of the participants in these current account debates argue that regional growth differentials are at the heart of the so-called global imbalances. The argument runs along the following lines: rapid growth in the United States has been associated with an increase in U.S. investment (over savings); at the same time, slower growth in Europe and Japan has been associated with higher savings (relative to investment) in those parts of the world.[3] Global imbalances, the argument goes, are a reflection of these growth differentials. An implication of this perspective is that, far from reflecting a serious problem, the large current account deficits in the United States are a sign of strength; they reflect the fact that the United States has been the locomotive of global growth in the last few years. According to this view, a realignment of growth—with an increase in growth in Europe and Japan and a slowdown in the United States—would play an important role in correcting global imbalances. In a recent interview, U.S. Secretary of the Treasury Hank Paulson "acknowledged to reporters that… he saw the problem of [the U.S.] deficits as… part of the problem of other imbalances in other countries." The Secretary went on to say that the United States "has for a good number of years now been growing much faster than the major developed trading partners, Europe and Japan." For the imbalances to be corrected, Japan and Europe would have "to get the kind of growth on the consumption side that is going to make the difference."[4]

In the 1940s, Keynes was particularly interested in understanding the role of surplus countries in global adjustment. His proposal for an international clearing union was based on the notion that in the face of large payments imbalances, both deficit and surplus nations

2. See Bernanke (2005). Some recent theoretical papers on this issue and inquire under what conditions the large U.S. deficit could be maintained over time. See, for example, Dooley, Folkerts-Landau, and Garber (2004, 2005). See also Caballero, Fahri, and Gourinchas (2006), Loayza, Schmidt-Hebbel, and Servén (2000), and De Gregorio (2005). On the global savings glut, see Clarida (2005a, 2005b) and R. G. Hubbard "A Paradox of Interest," *Wall Street Journal*, 23 June 2005. One of the few empirical papers on the savings glut is Chinn and Ito (2005). See Chinn and Lee (2005) for a vector autoregression (VAR) analysis of two surplus countries. See also Gruber and Kamin (2005). Two important volumes with papers on the U.S. deficit and global adjustment are Bergsten and Williamson (2003, 2004).

3. This argument is very general and refers to the relationship between investment, savings, and growth; no causality is implied in the above statement.

4. S. R. Weisman, "Paulson Shows Talent for Deflecting Criticism," *International Herald Tribune*, 27 September 2006; emphasis added.

should share the burden of adjustment.[5] In recent years, however, very few empirical academic studies systematically analyze the process through which countries with large external surpluses have reduced their imbalances. This paucity of analysis contrasts with the case of current account deficits, which have been studied extensively.[6]

The purpose of this paper is to assess the historical evidence on current account adjustments in surplus countries. I am particularly interested in investigating whether large surpluses are persistent and the process and speed through which large surplus countries have reduced their imbalances in the past. A particularly relevant issue is whether current account surpluses have historically registered large abrupt declines. Such abrupt surplus adjustments would be required if, as some fear, the United States—and other Anglo-Saxon countries, such as Australia, New Zealand, and the United Kingdom—experience a sudden stop of capital inflows and rapid current account reversals. I also investigate the connection between large surpluses and the business cycle and consider whether, as recently argued by U.S. Secretary of the Treasury Hank Paulson and others, an acceleration in the growth rates of the non-Anglo-Saxon advanced countries is likely to cause a decline in their surpluses and thus in global imbalances.

The rest of the paper is organized as follows. In Section 1, I analyze the distribution of current account deficits and surpluses over the last thirty-five years (1970–2004). The analysis focuses on the asymmetries between surpluses and deficits. Section 2 concentrates on the incidence of large and persistent current account surpluses. In Section 3, I examine the relationship between current account balances and the business cycle. In particular, I ask whether an acceleration in the growth rate (relative to the long-term trend) in advanced countries (other than the United States) is likely to reduce their surpluses. Section 4 explores the anatomy of large surplus adjustments. I use data for thirty-five years and over a hundred countries to analyze the most important characteristics of rapid and major declines in current account surpluses. I focus on several aspects of adjustments, including

5. See, for example, the discussion in Skidelsky (2000, chap. 6), as well as the papers, reports, and memoranda by Keynes cited in that chapter.

6. The sum of all deficits is equal to the sum of all surpluses, so knowing how all deficit countries behave in the aggregate reveals exactly how the sum of all surplus countries behaves in the aggregate. This, however, is not a very interesting proposition.

their frequency and distribution across different groups of countries and regions. This Section also assesses the concomitant behavior of exchange rates, growth, inflation, and interest rates. I use a battery of nonparametric tests to determine whether the behavior of these key variables has been statistically different in surplus-adjustment countries and a control group of countries. Finally, section 5 contains some concluding remarks and discusses directions for future research. The paper also has a data appendix.

1. Current Account Surpluses and the Distribution of Imbalances in the World Economy

A fundamental accounting principle in open economy macroeconomics is that the sum of all current account balances (deficits and surpluses) across all countries in a given year, should add up to zero.[7] However, the fact that the value of the sum of all current account balances adds up to zero does not mean that the number of deficit countries should be equal to the number of surplus countries. It is perfectly possible that the vast majority of countries run deficits, while only a handful of nations run (rather large) surpluses. In this section I analyze the distribution of current account balances (deficits and surpluses) in the world economy during the last thirty-five years, and I investigate the evolution of this distribution. I am particularly interested in understanding how the increasingly large U.S.—and, more generally, Anglo-Saxon—deficits have been financed. Are they being financed by an increasingly larger number of countries? How important are surpluses in the emerging countries? What has been the role of commodity-exporting countries?

The data are taken from the World Bank data set and cover all countries for which there is information, including —, transition, and emerging economies. To organize the discussion, I have divided the data into six groups: Africa (excluding North Africa); Asia; eastern Europe; industrialized (or advanced) nations; Latin America and the Caribbean; and the Middle East and North Africa. The data set covers 160 countries in the 1970–2004 period. With over 4,200 observations, this is the largest data set available for empirical work on current account balances. Table A1 in the appendix details the availability

7. As is discussed below, the actual sum of balances has become significantly different from zero in recent years.

of data on the current account, both for the complete sample and for the different groups of countries. In most of the empirical exercises that I report in the rest of this paper, I have restricted the data set to countries with a population of over half a million and per capita income above $500 in 1985 purchasing power parity (PPP) terms. Also, the analysis presented in this paper primarily uses data on current account balances as a percentage of GDP; in what follows, positive numbers refer to a current account surplus, while negative numbers refer to deficits.

Tables 1 and 2 summarize the basic data on current account imbalances over the last thirty-five years. Table 1 contains data on average balances, while table 2 presents data on median balances. Several interesting results emerge from these tables. First, current account balances in Asia experienced a deep change in the period under study. Until 1998, both the mean and median reflected the fact that most countries in that region posted large current account deficits and were capital importers. Another way of saying this is that until that year the Asian nations had positive foreign savings. The situation changed drastically after the 1997–98 Asian debt crises. In 1990–95, the mean current account balance in Asia was a deficit of 3.3 percent of GDP; in 1999–2004, it was a surplus of 2.4 percent. This represents a remarkable current account reversal in excess of 5 percent of GDP!

Second, current account balances also underwent important changes in most other country groups. The Middle East recorded surpluses, on average, after 1999. These became more accentuated in 2005–06, as a result of the higher oil prices.

Third, the magnitude of the external adjustment in the Latin American and Caribbean countries is particularly noticeable from the data on median balances (table 2). The current account deficit declined from 5.3 percent of GDP in 2002 to barely 1.0 percent of GDP in 2004.

Finally, the data in tables 1 and 2 also reveal a difference in the mean and median behavior of the advanced countries. In the last few years, the mean current account over GDP balance has been a small surplus—below 1 percent—in the industrial nations. The median balance in 2003 and 2004 was a small deficit.

As pointed out above, even though the value of all current account balances has to add up to zero, the number of deficit countries does not have to equal the number of surplus countries. Table 3

Table 1. Current Account Balances as a Percentage of GDP in the World Economy: Means, 1970–2004

Year	*Africa*	*Asia*	*Eastern Europe*	*Industrial countries*	*Latin America and the Caribbean*	*Middle East and North Africa*	*All countries*
1970	−3.01	−0.26	n.a.	0.05	−7.51	−6.66	−2.81
1971	−6.01	−0.64	n.a.	0.26	−5.53	−2.50	−2.21
1972	−4.44	−2.43	n.a.	1.38	−3.78	3.79	−0.68
1973	−5.10	−1.36	n.a.	1.15	−3.32	1.82	−0.78
1974	2.25	−4.57	−1.50	−2.51	−3.20	6.44	−0.68
1975	−4.45	−5.46	−3.55	−1.33	−2.33	8.38	−2.20
1976	−5.70	0.37	−3.81	−2.00	−1.46	9.42	−1.43
1977	−3.63	0.76	−5.14	−1.70	−4.08	5.39	−1.97
1978	−8.25	−1.79	−1.90	−0.42	−3.74	−0.46	−4.06
1979	−6.02	1.58	−1.60	−1.30	−4.54	8.44	−2.56
1980	−7.05	−7.49	−0.02	−2.03	−6.91	9.13	−4.72
1981	−9.51	−11.63	−1.15	−2.32	−10.00	7.61	−7.15
1982	−10.82	−10.85	−0.96	−2.23	−9.08	1.76	−7.66
1983	−8.22	−8.22	−1.26	−1.14	−6.53	−1.03	−5.82
1984	−5.63	−3.07	−0.15	−0.88	−4.27	−0.87	−3.56
1985	−5.64	−5.04	−1.54	−1.01	−2.84	−0.89	−3.59
1986	−6.00	−3.84	−2.80	−0.75	−5.44	−0.58	−4.16
1987	−4.64	−3.20	−0.17	−0.86	−5.42	−0.05	−3.48

Table 1. (continued)

Year	*Africa*	*Asia*	*Eastern Europe*	*Industrial countries*	*Latin America and the Caribbean*	*Middle East and North Africa*	*All countries*
1988	−5.80	−2.85	1.05	−0.71	−4.44	0.03	−3.51
1989	−4.42	−3.94	−0.33	−0.99	−5.22	4.74	−3.09
1990	−4.04	−4.50	−2.96	−1.04	−4.26	4.99	−2.86
1991	−4.40	−2.30	−2.70	−0.71	−6.87	−28.55	−5.87
1992	−5.33	−3.07	−0.01	−0.46	−5.59	−8.93	−4.12
1993	−5.39	−4.32	−2.04	0.42	−6.13	−7.68	−4.30
1994	−4.80	−2.49	−1.37	0.27	−4.80	−3.30	−3.16
1995	−6.66	−3.24	−3.45	0.80	−5.10	−1.42	−3.91
1996	−6.51	−2.95	−6.84	0.69	−5.74	−0.32	−4.42
1997	−4.13	−3.57	−7.31	1.04	−7.83	−0.15	−4.25
1998	−7.36	−0.44	−9.28	0.18	−8.09	−5.48	−5.68
1999	−6.69	1.76	−5.31	0.03	−6.45	2.55	−3.63
2000	−3.58	1.87	−3.02	0.00	−6.00	6.74	−2.02
2001	−5.99	1.52	−3.27	0.37	−7.61	2.53	−3.38
2002	−4.78	2.85	−3.56	0.72	−7.46	1.82	−2.96
2003	−2.48	4.80	−4.40	0.28	−5.42	3.70	−1.75
2004	−2.07	1.97	−4.56	0.12	−2.97	4.00	−1.29
All years	−5.65	−2.74	−3.89	−0.50	−5.71	0.47	−3.73

Source: Author's calculations, based on World Bank data.
n.a. Not available.

Table 2. Current Account Balances as a Percentage of GDP in the World Economy: Medians, 1970–2004

Year	*Africa*	*Asia*	*Eastern Europe*	*Industrial countries*	*Latin America and the Caribbean*	*Middle East and North Africa*	*All countries*
1970	–1.90	–0.90	n.a.	0.40	–4.07	–5.90	–1.10
1971	–7.53	–1.00	n.a.	0.27	–4.60	–7.25	–1.04
1972	–0.93	–1.55	n.a.	0.71	–1.45	–1.10	–0.41
1973	–4.40	–0.70	n.a.	0.44	–1.07	–2.18	–0.86
1974	–2.71	–3.00	–1.50	–1.90	–4.00	0.29	–2.92
1975	–6.13	–3.64	–3.55	–1.26	–4.09	3.01	–3.30
1976	–5.17	1.28	–3.81	–1.96	–1.41	2.19	–2.94
1977	–3.39	0.84	–5.14	–1.89	–3.96	1.45	–2.80
1978	–9.91	–2.03	–1.90	–0.63	–3.95	–2.76	–3.23
1979	–4.64	–2.67	–1.60	–0.65	–4.68	9.02	–2.73
1980	–7.21	–3.77	–0.02	–2.29	–5.59	3.96	–4.04
1981	–9.44	–8.54	–1.15	–2.58	–7.80	–1.43	–6.46
1982	–8.68	–7.77	–1.48	–1.84	–7.41	1.53	–5.81
1983	–6.35	–6.56	–0.86	–0.77	–4.70	–2.98	–4.24
1984	–2.61	–2.27	–0.63	–0.17	–3.96	–4.84	–2.43
1985	–3.90	–3.59	–1.51	–0.96	–2.08	–2.68	–2.37
1986	–3.95	–2.19	–1.94	0.21	–2.98	–2.34	–2.58
1987	–4.66	–1.68	–0.76	–0.35	–3.95	–2.07	–2.36

Table 2. (continued)

Year	*Africa*	*Asia*	*Eastern Europe*	*Industrial countries*	*Latin America and the Caribbean*	*Middle East and North Africa*	*All countries*
1988	–5.76	–2.57	–0.72	–1.03	–2.36	–2.21	–2.61
1989	–3.52	–3.44	–1.70	–1.47	–4.36	0.47	–2.63
1990	–3.78	–3.93	–3.69	–1.37	–2.78	2.82	–2.63
1991	–3.18	–3.10	–0.70	–0.88	–4.35	–9.38	–2.83
1992	–4.51	–3.66	0.10	–0.80	–3.98	–9.26	–3.01
1993	–4.29	–4.11	–2.29	–0.53	–5.47	–6.75	–3.19
1994	–3.66	–3.49	–1.42	0.35	–3.11	–4.60	–2.28
1995	–4.48	–4.97	–1.89	0.73	–2.96	–1.37	–2.50
1996	–4.21	–3.90	–5.01	0.93	–4.50	0.36	–3.43
1997	–4.65	–2.82	–6.08	0.20	–5.39	–0.15	–3.74
1998	–5.68	–0.73	–7.21	–0.47	–5.36	–2.56	–4.30
1999	–6.52	2.73	–5.29	0.26	–4.33	0.26	–2.97
2000	–4.50	1.71	–4.80	–0.46	–4.50	6.74	–3.18
2001	–4.79	1.84	–4.74	–0.06	–4.34	3.53	–2.95
2002	–2.82	3.15	–5.13	0.52	–5.31	5.44	–1.98
2003	–4.28	2.94	–5.78	–0.10	–3.91	3.53	–1.65
2004	–3.28	1.83	–5.18	–0.60	–1.09	1.75	–2.00
All years	–4.74	–2.36	–3.47	–0.55	–4.33	–0.58	–2.96

Source: Author's calculations, based on World Bank data.
n.a. Not available.

Table 3. Current Account Balances as Percentage of GDP in the World Economy: Proportion of Countries with Surpluses, 1970–2004

Year	*Africa*	*Asia*	*Eastern Europe*	*Industrial countries*	*Latin America and the Caribbean*	*Middle East and North Africa*	*All countries*
1970	0.333	0.200	n.a.	0.625	0.000	0.000	0.292
1971	0.000	0.200	n.a.	0.600	0.167	0.250	0.321
1972	0.000	0.333	n.a.	0.727	0.167	0.500	0.433
1973	0.000	0.333	n.a.	0.545	0.333	0.500	0.400
1974	0.273	0.143	0.000	0.333	0.143	0.600	0.279
1975	0.200	0.100	0.000	0.316	0.200	0.667	0.258
1976	0.083	0.545	0.000	0.238	0.412	0.667	0.313
1977	0.242	0.500	0.000	0.304	0.231	0.500	0.305
1978	0.162	0.333	0.000	0.435	0.250	0.222	0.264
1979	0.237	0.400	0.000	0.261	0.233	0.556	0.284
1980	0.244	0.125	0.500	0.217	0.188	0.600	0.242
1981	0.143	0.000	0.500	0.304	0.094	0.400	0.165
1982	0.116	0.056	0.333	0.391	0.031	0.500	0.171
1983	0.093	0.222	0.333	0.348	0.125	0.400	0.194
1984	0.256	0.250	0.500	0.391	0.212	0.300	0.278
1985	0.311	0.100	0.000	0.391	0.303	0.300	0.279
1986	0.213	0.250	0.000	0.565	0.219	0.200	0.270
1987	0.229	0.250	0.333	0.304	0.212	0.300	0.250

Table 3. (continued)

Year	*Africa*	*Asia*	*Eastern Europe*	*Industrial countries*	*Latin America and the Caribbean*	*Middle East and North Africa*	*All countries*
1988	0.167	0.250	0.333	0.261	0.242	0.200	0.221
1989	0.208	0.250	0.333	0.348	0.242	0.545	0.277
1990	0.208	0.200	0.333	0.348	0.303	0.750	0.303
1991	0.250	0.250	0.429	0.391	0.152	0.182	0.254
1992	0.188	0.286	0.538	0.391	0.273	0.182	0.282
1993	0.208	0.190	0.350	0.478	0.242	0.250	0.274
1994	0.333	0.286	0.391	0.522	0.212	0.417	0.344
1995	0.277	0.200	0.208	0.542	0.125	0.417	0.277
1996	0.283	0.250	0.120	0.542	0.091	0.583	0.275
1997	0.200	0.100	0.120	0.500	0.030	0.500	0.208
1998	0.116	0.450	0.080	0.478	0.030	0.333	0.205
1999	0.163	0.600	0.080	0.542	0.156	0.545	0.290
2000	0.256	0.529	0.200	0.458	0.156	0.667	0.320
2001	0.227	0.647	0.160	0.480	0.063	0.583	0.297
2002	0.256	0.688	0.200	0.583	0.152	0.636	0.351
2003	0.297	0.786	0.160	0.500	0.241	0.818	0.386
2004	0.259	0.583	0.227	0.458	0.304	0.727	0.378
All years	0.215	0.305	0.215	0.422	0.185	0.462	0.276

Source: Author's calculations, based on World Bank data.
n.a. Not available.

contains data on the proportion of countries with current account surpluses in each year. This table shows an important asymmetry between surpluses and deficits: many more countries run deficits than surpluses. Only 27.6 percent of the countries in the full sample experienced surpluses. Moreover, the percentage of surplus countries has changed significantly through time. This proportion was at its highest level of the last twenty-five years in 2003 and 2004, at 38.6 percent and 37.8 percent, respectively. This pattern indicates that the growing U.S. deficit has been financed by an increasingly large array of countries. The last time the United States experienced large deficits (1985–87), the proportion of surplus nations was much lower, ranging from 25.0 percent to 27.9 percent. In many ways this is not surprising, as the magnitude of the U.S. deficit has been significantly larger in the last few years than in 1985–87. As table 3 shows, the main difference between these two periods lies with the Asian countries: in 1985–87 less than 25 percent of the Asian nations ran a current account surplus; in 2002–04 almost 70 percent of the Asian nations ran a surplus.

These results do not say anything regarding causal relationships. It is not possible to know if the number of surplus countries has increased because there is a need to finance an ever growing U.S. current account deficit, or if the U.S. deficit has expanded because the number of surplus countries has grown over the last few years.[8] Moreover, since these balances are gathered by independent country agencies, there is bound to be a statistical discrepancy. Thus, while the sum of all current account balances should add up to zero, it is highly unlikely that for any given year the sum of these balances would actually be identical to zero. The size of the statistical discrepancy has been growing, however, and it has become increasingly negative since 1997 (IMF, 2002). According to the 2003 World Economic Outlook, the (negative) discrepancy exceeded 3 percent of the world's imports in 2002. This might be called the mystery of the missing current account surpluses. Marquez and Workman (2001) argue that it may reflect a number of factors, including cross-country differences in the lags with which actual transactions are recorded; asymmetric valuations of the same transaction in the two countries involved; and misreporting of investment income.

8. Bernanke's (2005) view on the global savings glut assumes that the causal relationship goes from higher national savings in the rest of the world to a U.S. increased deficit.

2. High and Persistent Large Current Account Surpluses

According to modern intertemporal models of the current account, including the portfolio-based models of Obstfeld and Rogoff (1996), Kraay and Ventura (2000, 2003) and Edwards (2002, 2004), countries tend to experience short-term deviations from their long-run sustainable current account levels.[9] This implies that large current account imbalances—or large deviations from sustainability—should not persist through time. Once the temporary shocks that trigger the large imbalances have passed, the current account will return to its long-run sustainable level. In this section, I use the data set described above to analyze the degree of persistence through time of large current account surpluses. I am particularly interested in finding out whether some countries have experienced very high surpluses for very long periods of time.

As a first step, I constructed two measures of high surpluses. (I also constructed equivalent measures of high deficits.) *High Surplus 1* is an index that takes the value of one if, in a particular year, a country's surplus is among its region's 25 percent highest surpluses; the index takes a value of zero otherwise. *High Surplus 2* takes the value of one if, in a particular year, a country's surplus is among its region's 10 percent highest surpluses; it takes a value of zero otherwise.

Table 4 lists the countries that have had persistently high surpluses. I define persistently high surpluses as occurring when the country in question has a high surplus, as defined above, for at least four years in a row. The first column in table 4 reports the results for High Surplus 1, while the second column covers High Surplus 2. As the table shows, forty-one countries had persistently high surpluses according to the High Surplus 1 definition, and while only seventeen did so according to the more stringent High Surplus 2 definition. Some interesting facts emerge from this table. First, the number of large countries that have had persistently large surpluses (using the High Surplus 1 definition) is very small. Germany and Japan are the only advanced nations that make the list, and China and Russia are the only large emerging and transition countries. Second, many

9. In these models, changes in current account balances are largely the result of efforts by domestic economic agents to smooth consumption. The sustainable level of the current account balance, in turn, will depend on portfolio decisions by both foreign and domestic investors.

Table 4. Countries with Persistently High Current Account Surpluses, 1970–2004[a]

High Surplus 1		*High Surplus 2*	
Region and country	*Years*	*Country*	*Years*
Industrial countries			
Belgium	1989–2001	Germany	1986–89
Finland	1995–2004	Luxembourg	1995–99
Germany	1984–90	Malta	1975–81
Japan	1983–89	Norway	2000–2004
Luxembourg	1995–2004	Switzerland	1991–2001
Malta	1972–82		
Netherlands	1972–77; 1981–85; 1987–91; 1993–99		
Norway	1980–85; 1994–97; 1999–2004		
Switzerland	1981–2004		
United Kingdom	1980–83		
Latin America and the Caribbean			
Guyana	1986–89	Suriname	1987–90; 1992–95
Panama	1987–90	Venezuela	1999–2004
Suriname	1987–90; 1992–95		
Trinidad and Tobago	1975–78; 1992–96; 1999–2003		
Uruguay	1988–91		
Venezuela	1994–97; 1999–2004		

Table 4. (continued)

High Surplus 1		*High Surplus 2*	
Region and country	*Years*	*Country*	*Years*
Asia			
China	1994–97	Hong Kong, China	1984–90
Fidji	1985–88	Papua New Guinea	1993–96
Hong Kong, China	1970–78; 1983–94; 2001–04	Singapore	1989–92; 1994–2004
Korea, Rep.	1986–89		
Malaysia	1998–2003		
Papua New Guinea	1992–96		
Singapore	1988–2004		
Africa			
Botswana	1985–89; 1991–2003	Botswana	1985–89; 1991–99
Chad	1980–84	Gabon	1979–84; 1994–97; 1999–2003
Gabon	1978–84; 1994–97; 1999–2003	Gambia, The	1987–90
Gambia, The	1984–92	Lesotho	1990–94
Lesotho	1980–84; 1989–94	Libya	1977–80
Liberia	1979–82		
Libya	1977–80; 1994–97		
Mauritania	1995–2001		
Namibia	1990–2004		
Nigeria	1989–92; 1999–2004		
South Africa	1977–80; 1985–93		
Swaziland	1986–91		
Zimbabwe	1986–89		

Table 4. (continued)

High Surplus 1		*High Surplus 2*	
Region and country	*Years*	*Country*	*Years*
Middle East and North Africa			
Kuwait	1975–90; 1993–2004	Kuwait	1980–90; 1993–2004
Saudi Arabia	1971–74		1998–2004
Eastern Europe			
Russian Federation	1998–2004	Russian Federation	
Ukraine	1999–2004		
Other			
Samoa	1995–98		

Source: Author's calculations, based on World Bank data.
a. The two measures of high surpluses are defined as follows. *High Surplus 1* is an index that takes the value of one if, in a particular year, a country's surplus is among its region's 25 percent highest surpluses; the index takes a value of zero otherwise. *High Surplus 2* takes the value of one if, in a particular year, a country's surplus is among its region's 10 percent highest surpluses; it takes a value of zero otherwise.

oil-producing countries run persistently high surpluses, particularly in the years following a major oil price increase. Third, many East Asian countries had persistently large surpluses in after the 1997–98 debt crises. Finally, only a handful of countries have truly maintained long-term high surpluses. The most important ones are Switzerland and Singapore.

Overall, the picture that emerges from table 4 has two implications. First, the fact that large countries don't seem to run very persistent high surpluses is consistent with the notion that to finance the increasingly large U.S. deficit, more and more small and medium-sized countries have to run surpluses. Second, the lack of persistency suggests that the majority of countries that do run large surpluses do so for a rather limited period of time. After posting these large surpluses, these countries go through an adjustment process that reduces their surpluses to more "normal"—or sustainable—levels. An important question, which I address in section 4 of this paper, involves the nature of these surplus adjustment episodes: from a historical point of view, have these adjustments been gradual or abrupt? Other relevant questions from a policy perspective include how other key macroeconomic variables behave during the adjustment and whether macroeconomic variables such as inflation, interest rates, exchange rates, and growth behave differently in countries undergoing a surplus adjustment than in non adjustment countries.

2.1 The Persistence of High Surpluses: Some Econometric Results

To investigate further the degree of persistence of high current account imbalances, I estimated a number of variance component probit regressions of the following type:

$$\mathrm{High}_{j,t} = \alpha + \sum_{k=1}^{t-1} \beta_k \mathrm{High}_{j,t-k} + \gamma X_{j,t} + \varepsilon_{jt}\,, \tag{1}$$

where High_{jt} is a dummy variable that takes a value of one if country j has a high surplus in period t (using the two different high surplus measures defined above); X_{jt} refers to other covariates including time, country, and region fixed effects. The error term, ε_{jt}, is given by a variance component model: $\varepsilon_{jt} = \nu_{\mathrm{j}} + \mu_{jt}$. The variable ν_j is independent and identically distributed (i.i.d.) with zero mean and variance σ_ν^2; μ_{jt} is normally distributed with zero mean and variance $\sigma_\mu^2 = 1$. My main interest lies with the β_k coefficients on lagged high surpluses: I want to find out whether having had a high surplus in the past (up to four years) affects the probability of having a high deficit in the current period. An important question is whether the degree of persistence is similar for high surpluses and high deficits. To address this issue, I also estimated equations such as equation (1) for deficit countries.[10] Table 5 reports the resulting estimated marginal effects, which capture the change in the probability of a high surplus (deficit) in period t given a high surplus (deficit) in period $t-k$.[11]

Table 5. Persistence in Current Account Imbalances: Marginal Effects from Variance Component Probits[a]

	High 1		*High 2*	
Explanatory variable	*Surplus*	*Deficit*	*Surplus*	*Deficit*
Lag 1	0.403 (12.53)***	0.478 (18.99)***	0.137 (4.35)***	0.279 (5.66)***
Lag 2	0.059 (2.62)***	0.085 (3.32)***	0.040 (2.50)**	0.032 (1.92)*
Lag 3	0.008 (0.39)	0.032 (1.28)	0.015 (1.37)	0.003 (0.24)
Lag 4	0.089 (3.75)***	0.084 (3.39)***	0.025 (1.96)**	0.021 (1.36)
Summary statistic				
Probability	0.122	0.788	0.025	0.034
No. observations	3415	3415	3415	3415
No. groups	161	161	161	161

Source: Author's estimations.
* The null hypothesis is rejected at the 10 percent level. ** The null hypothesis is rejected at the 5 percent level. *** The null hypothesis is rejected at the 1 percent level.
a. The dependent variable is high surplus 1 and 2 and high deficit 1 and 2, as indicated. The estimation model is a variance component probit, with the following explanatory variables: lags of the dependent variable, time fixed effects, country fixed effects, and region fixed effects. Test t statistics are in parentheses.

These results suggest that the degree of persistence of high deficits is larger than that of high surpluses, especially for the

10. The computation of the High Deficit 1 and High Deficit 2 variables parallels that of the two high surplus variables.

11. The marginal effects, dF/dx, in table 5 have been computed for a discrete change in the dummy variables from 0 to 1, and they have been evaluated for the mean values of all the regressors. In addition to these panel probits, I also estimated dynamic linear probability models and dynamic panel probits (Heckman, 1981). The results obtained support those presented here.

stricter definition of high imbalances (High Surplus 2). Beyond the first lag, the point estimates of the marginal effects are very small, and in many cases they are not statistically significant. This confirms the results in table 4 indicating that the degree of persistence of large current account imbalances tended to be low in the last thirty-five years.

2.2 Large and Persistent Surpluses in Absolute Terms

The results presented above on persistently high deficits were constructed using the ratio of the current account balance to GDP. From a global financing perspective, however, what really matters is which countries have large deficits measured in convertible currency. Table 6 contains data on countries with persistently high surpluses, measured in absolute terms. The table differs significantly with table 4, which measures surpluses as a proportion to GDP. As expected, large countries have a stronger presence in table 6: France and Italy are now classed as having highly persistent surpluses, and Japan's streak of high surpluses appears to be much longer than in table 4. The most important difference between the two tables is that according to table 6, China has run a persistently high surplus for more than a decade. This suggests that, as many have argued for some time now, an adjustment in China's large external surplus will be an important component in solving current global imbalances.

3. Current Account Surpluses and the Business Cycle

One of the basic macroeconomic relationships—and one that is taught early on to undergraduate students—is that the current account is the difference between savings and investment. This means that countries that experience an investment boom will undergo a deterioration of their current account. Likewise, countries that experience an increase in savings will tend to post larger surpluses. This savings-investment perspective is complementary to the more popular view that focuses on trade flows, net incomes from abroad, and international net transfers. The advantage of concentrating on the savings-investment relationship is that it allows analysts to focus on the way in which changes in aggregate demand—and in policies that affect aggregate demand, for that matter—will affect current account balances.

Table 6. Countries with Persistently High Current Account Surpluses, Convertible Currency, 1970–2004[a]

Region and country	*Years*
Industrial countries	
Belgium	1991–97
France	1995–2001
Germany	1973–78; 1983–90
Italy	1994–98
Japan	1981–2004
Netherlands	1981–99
Norway	1999–2004
Switzerland	1984–2004
Latin America and the Caribbean	
El Salvador	1979–84
Trinidad and Tobago	1990–96; 1999–2003
Venezuela, RB	1999–2004
Asia	
China	1994–2004
Hong Kong, China	1970–80; 1982–94
Papua New Guinea	1993–97
Singapore	1988–2004
Africa	
Botswana	1985–89; 1991–2001
Ethiopia	1993–97
Gabon	1978–84; 1999–2003
Namibia	1990–2004
Nigeria	1999–2004
South Africa	1985–94
Swaziland	1986–91
Middle East and North Africa	
Kuwait	1977–81; 1983–90; 1993–2004
Saudi Arabia	1971–77; 2000–04
Eastern Europe	
Russian Federation	1992–2004
Ukraine	1999–2004

Source: Author's calculations.

a. A high surplus is defined as in table 4, except that the surplus is measured in convertible currency instead of relative to GDP.

A practical implication of the savings-investment perspective involves the role of differences in regional growth rates on current account balances. As described earlier, the analysis runs along the following lines. The rapid growth in the United States over the past few years has been associated with an increase in U.S. investment (over savings), while slower growth in Europe and Japan has been associated with higher savings (relative to investment) in those parts of the world.[12] According to this view, global imbalances are largely a reflection of these growth differentials. Far from reflecting a serious problem, the large current account deficits in the United States are a sign of strength, in that they reflect the fact that the United States has been the locomotive of global growth in the last few years. An implication of this perspective is that an international realignment of growth (with an increase in growth in Europe and Japan and a slowdown in the United States) would play an important role in correcting global imbalances.13 In a 1999 article, the Financial Times summarized the IMF's *World Economic Outlook* views on global imbalances as follows (emphasis added):

> "Current account imbalances between the world's three main economic blocks have widened in recent years, *reflecting stronger growth in the U.S. economy than in Japan and Europe.*"[14]

In a 2004 speech, then Undersecretary of the Treasury John B. Taylor discussed the relationship between savings, investment, growth differentials, and global imbalances:

> "[The] increase in investment was a key factor in U.S. economic growth during this period. Over a longer period the increase in investment will expand the capital stock… [T]he increase of the U.S. current account deficit over more than a decade has been linked to domestic U.S. capital formation increasing more than U.S. saving.…" (Taylor, 2004, emphasis added).

12. This very general argument refers to the relationship between investment, savings, and growth. No causality is implied in the above statement.

13. Implicit in this view is the notion that growth realignment would require higher savings (and lower investment) in the United States and higher investment (and lower savings) in Europe and Japan (and maybe other parts of non-China Asia).

14. See R. Chote, "IMF: U.S. Slowdown Now Inevitable," *Financial Times*, 21 April 1999.

Regarding the correction of global imbalances, in the same speech Taylor identified a need to boost global growth:

> "We would certainly not object—in fact, we'd be very pleased—if other countries strengthened their investment environment, their level of investment, and their *economic growth performance*. [Pro-growth] policies are those that will raise global growth… [and] will ameliorate the deficit by raising U.S. exports and increasing investment opportunities around the globe…. [M]ore growth throughout the world… [will] reduce external imbalances." (Taylor 2004, emphasis added).

In 2003, former IMF Chief Economist Michael Mussa wrote the following:

> "With respect to the necessary correction of the U.S. current account deficit, *acceleration of growth in the rest of the world* and the depreciation of the U.S. dollar since 2001 should help to bring an end to further increases in the U.S. imbalance." (Mussa, 2003, emphasis added).

Many authors address the question of whether large external imbalances are worrisome by investigating whether they are consistent with intertemporal optimizing models that posit that savings and investment decisions—and thus the current account—are the result of optimal decisions by the private sector. If the data support the intertemporal model, observed current account balances (even very large balances) are the reflection of optimal decisions, so they should not be a cause for concern. An important and powerful implication of intertemporal models is that at the margin, changes in national savings should be fully reflected in changes in the current account balance (Obstfeld and Rogoff, 1996). Empirically, however, this prediction of the theory has been systematically rejected by the data.[15] Typical analyses that regress the current account on savings have found a coefficient of approximately 0.25, significantly below the hypothesized value of one. Many numerical simulations based on the intertemporal approach have also failed to account for current account behavior. According to these models, a country's optimal response to negative exogenous shocks is to run very high

15. See, for example, Aizenman (1983), Ogaki, Ostry, and Reinhart (1995), Gosh and Ostry (1995), and Nason and Rogers (2006).

current account deficits, indeed much higher than what is observed in reality. Obstfeld and Rogoff (1996), for example, develop a model of a small open economy where under a set of plausible parameters, the steady-state trade surplus equals 45 percent of GDP, and the steady-state debt-to-GDP ratio is 15.[16]

The rejection by the data of the intertemporal (or present value) model of the current account has generated an intense debate among international economists. Some argue that there is a group of "usual suspects" that explain this outcome (Nason and Rogers, 2006); others hold that the problem resides in the low power of traditional statistical tests (Mercereau and Miniane, 2004). Kraay and Ventura (2000, 2003) and Ventura (2003) propose some amendments to the traditional intertemporal model that go a long way in helping bridge theory with reality. In their model, portfolio decisions play a key role in determining the evolution of the current account balance. When investors care about both return and risk, changes in savings will not be translated into a one-to-one improvement in the current account. Investors will want to maintain the composition of their portfolios, and only a proportion of the additional savings will be devoted to increasing the holdings of foreign assets (that is, bank loans). Kraay and Ventura further argue that when short-run adjustment costs in investment are added to the analysis, the amended intertermporal model tracks reality quite closely. In this setting, the behavior of countries' net foreign assets play an important role in explaining current account behavior. In particular, and as pointed out by Lane and Milesi-Ferreti (2002, 2003), changes in foreign asset valuation stemming from exchange rate adjustments will tend to affect the adjustment process and the evolution of current account balances.

Intertemporal-based models of the current account do not generate clear-cut predictions on the relation between growth (or deviations of growth from long-term trend) and the current account balance. Generally speaking, the relationship may be positive or negative, depending on the source of the shock that affects growth.[17] For instance, if the source of stronger growth is an expansion in exports, the current account balance will tend to improve. If, on the other hand, growth accelerates because of an expansion in household expenditure, the current account is likely to deteriorate.

16. Obstfeld and Rogoff (1996) do not claim that this model is particularly realistic. In fact, they present its implications to highlight some of the shortcomings of simple intertemporal models of the current account.

17. See, for example, Obstfeld and Rogoff (1996) and Kraay and Ventura (2000).

In this section, I take a somewhat different approach to analyzing the determinants of the current account and the mechanisms through which current global imbalances are likely to be solved. Instead of testing whether the implications of the present value model of the current account hold for a particular set of countries, I use panel data to investigate the relationship between the business cycle and the current account. In particular, I ask how sensitive have current account balances been to expansions (contractions) in real GDP growth, relative to its long-term trend, in different countries. I also investigate how current account balances have been affected by terms-of-trade shocks, fiscal imbalances, changes in the real exchange rate, and the country's net external position or net international investment position. In principle, this analysis should throw light on the extent to which an expansion that propels growth in Europe and Japan closer to its long-term trend—or, for that matter, above this trend—will affect global imbalances. The analysis also provides an indication of the long-run relationship between a country's net external position and its current account balance.[18]

3.1 The Empirical Model

The empirical analysis starts from the notion that, in the long run, a country's current account balance (relative to nominal GDP) should be at its sustainable level. Modern analyses of current account sustainability are based on the idea that in equilibrium the ratio of the net external position (NEP) to GDP (or to some other aggregate) has to stabilize at some level.[19] The relationship between the equilibrium and stable ratio of NEP to GDP—which I denote as γ—and the sustainable current account to GDP balance (SCA) may be written as follows:[20]

$$\mathrm{SCA} = \gamma (g^T + \pi), \tag{2}$$

where $(g^T + \pi)$ is the nominal growth rate of trend GDP, g^T is the long-run trend real growth rate of GDP, and π is the long-run steady-state

18. Recent attempts to estimate current account regressions for a panel of countries include Calderón, Chong, and Loayza (2002), Chinn and Prasad (2003), Chinn and Lee (2005), Chinn and Ito (2005), and Gruber and Kamin (2005).

19. See Milesi-Ferreti and Razin (1996) and Edwards (2005a, 2005b).

20. See Edwards (2005a) for a detailed analysis along these lines that incorporates the dynamic effects of changes in γ.

inflation rate. If a country's equilibrium NEP-to-GDP ratio is negative ($\gamma < 0$), then the country is said to be a net debtor, and it will run a current account deficit. If the country is a global net creditor, γ will be positive, and the country will run a sustainable current account surplus.[21] Current account regressions, then, should incorporate this sustainability condition and provide estimates on the long-run relationship between the current account balance and the NEP-to-GDP ratio. The empirical analysis presented in this section is based on a two-equation formulation:

$$CA_{j,t} = \alpha_0 + \alpha_1 (g_j^T - g_{j,t-1}) + \phi NEPGDP_j^* + \sum \beta_i Xi_{j,t-k} + \varepsilon_{j,t} ; \qquad (3)$$

$$g_j^T = \psi + \sum \delta_j Zi_j + \sum \theta_j Vi_j + \xi_j . \qquad (4)$$

These equations use the following notation:

- $CA_{j,t}$ is the current account balance relative to GDP, in country *j* in year *t* (a positive number denotes a current account surplus).

- $g^T_{j,t}$ is country *j*'s long-term trend per capita growth rate, and $g_{j,t-1}$ is country *j*'s actual per capita growth rate in period $t-1$.

- The term $(g_j^T - g_{j,t-1})$ is thus a measure of the growth gap: if the country in question is growing below trend, this term is positive; if it is expanding at a rate that exceeds the long-term trend, the term is negative. This term captures the effect of the business cycle on the current account balance. If economic activity slows down, $(g_j^T - g_{j,t-1})$ will become positive. There are, of course, many reasons for $(g_j^T - g_{j,t-1})$ to be positive or negative, but the formulation in equation (3) does not distinguish between the specific factors driving $(g_j^T - g_{j,t-1})$. In that sense, this analysis is very general. In long-run equilibrium, however, $(g_j^T - g_{j,t-1}) = 0$. An important question refers to the sign of coefficient α_1. If an acceleration in growth (relative to long-term trend) results in a deterioration of the current account balance, the estimated

21. Strictly speaking, the net international investment position refers to all assets and liabilities held by nonnationals. In that sense, the concept extends beyond debt to include equities and FDI.

coefficient of $(g_j^T - g_{j,t-1})$—that is, the coefficient α_1—will be positive. In this paper, however, I am interested not only in the sign of α_1, but also in the magnitude of the coefficient. In equation (3), as in most panel data equations, the coefficients are common for all regions and countries. In section 3.4 on robustness, however, I present results for estimations that allow some of the coefficients to differ by region.

- NEPGDP_j^* is a measure of the equilibrium (long-run) ratio of country's *j*'s net external assets (or NIIP) to GDP. It will be positive if the country is a net global creditor and negative if the country is a net debtor. In the estimation of equation (3), its coefficient should be positive; it will capture the long-run relationship between NEP and the sustainable current account balance. The way this variable is constructed in the empirical analysis is explained in detail below.

- The variables $Xi_{j,t-k}$ in equation (3) are other determinants of the current account, such as changes in the real exchange rate, the fiscal balance over GDP, and changes in the international terms of trade. These $Xi_{j,t-k}$ are defined such that they equal zero in long-run steady-state equilibrium.

- The error term, $\varepsilon_{j,t}$, is given by given by $\varepsilon_{j,t} = \nu_j + \mu_{j,t}$, where ν_j is an i.i.d. country-specific disturbance with zero mean and variance σ_ν^2; and $\mu_{j,t}$ is normally distributed with zero mean and variance $\sigma_\mu^2 = 1$.

Equation (4) is the equation for the long-run (trend) growth rate of real GDP. The Zi_j are economic determinants, while the Vi_j are institutional determinants of long-term growth. ξ_j is an error term assumed to be heteroskedastic. In determining the specification of equation (4), I followed the standard literature on growth (Barro and Sala-i-Martin, 1995).

An important property of the model in equations (3) and (4) is that since in the long-run equilibrium, $(g_j^T - g_{j,t-1}) = 0$ and $Xi_{j,t-k} = 0$, it follows that

$$\text{CA}_j^{\text{Long run}} = \alpha_0 + \phi\text{NEPGDP}_j^* . \tag{5}$$

This is an estimate of the long-run sustainable current account balance. If the model given by equations (3) and (4) is estimated for different groups of countries, the estimated ϕ coefficients will help provide an estimate for the sustainable current account balance, for different values of $NEPGDP_j^*$. Also, if $\alpha_0 = 0$, the estimated coefficient ϕ is the average value of $(g^T + \pi)$. In the base run, I estimate a common ϕ for all countries; in section 3.4, however, I report different ϕ for different regions.

The specification in equations (3) and (4) differs from recent papers on current account behavior in several ways. The most important difference with Chinn and Prasad (2003) and Chinn and Ito (2005) is that the long-run current account balance does converge toward $\phi NEPGDP_j^*$ in the long run. Another difference is that while I have included the deviations of (per capita) growth from the long-term trend, Chinn and Prasad (2003) and Chinn and Ito (2005) focus on average growth. Chinn and Ito (2005) incorporate governance and institutional variables directly into the estimation of the current account balance; in this paper, in contrast, institutional variables play a role through the long-run value of $NEPGDP_j^*$. Another recent paper similar in spirit to this one is Gruber and Kamin (2005). Like Chinn and Ito (2005), Gruber and Kamin (2005) incorporate institutional variables directly into the estimation of their current account equations. They also include dummy variables for crisis periods. Another important difference between this paper and Gruber and Kamin (2005) has to do with the growth terms: the relevant growth variable in equation (3) is deviations of growth from trend, while Gruber and Kamin (2005) focus on the change in per capita growth differentials.

3.2 Estimation and Basic Results

I estimated the system contained in equations (3) and (4) using a two-step procedure. In the first step, I estimated the long-run growth equation (4) using a cross-country data set. These data are averages for 1974–2004, and the estimation makes a correction for heteroskedasticity. First-stage estimates are then used to generate long-run predicted growth rates to replace g_j^T in the current account equation (3). In the second step, I estimate equation (3) using both random- and fixed-effects methods. In estimating equation (4) for long-run per capita growth, I followed the now-standard growth literature (summarized by Barro and Sala-i-Martin, 1995), and use average data for 1974–2004. In terms of the equation specification, I also follow Barro and Sala-i-Martin (1995), Sachs and Warner (1995), and Dollar (1992), among others, and assume that the GDP growth rate (g_j^T) depends on a number of structural, policy, and social variables. More specifically, I include the following covariates: the log of initial GDP per capita; the investment ratio; the coverage of secondary education; an index of the degree of openness of the economy; the ratio of government consumption to GDP; and regional dummies for Latin American, sub-Saharan African, and transition economies. The results obtained in this first step estimation of the long-run growth equations are not reported due to space considerations; they are available on request.

The empirical definition of NEPGDP_j^* in equation (3) poses an interesting challenge. Conceptually this variable is the equilibrium, or desired, long-term ratio of country *j*'s net external position relative to GDP. It is difficult, however, to obtain data on this desired ratio. In the basic specification, I proxied NEPGDP_j^* by the mean value of the actual net external position to GDP, for the period 1970–2004. To check the robustness of the results, I estimated regressions using alternative definitions of NEPGDP_j^*; these exercises are discussed in subsection 3.3.

Following the empirical literature on the current account, I included the four $Xi_{j,t}$ covariates in the estimation of equation (3) (see the appendix for data sources).

- A terms-of-trade shock, defined as the percentage change in the relative price of exports to imports, lagged one period. A positive (negative) number represents an improvement (deterioration) in the terms of trade. Its coefficient is expected to be positive, indicating that a positive terms-of-trade shock results in an improvement in the current account balance.

- The accumulated percentage change in the real exchange rate over a three-year span, lagged one period. The real exchange rate is defined such that a positive change represents a real exchange rate depreciation. The coefficient is expected to be positive: a real depreciation results in a higher (lower) surplus (deficit).

- The ratio of the public sector deficit to GDP, lagged one period. The coefficient is expected to be negative.

- To check for robustness, I considered alternative specifications and variable definitions. The results show that the main findings from the base run are not significantly affected (see sections 3.3 and 3.4).

In the regression analysis reported in this section, I focus on medium-sized and large countries; these are defined as countries with a GDP in 1995 of at least US$52 billion.[22] The sample includes forty-one countries over the period 1974–2004. Of these, twenty are advanced nations and twenty-one are emerging or transition countries. The size of the sample was determined by data availability; not all countries have data for all variables (see the appendix for a list of countries). I estimated equation (3) for three alternative samples within the group of large countries: advanced, nonadvanced, and all countries.

The base estimates are presented in table 7, where the first three columns report the results for random effects and the last three columns those for fixed effects. Robust standard errors were used to estimate the z statistics. All the estimated coefficients have the expected signs, and the vast majority is significant at expected levels. Moreover, the estimated coefficients are very similar for random and fixed effects. The point estimates for the coefficient of $(g^T + \pi)$ are very similar across samples and estimation techniques, ranging from 0.180 to 0.225. These estimates indicate that a decline in the per capita GDP growth rate of, say, 1 percentage point below the long-term trend would result in an increase in the current account surplus of at most one quarter of a percentage point of GDP.

These results have interesting implications for the analysis of global imbalances. In the case of Japan, for example, my estimates indicate that per capita growth was, on average, 3.3 percentage points below trend in 2003–04. Had Japan's growth been on trend, its current account surplus would thus have been 0.54–0.68 percent of GDP lower than it actually was. GDP growth was also below trend in other large industrial countries in 2003–04: in Germany and Italy, it was 1.0 percent below trend, and in France, it was 0.6 percent below trend. Section 3.5 presents a more detailed analysis of the effects of a realignment of national growth rates on global imbalances.

The estimates in table 7 also imply that improvements in the terms of trade result in larger (smaller) surpluses (deficits); this effect is particularly clear in the advanced countries. An accumulated real

22. Below I discuss the results obtained when all countries—large and small—are included in the sample.

Table 7. The Current Account and the Business Cycle: Variance Component Regressions, 1970–2004[a]

	Random effects			*Fixed effects*		
Explanatory variable	*Large countries*	*Industrial countries*	*Nonindustrial countries*	*Large countries*	*Industrial countries*	*Nonindustrial countries*
Growth gap	0.217 (5.72)***	0.18 (3.21)***	0.207 (4.5)***	0.225 (5.8)***	0.191 (3.3)***	0.206 (4.3)***
Change in terms of trade	0.028 (2.25)**	0.113 (4.74)***	0.013 (0.97)	0.029 (2.24)	0.114 (4.75)***	0.013 (0.96)
Public sector deficit / GDP	–0.162 (–4.23)***	–0.211 (–4.08)***	–0.06 (–1.13)	–0.188 (–4.38)	–0.222 (–4.14)***	–0.116 (–1.66)*
Accumulated change in RER	0.008 (3.62)***	0.004 (3.54)***	0.026 (4.44)***	0.008 (4.25)***	0.004 (4.37)***	0.026 (4.47)***
Net external position / GDP	0.064 (9.06)***	0.069 (5.54)***	0.07 (5.66)***	––	––	––
Summary statistic						
R^2	0.2377	0.3627	0.1840	0.0628	0.0822	0.0995
No. observations	1001	522	479	1001	522	479
No. groups	41	20	21	41	20	21

Source: Author's estimations.
* Statistically significant at the 10 percent level. ** Statistically significant at the 5 percent level. *** Statistically significant at the 1 percent level.
a. The dependent variable is the current account over GDP. The sample includes all countries with a GDP in 1995 of at least US$52 billion, resulting in forty-one countries over the period 1974–2004. Test t statistics are in parentheses.

depreciation similarly improves the current account balance. The point estimates of this coefficient are significantly higher for the emerging and transition countries than for the advanced nations. A higher public sector deficit, on the other hand, tends to reduce the current account surplus or increase the deficit.

The coefficients of $NEPGDP_j$* are positive, as expected, and significant.[23] The estimated coefficients of $NEPGDP_j$* range from 0.064 to 0.070, and they are similar for the advanced nations and the emerging and transition countries. The results in this table suggest that for advanced countries with a long-run net asset position of 30 percent of GDP, the sustainable current account balance is a surplus of 1.9 percent of GDP.[24] For an (average) emerging nation with a negative net external position of 40 percent of GDP (that is, $NEPGDP_j^* = -40$), the long-run sustainable deficit will, on average, equal 1.1 percent of GDP.[25]

3.3 Alternative Definitions of $NEPGDP_j$*

For the estimations presented in table 7, the long-run equilibrium $NEPGDP_j$* was proxied by the average ratio of net external assets to GDP over the sample period. In this subsection, I report results obtained using an alternative measure of $NEPGDP_j$*. I followed a two-step procedure to generate this new variable: first, I used long-term averages to estimate a cross-section equation for $NEPGDP_j$*; second, I used the predicted values obtained from this equation as estimates of $NEPGDP_j$*. In estimating the cross-section equation, the dependent variable is the actual 1970–2004 average of the net external position for each country. I considered the following covariates when specifying the equation: (a) the degree of trade openness, measured as exports plus imports over GDP (this coefficient is expected to be positive); (b) the ratio of government consumption to GDP (the expected coefficient is negative); (c) a dummy variable for commodity exporting countries (including oil exporters); (d) a measure of political stability, captured by an index of civil liberties;

23. Since $NEPGDP_j^*$ is constant across time for each country, its coefficient cannot be estimated using fixed effects.

24. This assumes that all other variables are given at their mean. The estimations in table 7 use the point estimate for advanced nations.

25. The sustainable surplus or deficit includes the intercept. These computations assume that in the long run, the fiscal deficit is equal to zero. The calculated sustainable balances will be different under alternative assumptions.

(e) the average per capita GDP growth rate; (f) a measure of the degree of financial openness, calculated as the sum of total external liabilities and total external assets (which include debt, equities, FDI, and international reserves) relative to GDP (the expected coefficient is positive); (g) inflation, measured as the average percentage rate of change of CPI (the expected coefficient is negative); (h) the initial level of per capita GDP (the expected coefficient is positive); and (i) regional dummy variables.

Table 8 reports the results obtained from the estimation of this long-run cross-country regression of the net external position, for a sample of 130 countries; the first column excludes regional dummies, while the second column includes them. As shown by the between-group R squared, the fit is quite good. Moreover, many of

Table 8. Net External Position Regressions, 1970–2004[a]

Explanatory variable	*No regional dummies*	*Regional dummies*
Trade openness	0.293 (2.3)**	0.163 (1.18)
Gov. consumption / GDP	–2.488 (–2.48)**	–2.507 (–2.13)**
Commodity dummy	–3.592 (–0.85)	–5.223 (–1.02)
Political stability	6.616 (1.73)*	1.541 (0.33)
GDP per capita	–1.622 (–0.71)	–3.159 (–1.31)
Financial openness	0.39 (1.29)	0.395 (1.29)
Inflation	–0.153 (–3.87)***	–0.13 (–3.03)***
Initial GDP per capita	28.329 (5.84)***	29.45 (4.72)***
Summary statistic		
R^2	0.1747	0.2104
Between R^2	0.3986	0.4555
No. observations	2912	2904
No. groups	130	129

Source: Author's estimations.

* Statistically significant at the 10 percent level. ** Statistically significant at the 5 percent level. *** Statistically significant at the 1 percent level.

a. The dependent variable is the net external position over GDP. The estimation model is a between-effects estimator. The sample and sample period are defined in table 5, but are constrained by data availability. Test t statistics are in parentheses.

the coefficients are statistically significant and have the expected signs. Whether a country is a commodity exporter doesn't appear to affect the (average) level of NEP over GDP. Interestingly, there is no evidence that countries with a faster average economic growth rate have a higher NEP–to-GDP ratio.

I used the estimates in column 2 of table 8 to generate predicted values of NEPGDP that include estimates of the country-specific error component. I call this variable NEPGDP_STAR, and I used it as a proxy for $NEPGDP_j*$ in a series of regressions for the current account equation (3). The results obtained when a random-effects procedure was used are in table 9; *z* statistics were computed using robust standard errors. The overall results are similar to those reported in table 8: all coefficients have the expected signs and most of them are significant at conventional levels. The estimated coefficients of NEPGDP_STAR are lower than those obtained when the average NEP-to-GD ratio was used (see table 7). The difference between these two coefficients is particularly marked for the emerging and transition countries: 0.070 in table 7, versus 0.011 in table 9.

Table 9: The Current Account and the Business Cycle, Alternative Measure of NEP/GDP: Variance Component Regressions, 1970–2004

Explanatory variable	*Large countries*	*Industrial countries*	*Nonindustrial countries*
Growth gap	0.244 (6.00)***	0.155 (2.68)***	0.251 (5.17)***
Change in terms of trade	0.027 (2.06)**	0.127 (4.65)***	0.012 (0.84)
Public sector deficit / GDP	–0.139 (–3.3)***	–0.138 (–2.79)***	–0.04 (–0.67)
Accumulated change in RER	0.007 (3.54)***	0.005 (3.92)***	0.025 (4.33)***
Net external position / GDP	0.017 (2.78)***	0.049 (6.83)***	0.011 (2.51)**
Summary statistic			
R^2	0.1611	0.391	0.1446
No. observations	949	488	461
No. groups	41	20	21

Source: Author's estimations.
* Statistically significant at the 10 percent level. ** Statistically significant at the 5 percent level. *** Statistically significant at the 1 percent level.

This implies that according to table 9 the (average) sustainable current account balance for the emerging and transition countries is smaller than previously suggested. A possible interpretation for this result—and one that I investigate in subsection 3.4—is that this aggregate estimate is averaging (very) different estimates for the different regions.

An important result for the discussion on global imbalances is that the estimates of the coefficients for $(g_j^T - g_{j,t-1})$ in table 9 are similar to those reported above, and they support the view that current account balances have been quite sensitive to the business cycle.

3.4 Potential Endogeneity and Other Robustness Checks

This subsection addresses potential endogeneity issues and reports the results from a number of robustness checks. The main results reported above stand up to this scrutiny.

3.4.1 Potential endogeneity

One of the covariates in the current account equation (3) is the (lagged) accumulated change in the real exchange rate. This variable could potentially be influenced by the perceived (future) evolution of the current account.[26] To assess this potential source of endogeneity I re-estimated equation (3) using an instrumental variables (IV) random-effects procedure. The following instruments were used: an index that measures the proportion of countries in the country's region that were subject to a sudden decline in capital inflows, lagged one period; a similar index that measures the incidence of sudden declines in inflows in other regions, also lagged one period; changes in the terms of trade, lagged two periods; inflation, lagged two periods; initial (1970) per capita GDP; population growth; and regional dummy variables. The results obtained from this IV random-effects estimation are reported in table 10. In most respects, the results are very similar to those reported above. The estimated coefficients of NEPGDP_j^* and $(g_j^T - g_{j,t\text{-}1})$ continue to have the expected positive sign and to be significant. Also, their point estimates are quite similar to those

26. Since the change in the real exchange rate is lagged one period, it is a predetermined variable. It may still be correlated with the error term, however, if there is serial correlation.

reported above. The most important difference between the IV random-effects estimates in table 10 and the results in tables 7 and 9 is that the coefficient of the accumulated change in the real exchange rate is no longer significant for advanced countries. A possible interpretation of this result is that the measure of real exchange rate changes is a poor proxy for real exchange rate misalignment.

Table 10. The Current Account and the Business Cycle: Variance Component Instrumental Variable Regressions, 1970–2004[a]

Explanatory variable	*Large countries*	*Industrial countries*	*Nonindustrial countries*
Accumulated change in REER	0.067	–0.001	0.111
	(2.02)**	(–0.04)	(0.044)**
Growth gap	0.155	0.19	1.36
	(2.76)***	(3.39)***	(0.074)
Change in terms of trade	0.011	0.124	–0.180
	(0.61)	(4.74)***	(0.019)
Public sector deficit / GDP	–0.163	–0.190	0.040
	(–3.42)***	(–2.4)**	(0.066)
Net external position / GDP	0.075	0.069	5.590
	(9.65)***	(5.55)***	(0.015)***
Summary statistic			
R^2	0.0916	0.3706	0.1069
Between R^2	0.5953	0.6783	0.7941
No. observations	924	475	449
No. groups	40	19	21

Source: Author's estimations.
* Statistically significant at the 10 percent level. ** Statistically significant at the 5 percent level. *** Statistically significant at the 1 percent level.
a. The dependent variable is the current account over GDP. The estimation model is instrumental variables (IV) with random effects, using the following instruments: an index that measures the proportion of countries in the country's region that were subject to a sudden decline in capital inflows, lagged one period; a similar index that measures the incidence of sudden declines in inflows in other regions, also lagged one period; changes in the terms of trade, lagged two periods; inflation, lagged two periods; initial (1970) per capita GDP; population growth; and regional dummy variables. The sample includes all countries with a GDP in 1995 of at least US$52 billion, resulting in forty countries over the period 1974–2004. Test t statistics are in parentheses.

3.4.2 Alternative samples

I also estimated the model in equations (3) and (4) for alternative samples; the detailed results are not reported here due to space considerations. For a sample of smaller countries, the point estimate of the $(g_j^T - g_{j,t-1})$ variable is significantly smaller, although still significant. Other sample variations, including the elimination of outliers, did not significantly alter the main results.

3.4.3 Alternative specifications

I considered alternative specifications of the current account equation (3). In particular, instead of the accumulated change in the real exchange rate, I used a variable that captures the deviation of an estimate of the equilibrium real exchange rate and the one-period-lagged actual real exchange rate. I also modeled in greater detail the mechanics of the dynamic adjustment of the current account. In both cases, the results obtained are similar to those reported above; these results are available on request.

3.4.4 Region-specific coefficients

The results reported above were obtained under the assumption of common coefficients for all countries. This, of course, need not be the case. This subsection reports on estimations using different regional coefficients for NEPGDP_j^* and $(g_j^T - g_{j,t-1})$, which I obtained by interacting regional dummies with these two variables. The results are reported in table 11. The coefficients for the different variables continue to have the same signs as in the previous tables, and they continue to be significant at conventional levels. The point estimate of $(g_j^T - g_{j,t-1})$, however, is somewhat smaller than what was reported earlier. Two of the regional dummies interacted with NEPGDP_j^* are significant: namely, Latin America and Asia. The results in table 11 suggest that the coefficient of net external assets for the Latin American region is not different from zero; the chi-squared test has a value of 0.29 and a p value of 0.58. The coefficient of net external assets interacted with the Asia dummy is 0.039 and significant. This implies an overall coefficient for Asia of 0.095.

The estimate in table 11 also includes terms that interact regional dummy variables with $(g_j^T - g_{j,t-1})$. The interactive terms for Asia and Africa are significant at conventional levels. Their point estimates suggest that the sensitivity of the current account to changes in growth relative to trend is higher in these two regions than in the rest of the world.

Table 11. The Current Account and the Business Cycle: Variance Component Regressions with Interactions, 1970–2004[a]

Explanatory variable	*Full sample*
Growth gap	0.124 (2.27)**
Change in terms of trade	0.033 (2.48)**
Public sector deficit / GDP	–0.073 (–1.85)*
Accumulated change in RER	0.008 (4.01)***
Net external position / GDP	0.055 (8.09)***
Growth gap / GDP interactions	
with Latin America and the Caribbean	0.029 (0.33)
Asia	0.306 (3.39)***
Africa	0.523 (2.75)***
Middle East and North Africa	0.037 (0.3)
Eastern Europe	–0.081 (–0.84)
Net external position / GDP interactions	
with Latin America and the Caribbean	–0.054 (–7.58)***
Asia	0.038 (2.36)**
Africa	–0.036 (–0.85)
Middle East and North Africa	–0.004 (–0.22)
Eastern Europe	–0.001 (–0.02)
Summary statistic	
R^2	0.3031
Between R^2	0.6068
No. observations	949
No. groups	41

Source: Author's estimations.

* Statistically significant at the 10 percent level. ** Statistically significant at the 5 percent level. *** Statistically significant at the 1 percent level.

a. The sample includes all countries with a GDP in 1995 of at least US$52 billion, resulting in forty-one countries over the period 1974–2004. Test t statistics are in parentheses.

3.4.5 Interacting growth deviations with net external assets

Kraay and Ventura (2000) raise the issue of whether the effects of different shocks on the current account depend on the country's net external position. To explore this possibility in the current context, I included in the estimation of equation (3) a variable that interacts $(g_j^T - g_{j,t-1})$ with the (twice lagged) ratio of net external assets to GDP. The estimated coefficient was negative, as suggested by Kraay and Ventura (2000), but it was not significant at conventional levels. The results are not reported, but are available on request.

3.5 Growth Realignment in Japan and the Euro Area

As pointed out above, many analysts and government officials argue that a realignment of regional growth—with Japan and the Euro area growing faster and the United States experiencing a slowdown—would contribute significantly toward solving current global imbalances. In this subsection, I use the econometric estimates reported above to investigate the extent to which global imbalances would be reduced if growth moved toward a more "normal" level in a number of key countries. In particular, I assume that per capita growth increases in Japan and Germany, two countries with a combined surplus of US$270 billion that year. I assume that Japan's growth increases by 3.3 percent relative to its 2003–04 average, while Germany's growth increases by 1.0 percent. These higher growth rates would put both of these countries back onto their long-term growth trends. In addition, I assume that France and Italy, which posted small deficits in 2005, increase their growth by 1.0 percent each.[27]

Using the estimated coefficients from the equations in table 7, the acceleration in growth in Japan and the most important euro area countries would result in a surplus reduction of merely US$40 billion. Of this amount, US$27 billion would correspond to a surplus reduction in Japan, and US$13 billion to a surplus reduction in the euro zone. Finally, if U.S. growth declines toward its long-term trend, the U.S. deficit would fall by US$23 billion.

The magnitude of these corrections is quite small when compared with the type of adjustment that many analysts believe

27. Germany, France, and Italy's GDP add up to the bulk of the Euro area's GDP.

is required. Indeed, if the sustainable current account deficit in the United States is in the neighborhood of 3.6 percent of GDP, the needed correction would add up to approximately US$350 billion. These results suggest, then, that global imbalances will not be corrected without a significant adjustment in China and the oil-exporting countries. Moreover, these results support the view that (significant) exchange rate realignments will be needed to correct global imbalances.[28]

4. The Anatomy of Major and Rapid Surplus Adjustments

Since the mid-1990s, a number of authors have analyzed episodes of sudden stops of capital inflows and current account reversals.[29] These studies focus on the abrupt decline of international financing and the resulting rapid turnaround in the current account, from a large deficit to a moderate deficit (or even to a surplus). Until now, there have been no equivalent studies on episodes of large and sudden adjustments in surplus countries. This section aims to fill this void by exploring the anatomy of surplus adjustment episodes, or large reductions in current account surpluses over short periods of time. In particular, I am interested in analyzing how key macroeconomic variables—including inflation, GDP growth, interest rates, and real exchange rates—behave in the period surrounding these surplus adjustments. I define surplus adjustments in two alternative ways. First, a *2 percent surplus adjustment* is defined as a reduction of a country's current account surplus by at least 2 percent of GDP in one year. In addition to this requirement, the initial surplus has to be of 3 percent of GDP or higher. Second, a *3 percent surplus adjustment* is defined as an accumulated reduction of a country's current account surplus in at least 3 percent of GDP in three years, from an initial surplus of 3 percent of GDP or higher.

Table 12 contains information on the incidence of both definitions of surplus adjustments for the period 1970–2004. The data are for the full sample, as well as for six groups of countries: advanced economies, Latin America and the Caribbean, Asia, Africa, the Middle East and

28. See Blanchard, Giavazi, and Sa (2005), Obstfeld and Rogoff (2005), and Edwards (2005a, 2005b).

29. For recent papers, see Calvo, Izquierdo, and Mejía (2004) and Frankel and Cavallo (2004). For capital flows and crises, see Eichengreen (2003).

North Africa, and eastern Europe. The 2 percent surplus adjustment has been a more common phenomenon than the 3 percent surplus adjustment. The overall incidence for the former is 6.6 percent; it is only 3.0 percent for the latter. For both definitions, the highest incidence is in the Middle East and North Africa, with 19.7 percent and 10.2 percent. This reflects the important role played by Middle Eastern oil-producing countries in the generation of current account surpluses in the last thirty-five years. The industrial countries, in contrast, have had the lowest occurrence of surplus adjustments in our sample.

Table 12. Surplus Adjustment Episodes: Incidence by Region, 1970–2004

Sample group	*2% surplus adjustment*	*3% surplus adjustment*
Industrial countries	2.51	1.64
Latin America and the Caribbean	5.41	2.15
Asia	6.93	3.43
Africa	6.30	2.51
Middle East and North Africa	19.69	10.2
Eastern Europe	5.62	2.43
All countries	6.63	3.02

Source: Author's estimations.

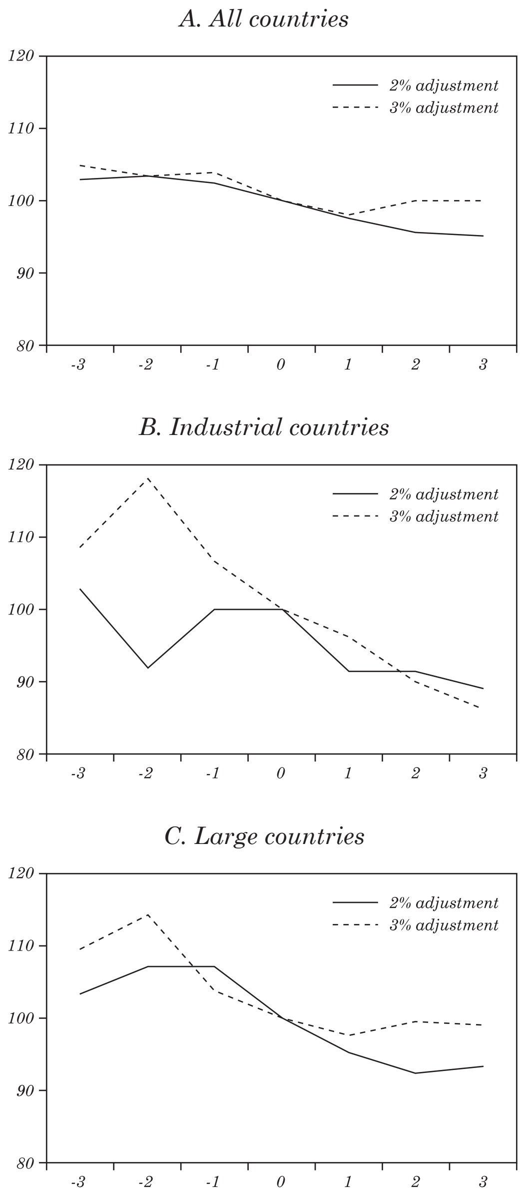
4.1 Surplus Adjustments and Exchange Rates

The issue of whether surplus adjustment episodes (as defined above) have historically been associated with large exchange rate appreciations is particularly relevant within the context of current policy debate on global imbalances.[30] Figure 1 presents the evolution of the median (bilateral) real exchange rate in surplus adjustment countries. These data are centered on the year of the surplus adjustment and presented as an index with a value of 100 in that year. The indexes are tracked from three years prior to the current

30. A related question has been asked of current account reversal episodes. On the relationship between depreciations and crises, see Eichengreen, Rose, and Wyplosz (1996).

Figure 1. Real Exchange Rate

Index: adjustment year = 100



Source: Author's calculations.

account surplus adjustment to three years after the adjustment.[31] In this figure, a lower value of the index reflects a real exchange rate appreciation.[32] The figure has three panels: one for advanced countries, one for large countries (defined as having a GDP in the top 25 percent of the distribution in 1995), and one for the full sample. In the figure, the large and advanced countries samples appear to undergo a visible real exchange rate appreciation in the period surrounding the surplus adjustment episodes, while the full sample shows no significant changes in the period around the surplus adjustment episodes.

Figure 2 shows the behavior of the (median) nominal effective exchange rate index. As before, a decline in the index represents a real appreciation. In this case, the picture is rather mixed. The full sample shows a slight nominal depreciation, the advanced economies register a small appreciation, and the large countries display no clear pattern.

To gain further insights on the nature of these surplus adjustment episodes, I estimated chi-squared statistics to test whether the medians in these figures were statistically different at different points in time. The tests were performed for three comparisons: three years after the adjustment relative to three years previous; one year after the adjustment relative to one year previous; and three years after the surplus adjustment relative to one year before the adjustment. The results are reported in table 13 for the 2 percent surplus adjustment episodes and in table 14 for the 3 percent surplus adjustment episodes. For the real exchange rate, the null hypothesis of equal medians is rejected in seven out of the nine cases in this table. The magnitude of the real exchange rate adjustment may be quite sizable according to these computations. For instance, for the 2 percent surplus adjustment episodes, the median appreciation between one year before and three years after the adjustment is 12.6 percent ($\chi^2 = 8.25$; p value = 0.004).

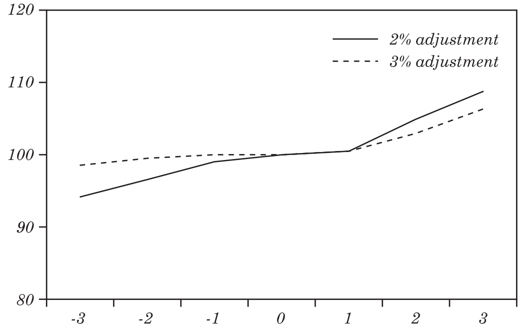
31. For the 3 percent surplus adjustment episodes, period zero corresponds to the first year of the three-year adjustment period.

32. If data for trade-weighted RER are used, the results are similar. The limitation of using trade-weighted data is that they are available for a smaller number of countries.

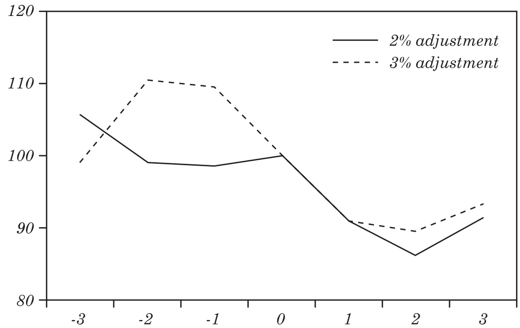
Figure 2. Nominal Exchange Rate

Index: adjustment year = 100

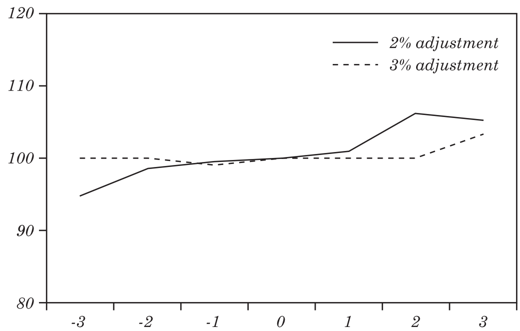
A. All countries



B. Industrial countries



C. Large countries



Source: Author's calculations.

Table 13: Two Percent Surplus Adjustment Episodes: Nonparametric Tests[a]

Period of comparison and explanatory variable	*All countries*		*Industrial countries*		*Large countries*	
	χ^2	Obs.	χ^2	Obs.	χ^2	Obs.
t = +3 versus t = –3						
Real exchange rate	3.610	233	0.000	22	2.450	80
Nominal exchange rate	35.650	258	0.727	22	9.561***	82
Real interest rate	0.055	147	0.090	13	3.431*	49
GDP per capita growth	6.109**	251	0.000	22	3.574*	81
Inflation	2.865*	238	0.727	22	0.050	80
Terms of trade	0.224	164	0.09	13	0.015	61
t = +1 versus t = –1						
Real exchange rate	10.933***	257	6.042**	24	14.406***	85
Nominal exchange rate	31.224***	281	2.685	24	8.389***	87
Real interest rate	2.986*	177	0.292	14	0.668	54
GDP per capita growth	0.000	278	0.671	24	0.047	86
Inflation	0.555	260	0.000	24	0.105	85
Terms of trade	30.211***	187	0.000	16	14.334***	67
t = +3 versus t = –1						
Real exchange rate	5.542**	247	2.909*	22	8.249***	82
Nominal exchange rate	47.980***	273	0.727	22	9.339***	84
Real interest rate	7.159***	171	0.090	13	3.769*	52
GDP per capita growth	0.450	269	0.000	22	0.974	83
Inflation	2.448	255	0.000	22	0.049	82
Terms of trade	13.916***	180	0.000	14	10.563***	64

Source: Author's estimations.
* The null hypothesis is rejected at the 10 percent level. ** The null hypothesis is rejected at the 5 percent level. *** The null hypothesis is rejected at the 1 percent level.
a. The null hypothesis is that the medians are equal.

Table 14. Three Percent Surplus Adjustment Episodes: Nonparametric Tests[a]

Period of comparison and explanatory variable	*All countries*		*Industrial countries*		*Large countries*	
	χ^2	Obs.	χ^2	Obs.	χ^2	Obs.
t = +3 versus t = –3						
Real exchange rate	1.221	118	0.076	11	1.316	37
Nominal exchange rate	18.955***	129	0.076	11	0.235	39
Real interest rate	0.061	68	0.500	8	1.149	21
GDP per capita	0.000	124	0.883	11	0.024	39
CPI	2.421	119	0.076	11	0.029	37
Terms of trade	2.475	80	0.109	7	0.615	26
t = +1 versus t = –1						
Real exchange rate	6.413**	131	1.143	14	2.273	44
Nominal exchange rate	14.368***	144	1.143	14	5.565**	46
Real interest rate	0.014	81	0.500	8	0.034	27
GDP per capita	1.211	139	0.000	14	1.391	46
CPI	2.758*	131	0.000	14	0.091	44
Terms of trade	6.719***	93	0.500	8	2.600	31
t = +3 versus t = –1						
Real exchange rate	1.162	124	1.371	12	0.232	41
Nominal exchange rate	21.383***	136	0.000	12	5.212**	43
Real interest rate	0.462	78	0.500	8	1.019	25
GDP per capita	1.091	132	1.371	12	0.601	43
CPI	2.572	126	1.371	12	0.021	41
Terms of trade	0.011	87	0.109	7	0.574	28

Source: Author's estimations.
* The null hypothesis is rejected at the 10 percent level. ** The null hypothesis is rejected at the 5 percent level. *** The null hypothesis is rejected at the 1 percent level.
a. The null hypothesis is that the medians are equal.

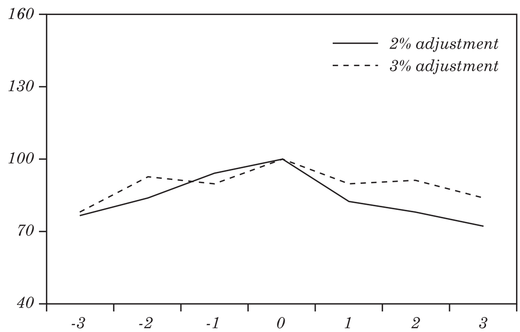
4.2 Surplus Adjustments, Interest Rates, Inflation, and Real Growth

Figures 3 and 4 present before-and-after data for real interest rates and inflation for the two definitions of surplus adjustments. These figures, together with the chi-squared statistics in tables 13 and 14, show a small decline in real interest rates and no significant trend for inflation in the years following the adjustment. Figure 5 presents data for per capita GDP growth during the period surrounding the surplus adjustment episodes. Once again, there is very little action here, and no clear pattern of behavior can be extracted from the analysis. This impression is largely supported by the results from the chi-squared tests reported in tables 13 and 14.

Figure 3. Real Interest Rate

Index: adjustment year = 100

A. All countries



B. Industrial countries

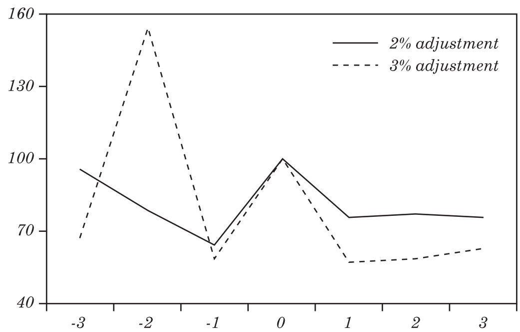
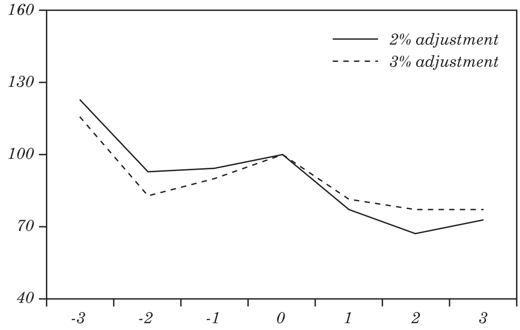


Figure 3. (continued)

C. Large countries

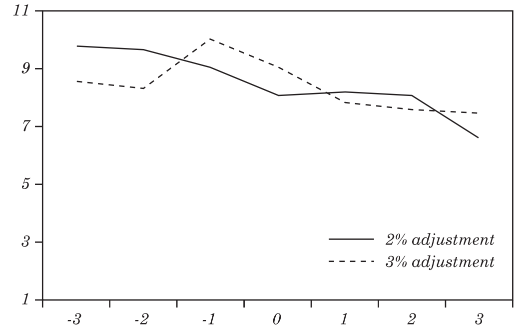


Source: Author's calculations.

Figure 4. Inflation

Annual percent change

A. All countries



B. Industrial countries

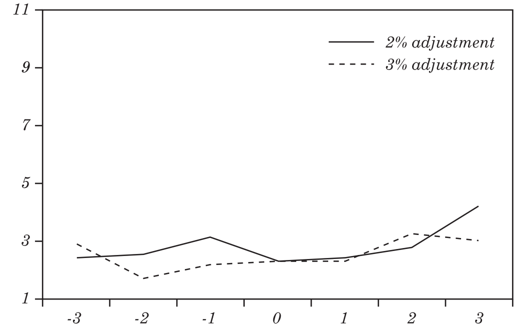
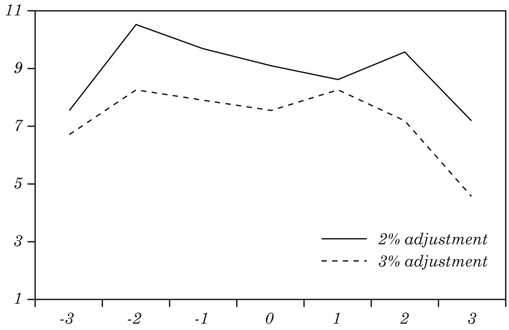


Figure 4. (continued)

C. Large countries

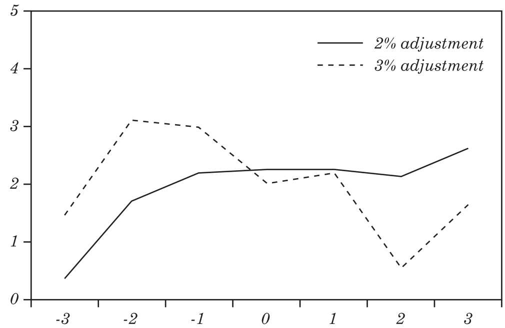


Source: Author's calculations.

Figure 5. Per Capital GDP Growth

Annual percent change

A. All countries



B. Industrial countries

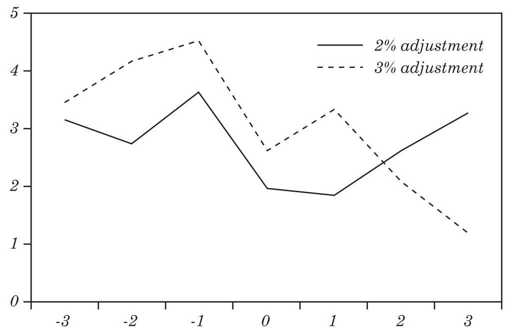
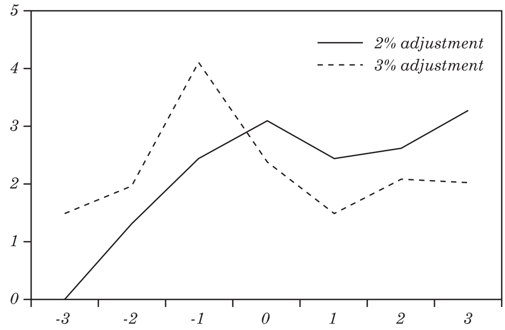


Figure 5. (continued)

C. Large countries



Source: Author's calculations.

4.3 Surplus Adjustments and Terms of Trade

Figure 6 investigates whether the surplus adjustment episodes identified in this paper have been associated with a sudden deterioration in the terms of trade. All three samples exhibit a worsening in the terms of trade in the year of the adjustment (period 0), relative to the previous year. This deterioration in the relative price of exports is reverted—in some cases partially and in others more than fully—in subsequent years. Despite these changes in the terms of trade, the data on the formal tests do not support the hypothesis that surplus adjustment episodes have been driven by terms-of-trade shock (see the chi-squared tests in tables 13 and 14).

Figure 6. Terms of Trade

Index: adjustment year = 100

A. All countries

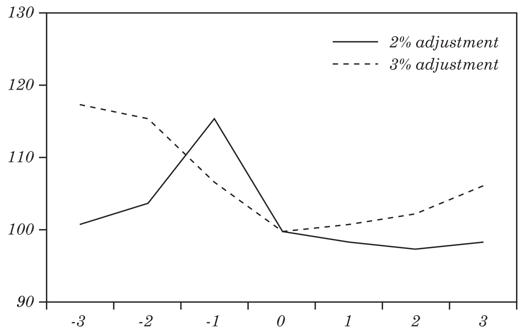
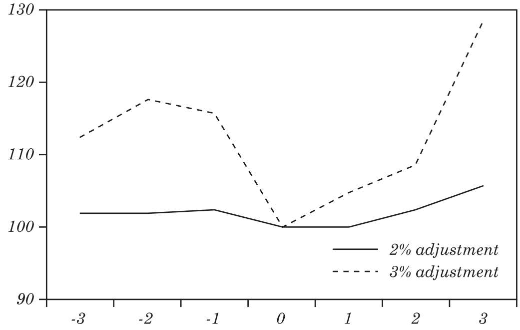
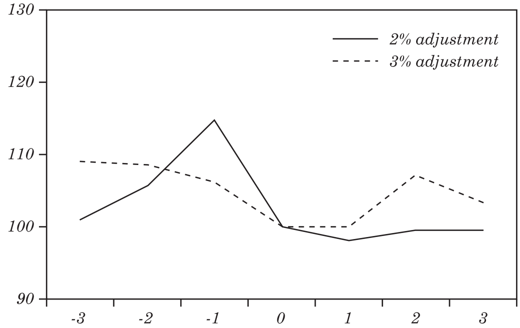


Figure 6. (continued)

B. Industrial countries



C. Large countries



Source: Author's calculations.

4.4 Current Account Surplus Adjustments versus Deficit Reversals

The picture that emerges in figures 1–6 on the evolution of key macroeconomic variables in the period surrounding surplus adjustment episodes is not very sharp, and it does not provide a clear-cut pattern of behavior. As one would expect from theory, there is some evidence of real exchange rate appreciation, a slight decline in real interest rates, and a short-lived and modest decline in the terms of trade in the period surrounding the surplus adjustment. This lack of a well-defined and sharp "typical" behavior in current account surplus adjustment episodes contrasts with the case of large and abrupt current account reversals. As I document in Edwards (2005a, 2005b), current account reversal episodes have historically been characterized by sharp depreciations, significantly higher real interest rates, and very significant declines in the growth rate relative to trend. These differences between current account reversals and surplus adjustment episodes confirm the notion discussed throughout this paper of the asymmetry of these two phenomena.

5. Concluding Remarks

This paper has addressed several issues regarding current account surplus. First, I identified the most important regularities of surpluses during the last thirty-five years, focusing on asymmetries between surpluses and deficits. Second, I explored whether large surpluses have been persistent and, if so, whether their degree of persistence has been higher than for large deficits. Third, the paper assessed the relationship between current account balances and the business cycle and, fourth, the relationship between external balances and countries' net external position. Fifth, I analyzed the likelihood that a realignment of world growth rates—with Japan and Europe growing faster and the United States growing more slowly—would solve the current situation of global imbalances. This issue is a particularly important because a number of analysts and U.S. government officials have argued that a normalization of growth would help solve global imbalances. Finally, I dimensioned the anatomy of significant and large surplus adjustments, defined as a decline in the surplus of at least 2 percent of GDP in one year.

The analysis generated a number of results. Current account deficits and surpluses exhibit an important asymmetry. During the last thirty-five years only 27.6 percent of all countries, on average, have run surpluses in a given year. This percentage, however, increased significantly in the last few years of the sample. Almost 40 percent of countries posted surpluses in 2003–04.

The most important recent changes in current account balances have occurred in Asia, where the current account reversal exceeded 5 percent of GDP between 1997 and 2003–04.

Large surpluses exhibit very little persistence through time, and very few large countries have had persistently large surpluses-to-GDP ratios. The Middle East displays the most persistent surpluses, which largely reflects the role of oil-exporting countries. Large surpluses are slightly more persistent than large deficits, but the degree of persistence of both types of imbalance is low.

Large and abrupt reductions in surpluses—what I call surplus adjustment episodes—are a relatively rare phenomenon. Their incidence fluctuates between 3.0 percent and 6.6 percent of all country years. The incidence of surplus adjustment episodes has been largest in the Middle East and smallest in the advanced countries. Surplus adjustment episodes have been associated with real exchange rate appreciations and deterioration in the terms of trade. No clear-cut picture emerges regarding the behavior of interest rates, inflation, and economic growth in the period surrounding major surplus adjustment episodes.

The econometric results reported in this paper indicate that the behavior of the current account balance can be explained by parsimonious models based on economic theory. In particular, current account balances have been associated with the business cycle, real exchange rates, fiscal imbalances, and the country's net external position. All of these variables enter into the current account equation with the expected sign, and their coefficients are significant.

The results obtained suggest that a 1 percentage point decline in growth relative to the long-term trend results in an improvement in the current account balance—that is, higher surplus or lower deficit—of one quarter of a percentage point of GDP. These results indicate that a realignment of global growth—with Japan and the euro area growing faster and the United States moderating its growth—would only make a modest contribution toward resolving current global imbalances. This suggests that even if there is a realignment of global growth, the world is likely to need significant exchange rate movements. Finally, the analysis also suggests that a reduction in China's very large surplus will be needed if global imbalances are to be resolved.

APPENDIX

Supplemental Tables

Table A1. Current Account Balances as a Percentage of GDP in the World Economy: Data Availability, 1970–2004

Number of observations

Year	*Africa*	*Asia*	*Eastern Europe*	*Industrial countries*	*Latin America and the Caribbean*	*Middle East and North Africa*	*All countries*
1970	3	5	0	8	5	3	24
1971	3	5	0	10	6	4	28
1972	3	6	0	11	6	4	30
1973	3	6	0	11	6	4	30
1974	11	7	1	12	7	5	43
1975	20	10	1	19	10	6	66
1976	24	11	1	21	17	9	83
1977	33	12	1	23	26	10	105
1978	37	12	1	23	28	9	110
1979	38	15	1	23	30	9	116
1980	41	16	2	23	32	10	124
1981	42	18	2	23	32	10	127
1982	43	18	3	23	32	10	129
1983	43	18	3	23	32	10	129
1984	43	20	4	23	33	10	133
1985	45	20	5	23	33	10	136

Table A1. (continued)

Year	*Africa*	*Asia*	*Eastern Europe*	*Industrial countries*	*Latin America and the Caribbean*	*Middle East and North Africa*	*All countries*
1986	47	20	5	23	32	10	137
1987	48	20	6	23	33	10	140
1988	48	20	6	23	33	10	140
1989	48	20	6	23	33	11	141
1990	48	20	6	23	33	12	142
1991	48	20	7	23	33	11	142
1992	48	21	13	23	33	11	149
1993	48	21	20	23	33	12	157
1994	48	21	23	23	33	12	160
1995	47	20	24	24	32	12	159
1996	46	20	25	24	33	12	160
1997	45	20	25	24	33	12	159
1998	43	20	25	23	33	12	156
1999	43	20	25	24	32	11	155
2000	43	17	25	24	32	12	153
2001	44	17	25	25	32	12	155
2002	39	16	25	24	33	11	148
2003	37	14	25	24	29	11	140
2004	27	12	22	24	23	11	119
All years	1277	558	363	746	943	338	4225

Source: Author's calculations.

Table A2. Definition of Variables and Data Sources

Variable	*Definition*	*Source*
Civil liberties	Index of civil liberties	Freedom House
Coverage of secondary education	Total gross enrollment ratio for secondary education	Barro and Lee (2001)
Current account		*World Development Indicators*
Current account reversal	Reduction in the current account deficit of at least 4% of GDP in one year	Author's elaboration based on data of current account
Domestic credit growth	Annual growth rate of domestic credit	*World Development Indicators*
Export		*World Development Indicators*
Fiscal deficit	Overall budget	*World Development Indicators*
GDP		*World Development Indicators*
Government consumption		IMF's *International Financial Statistics*
Import		*World Development Indicators*
Inflation	Change in CPI	*World Development Indicators*
Initial GDP per capita	GDP per capita in 1970	*World Development Indicators*
Investment ratio	Total investment over GDP	IMF's *International Financial Statistics*
Net external position		Lane and Milesi-Ferretti (2006)
Openness	Predicted trade from bilateral gravity equations	Author's elaboration
Population		World Development Indicators
Real exchange rate	(Nominal Exchange Rate*PPI US) / CPI	World Development Indicators
Surplus adjustmen	Two definitions: at least a 2% reduction in surplus in one year; a 3% reduction in surplus accumulated over 3 years	Author's elaboration based on data on capital flows *(World Development Indicators)*
Sudden stops in region	Relative occurrence of sudden stops in the country's region (excluding the country itself)	Author's elaboration
Terms of trade	Change in term of trade export as capacity to imports (constant local currency unit)	*World Development Indicators*

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Crises in Emerging Market Economies: A Global Perspective

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It is now more than ten years since the "first crisis of the twenty-first century," as Michel Camdessus, the former managing director of the International Monetary Fund (IMF), called Mexico's 1994–95 tequila crisis. The event is important not because it signaled a new environment (the tequila crisis was not that different from Mexico's 1982 crisis), but because it was the beginning of a long series of financial crises in emerging market economies. Their frequency and global span (Latin America, Asia, the Middle East, and Russia) set them apart from anything seen previously—at least since World War II. The key question that arises in this respect is as follows: is the higher frequency of emerging market crises an indication that emerging market economies have become sharply less creditworthy (for example, by running unsustainably large fiscal deficits), or does it show that greater access to the global capital market has made these economies more vulnerable to shocks originating in the capital market itself? In Calvo (2002), I refer to these capital market shocks as globalization hazard. The central point of this paper is that empirical evidence strongly supports the view that emerging market crises exhibit an important degree of globalization hazard; consequently, policies aimed at attenuating the incidence and seriousness of these crises should contain significant global or systemic components. Specifically, the international financial community needs to find ways to help lower globalization hazard. Without new and effective

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global instruments, the old modus operandi in which IMF missions are sent to nurse the wounds of economies hit by crisis may still alleviate the pain, but it is unlikely to wipe out the plague.

I begin my presentation in section 1 by discussing a remarkable fact that has received little attention in the literature, namely, the persistent slowdown in emerging market economies' growth (if not outright output collapse) and investment in the aftermath of the 1997 Asian and 1998 Russian crises, especially the latter.[1] The negative shock cuts across various emerging market economies, strongly suggesting the existence of systemic or global factors. This is confirmed by evidence pointing to the fact that the capital inflow episode in emerging market economies in the first half of the 1990s may also have global roots, such as the rapid development of the U.S. bond market and the creation of Brady bonds. The section closes by noting that these crises may have been preventable or significantly alleviated, albeit with new policies and institutions.

Sections 2 and 3 are more technical and could be skipped on a first reading without loss of continuity. Section 2 outlines a model explaining shocks that emanate from a malfunctioning of capital markets. The section further explains why a shock in the international capital market could spread to emerging market economies and how domestic vulnerabilities could help magnify the external shock and give rise to higher domestic volatility and financial disorder. Section 3 summarizes recent empirical and econometric findings, which further confirm the relevance of external factors and identify domestic vulnerabilities that might aggravate the impact of negative external shocks. In particular, empirical papers focus on domestic liability dollarization that is, domestic banks' loans denominated in foreign exchange as a share of GDP) and the current account deficit (as a share of the absorption of tradables). Finally, section 4 discusses policy issues, emphasizing the global perspective.

1. The Asian/Russian Crisis and Its Aftermath

It always happens after a big crisis: people happily reveal their inchoate views. Thus, after the 1982 Mexican crisis that inaugurated the so-called debt crisis period, enemies of government intervention immediately concluded that the crisis was due to the failure of import

1. For a discussion of the Russian crisis in the context of Latin American economies, see Calvo and Talvi (2005).

substitution. This conclusion stuck for many years, and it still does, as few bothered to question it.[2] Likewise, after the Asian/Russian crisis, it became fashionable in Latin America to blame the reform process inspired by the Washington Consensus (see Williamson, 1994), even though there is no thread of evidence connecting reforms to crises in the region. If left unchallenged, however, this view will soon become conventional wisdom (and an army of protection-hungry firms and politicians will have good reason to celebrate!).

In this section, I challenge that view in a somewhat indirect way. I present strong evidence that what recently happened in emerging market economies may have a great deal to do with the global capital market. This does not deny, I hasten to add, that local factors are relevant. Rather, it suggests that, without the external disturbances, emerging market economies would not have ridden the dizzying rollercoaster of recent years.[3]

Before starting, I should warn the reader that the discussion in this section is highly impressionistic and would not pass a rigorous scientific test. The latter will have to wait until section 3. Instead, the main objective in this section is to show some key stylized facts strongly suggesting that the 1997–98 Asian/Russian crisis appears to have had an inordinately strong impact on emerging market economies, thus challenging the opponents of reform while motivating the theoretical discussion in the next section.[4]

1.1 The Asian/Russian Crisis

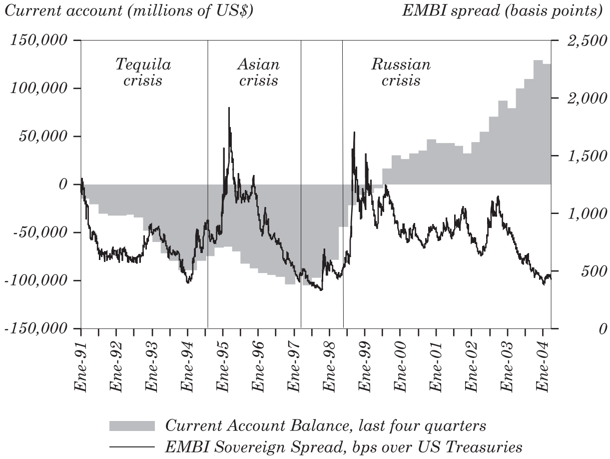
Figure 1 plots monthly observations of J. P. Morgan's Emerging Markets Bond Index (EMBI) and emerging market economies' current account from January 1991 to January 2004. Twice, the EMBI rises sharply above 1,500 basis points (that is, 15 percent above U.S. treasury bonds), namely, shortly after the onset of Mexico's tequila crisis in December 1994 and during the Russian

2. For a different view stressing the catalytic role of the sharp rise in U.S. interest rates, see Borensztein and Calvo (1989) and Stiglitz (2003). Panagariya (2004) even shows that it is incorrect to characterize the 1960s and 1970s in Latin America as a period of import substitution.

3. See, for example, Calvo and Talvi (2005), who attribute the sharp differences between Argentina and Chile after the Russian crisis to factors like domestic liability dollarization and openness to trade.

4. I combine the Asian and Russian crises because they happened in the span of about one year, but later I argue that the Russian crisis likely was the most damaging.

Figure 1. The 1997–98 Asian/Russian Crisis: Effects on Emerging Market Countries[a]



Source: J. P. Morgan; and International Monetary Fund (IMF), Balance-of-Payments Statistics.
a. Includes Argentina, Brazil, Chile, China, Colombia, Czech Republic, Egypt, Hungary, India, Indonesia, Israel, Korea, Malaysia, Mexico, Morocco, Pakistan, Peru, Philippines, Poland, Slovak Republic, South Africa, Thailand, Turkey, and Venezuela.

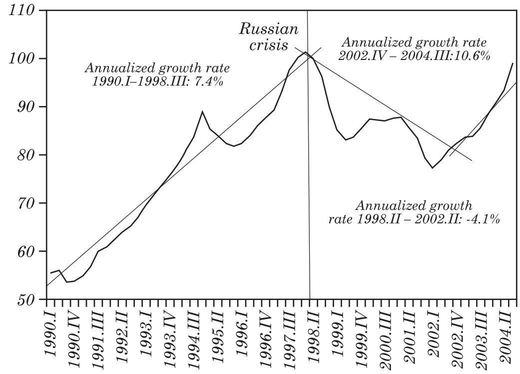
crisis in August 1998. The impact on current account adjustment is quite different in the two episodes, however. While it is difficult to see much of an adjustment around the tequila crisis (the emerging market current account deficit actually widens shortly after the tequila crisis until the Asian crisis in 1997), the combination of Asia and Russia set in motion an enormous current account adjustment that completely reversed earlier current account deficits; large emerging market current account surpluses are still the norm at present. Evidently, something very dramatic happened around the Asian/Russian crisis.[5] The impact of these crises on the real economy can be seen in figures 2 and 3.[6] Again, the difference between the tequila and Asian/Russian crises is quite striking. While the tequila

5. The drama or, rather, the tragedy also visited the north as Long-Term Capital Management (LTCM) hedge fund collapsed in September 1998 (see Kaminsky and Reinhart, 2001).

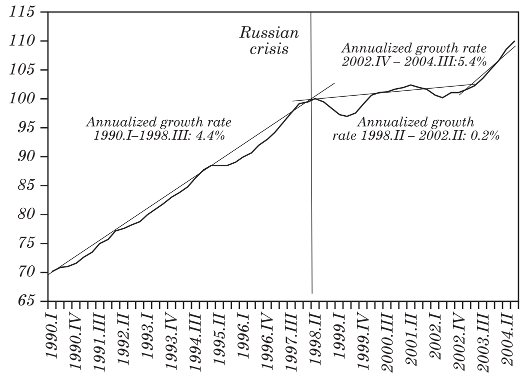
6. Quarterly data. Investment and output are unweighted averages across the corresponding regions. A similar pattern emerges if countries' data are weighted by their relative GDPs.

Figure 2. The 1997–98 Asian/Russian Crisis: Latin American Investment and Output[a]

A. Investment



B. Economic growth



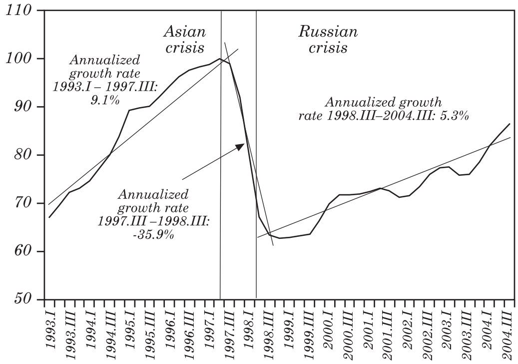
Source: Central banks of the included countries.

a. Seasonally adjusted investment and seasonally adjusted GDP, 1998:2 = 100. Includes Argentina, Brazil, Chile, Colombia, Mexico, Peru, and Venezuela.

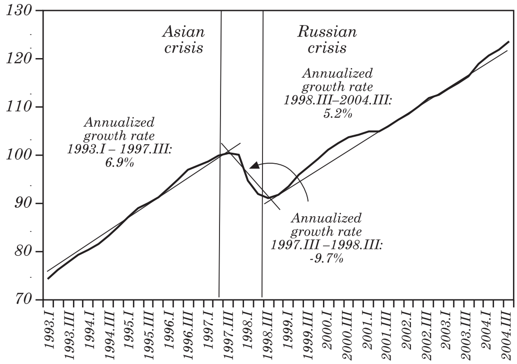
crisis represents a minor bump in the road, even for Latin America, the Asian/Russian crisis is associated with major collapses in growth and investment. Even in Asia, where recovery begins immediately after the Russian crisis, output does not return to its peak (prior to the Asian crisis) until 2002, and investment is still about 15 percent below its peak. Incidentally, the Asian/Russian crisis was much more

Figure 3. The 1997–98 Asian/Russian Crisis: Asian Investment and Output[a]

A. Investment



B. Economic growth



Source: Central banks of the included countries.
a. Seasonally adjusted investment and seasonally adjusted GDP, 1997:2 = 100. Includes Indonesia, Korea, Malaysia, Philippines, and Thailand.

benign in Latin America than in Asia: it brought about a slowdown in the growth rate in Latin America, while in Asia output showed a precipitous decline.

Why was the tequila crisis so mild, and the Asian/Russian crisis so severe? My conjecture is that the tequila crisis was mild because the timely and large Mexican bailout orchestrated by the International Monetary Fund succeeded in insulating the global capital market (particularly Wall Street) from this crisis.[7] The Asian crisis could also have been mild (the EMBI hardly budged during this episode), but it turned virulent when combined with the Russian crisis. The latter showed investors that the emerging market asset class was much more risky than they had originally believed in the early 1990s.

1.2 Capital Inflows in the Early 1990s

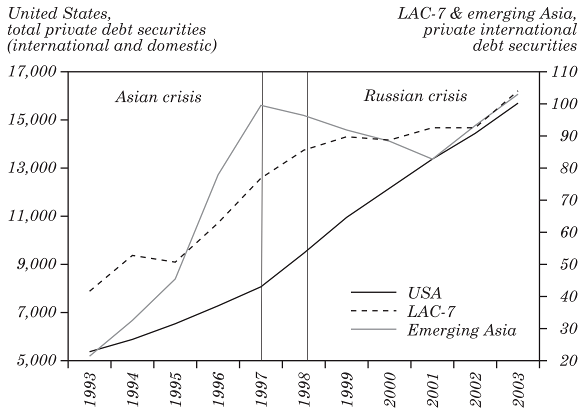
Thus far, the discussion has focused on crises, completely ignoring the capital inflow period in the early 1990s. Explanations run the gamut from domestic to external factors. During the capital inflow period, the official sector was quick to conclude that the surge in capital inflows reflected the end of the debt problem (that is, the debt crisis that involved several emerging market economies and started with Mexico's August 1982 financial crisis) and the onset of a promarket reform period. This fit the facts in Latin America, but not in Asia. By and large, emerging Asia did not suffer from the debt problem, and the 1990s was not a particularly active reform period (unless one counts as promarket reform the opening up of Asian capital markets). Thus, the domestic factors explanation is not terribly convincing.

The external factors view again has a better chance of hitting the bull's eye. As shown in figure 4, the U.S. private sector bond market exhibited almost a 211 percent expansion in the period from 1993 to 1997, as firms shifted from bank loans to tapping the bond market. This represented a major technical change in global financial markets, and the growth of the U.S. fixed-income market created an expertise that could arguably be applied to other bond issuers. Moreover, the onset of this expansion coincided with the creation of the so-called Brady bonds, which essentially took sovereign loans out of banks' balance sheets and placed them on the bond market. This, combined with the large expansion of the U.S. bond market, may have laid the groundwork for the emerging bond market. These factors may have additionally provided a platform for the initial wave of capital inflows in the 1990s, especially for countries afflicted by the debt problem. Some evidence in that direction is presented in figure 4, which shows that private international bonds increased by 84 percent in Latin

7. Some observers claim that the Mexican bailout is responsible for the Asian crisis, because it sent the signal that the public sector would bail investors out in case of trouble. I do not find this moral hazard argument very persuasive. See Calvo (2002) and the discussion in section 4.

America and the Caribbean in 1993–97, while in emerging Asia they rose by an impressive 365 percent.[8] After the Asian/Russian crisis, the U.S. private sector bond market kept growing at full steam, while emerging Asia recorded a sharp retrenchment and Latin America a marked slowdown (especially after the Russian crisis). Interestingly, the different nature of the Asian and Latin American private sector international bond stocks after the Asian/Russian crisis mirrors their output counterparts (recall figures 2 and 3).

Figure 4. Private Debt[a]



Source: BIS.
a. Amounts outstanding in billions of U.S. dollars.

An across-the-board increase in the supply of emerging market bonds may contain the seeds of its own destruction, or at least of instability. Calvo and Mendoza (2000) show that such an expansion of the bond market may diminish investors' incentives to collect information specific to each economy and induce them to make portfolio decisions on the basis of general information (like ex ante first and second moments).[9] However, a slight change in expectations may bring about a sharp portfolio repositioning. This theory thus helps

8. I focus on international debt for emerging market economies because domestic debt is subject to tricky valuation problems, and considering it would unduly extend the discussion. However, tentative estimates including domestic emerging market debt provide a similar picture.

9. A key assumption is that short sales are bounded (for example, there are margin constraints).

to explain the occurrence of a single country's sudden stop episode, which, to the unsuspecting observer, would appear to have come from nowhere. This type of shock may create confusion and make investors (especially the unsuspecting or uninformed) think that most emerging market economies are subject to a negative shock, giving rise to an across-the-board increase in interest rate spreads, such as occurred during the 1998 Russian crisis.

1.3 The Phoenix Miracle

Another topic that deserves mention here is the nature of recovery after a sudden stop of capital inflows.[10] In ongoing work, Alejandro Izquierdo, Ernesto Talvi, and I examine the recovery process in all emerging market sudden stop episodes from 1980 to the present, including all cases in which output fell by more than 5 percent from peak to trough and exhibited a systemic nature. Economies in the sample underwent sudden stops around the times of the 1982 and 1994–95 Mexican crises and the 1997–98 Asian/Russian crisis. In total, we examine fourteen cases. We find that the recovery took place under conditions in which domestic bank credit, the current account deficit, and investment were only a small fraction of their corresponding levels prior to the sudden stop. This phoenix miracle or rising-from-the-ashes phenomenon suggests that systemic sudden stops are preventable accidents.[11] How to avoid them depends on the underlying causes. If the triggering factor is external to emerging market economies, then global solutions are called for. The Asian/Russian crisis could be a case in point, as discussed above. Domestic factors are also likely to play a critical role, however, as I argue in the theoretical and econometric sections below. Policies to prevent sudden stops and attenuate their effects must thus encompass both domestic and global components.

The discussion above shows very clearly that the Asian/Russian crisis was associated with a major and persistent collapse in emerging market growth and investment. This empirical evidence should give pause to opponents of reform and at least make them reconsider their dogmas. That is unlikely to happen, however, unless they are faced

10. These are episodes in which the flow of new international credit is sharply curtailed; they are central to recent financial crises in emerging market economies. For a more formal definition, see section 3 below.

11. For an update of these results and formal empirical tests that confirm and extend them, see Calvo, Izquierdo, and Talvi (2006).

with well-structured theory and scientific empirical analysis. The next two sections provide a summary of the first steps in that direction. Readers less interested in technical details are prompted to proceed directly to the policy discussion in section 4.

2. Insights from Theory

The first step is to rationalize the existence of a sudden stop stemming from a malfunctioning of international capital markets. Let the emerging market production function be given by $f(k,\theta)$, where k is capital per unit of a fixed factor (which one might interpret as entrepreneurial services or home goods), and θ is a random shock.[12]

The representative firm is risk neutral and chooses k so as to maximize its quasi-rent. That is,

$$\max_{\iota \in \mathrm{I}} E\left(\max_{k} E\left\{\left[f(k,\theta) - rk\right]/\iota\right\} - N(\iota)\right), \tag{1}$$

where r is the international rate of interest or capital rental faced by the firm, E is the expectations operator, I is the set of information schemes (or σ fields) available to the firm, the forward slash stands for conditional on, information scheme ι is a member of I, and $N(\iota)$ is the cost of information scheme ι. Thus, given information scheme ι, the firm is assumed to maximize its expected quasi-rent with respect to k, conditional on information scheme ι. The firm then chooses the information scheme $\iota \in \mathrm{I}$ that maximizes ex ante expected profits.

International shocks are transmitted through the interest rate faced by the firm, r. Investors are risk neutral, but there are states of nature in which emerging market governments may impose a tax, τ, on interest income (for instance, in response to a negative common real shock).[13] Thus, letting R stand for the pure international interest rate, the no-arbitrage condition implies that

$$r = E\left(\frac{R}{1-\tau}\right). \tag{2}$$

12. As usual, I assume that function f is increasing and strictly concave with respect to k. A fixed factor is assumed, instead of allowing for a variable factor like labor, because I later introduce a fixed cost, and under those conditions, variable factors and linear homogeneity are inconsistent with the existence of a competitive equilibrium.

13. The tax story is chosen for its simplicity. There is nothing especially realistic about it.

Consider now a capital market mishap similar to the one that allegedly occurred during the Russian crisis, in which a set of key investors are subject to margin calls and therefore sharply lower their participation or dump a considerable share of their emerging market portfolios on the market.[14] On observing such strange behavior on the part of margin-constrained but high-profile investors and firms, the non-margin-constrained agents would face a classic signal-extraction problem. What prompted margin-constrained investors to withdraw from the market? Was it because they are margin-constrained, or because they learned that emerging market economies have been hit by a negative shock and, say, governments will increase the tax, τ, on capital flows? Under those circumstances, unless there is a totally credible leak signaling that all is due to margin calls, rational non-margin-constrained agents (the only ones that would be able to extend fresh loans to emerging market economies) will infer that emerging market economies have been hit by a common negative shock. Consequently, expected interest income taxes will rise, leading to an increase in the interest rates faced by firms, r.[15] Thus, a mishap in the international capital market that has nothing to do with emerging market economies may result in an increase in r and have a negative impact on output.[16]

Some degree of skepticism is warranted here, however, because the argument above could apply to developed economies, as well. Why, then, are emerging market economies more likely to suffer devastating effects from capital market accidents? The key element that differentiates developed economies from emerging market economies is in the very labeling of emerging market economies, especially if by emerging one means that these economies operate under highly incomplete information owing to, for example, a lack of a sufficiently long track record and weak economic and political institutions. These conditions make it more likely that, when faced with a shock stemming from the international capital market, uninformed economic agents give more weight to the conjecture that the shock has a large emerging market component and less weight to the alternative possibility that the shock comes from the international capital market.

14. Some investors buy financial securities by borrowing the attendant funds from a bank. Given a sharp fall in securities' market values, the bank may decide that the original loan is too risky and demand a swift (partial) repayment. This is a salient characteristic of margin calls.

15. For a more rigorous discussion of this issue, see Calvo (1999).

16. See Neumeyer and Perri (2005) for an analysis of the impact of the international interest rates faced by emerging market economies and their business cycle.

Calvo (1999) discusses an example along these lines in which margin-call shocks and emerging market shocks are log-normally distributed and are mutually stochastically independent; in that context, the weight that rational individuals give to domestic factors increases with the variance of domestic shocks relative to that of margin-call shocks. Thus, the larger the volatility of information about an economy, the bigger the weight uninformed (but rational) investors will put on domestic factors, which helps explain why the same accident in the world capital market may have a bigger negative impact in emerging market economies than in developed economies.

As argued in Calvo (1999), a sudden stop in capital inflows (provoked in this case by a sharp rise in r) may have negative effects that go beyond the decline in capital or investment. The existence of additional negative effects, called adjustment costs, is a standard feature in current macroeconomic models. These models typically assume that the larger the change in the rate of investment, the larger its associated adjustment cost. The standard assumption, however, is that such costs result in lower net output but have no direct effect on marginal productivities and, equally importantly, they are temporary. Relevant as the standard assumption may be for regular business cycle shocks, it does not seem to capture the great disarray that follows a sudden stop in emerging market economies, in which shocks are so large and widespread that they radically change the business environment. Therefore, a more appropriate assumption seems to be that adjustment costs impinge on the marginal productivity of capital, θ, in the model presented here and, in a dynamic extension, that the shocks are highly persistent (especially in the absence of sufficiently large and timely bailouts). At the very least, one should assume that a sudden stop temporarily lowers the unconditional expectation of θ. Since the sudden stop lowers the marginal productivity of capital, output will remain depressed even though interest rates go back to precrisis levels.[17]

The effect of a sudden stop on marginal productivities is likely to depend on the depth of the ensuing domestic financial turmoil. In extreme cases, such as in Argentina in 2002, even the domestic payments system may come to a sudden stop. Research with my

17. Mendoza (2004) studies a dynamic general equilibrium model in which sudden stops emerge exogenously, and when they occur the economy exhibits productivity effects on value added of the type discussed here. These effects are caused by changes in capacity utilization and demand for intermediate goods triggered by frictions in world credit markets.

collaborators, which is summarized in section 3, identifies two factors that may contribute to deepening domestic crisis and, as a result, increase the probability of a sudden stop. These factors are domestic liability dollarization and a large current account (of the balance of payments) deficit as a share of tradables output. Domestic liability dollarization is defined as domestic banks' foreign-exchange-denominated loans as a share of gross domestic product (GDP). It is a risk factor because sudden stops are associated with large real devaluations, which increase the chances that domestic agents will default on foreign-exchange-denominated loans. The current account deficit (as a share of the domestic production of tradables) is also a risk factor because a sudden stop typically leads to a sharp current account adjustment, which is likely to bring about large changes in relative prices (never a good omen in financial markets) when output of tradables is small.[18]

As discussed in section 3, empirical analyses also show that the volatility of relative prices rises sharply during sudden stops, suggesting that sudden stops are also likely to lead to a higher variance of θ. This may stem from the fact that a sudden stop increases the share of systemic, as opposed to firm-specific, shocks on individual θj, where j stands for firm j. Greater volatility, in turn, may increase firms' incentives to learn more about the state of nature. As firms divert resources to knowledge activities, output is likely to fall further in the short run. Moreover, better knowledge about the state of nature may be reflected in even larger price volatility, as shown in the following example.

2.1 Relative Price Volatility

To simplify the exposition, I assume that there are only two polar information schemes: no information, *NI*, in which firms know the distribution of random variable θ, but not its realization; and full information, *FI*, in which firms know the realization of θ. Moreover, following Calvo, Izquierdo, and Loo-Kung (2006), I assume that function f can be approximated by the following quadratic form:

$$f(k,\theta) = \theta k - \frac{1}{2}k^2. \tag{3}$$

18. If the economy produces only tradables, however, the current account adjustment would take place with hardly any change in the real exchange rate.

Thus, in the no-information case, the maximization problem stated in expression (1) (that is, after choosing the information scheme) yields, assuming interior solutions,

$$k^{NI} = \overline{\theta} - r. \tag{4}$$

where k^{NI} is the quasi-rent-maximizing capital stock under no information and $\overline{\theta}$ is the unconditional expectation of $\overline{\theta}$. Then,

$$\pi^{NI} = \max_{k} \underset{\theta}{E}\left[f(k,\theta) - rk\right] = \frac{1}{2}(\overline{\theta} - r)^2, \tag{5}$$

where π^{NI} stands for expected maximum quasi-rent in the no-information case. Moreover, the ex post return to the fixed factor, w^{NI}, is given by

$$w^{NI} = f(k^{NI},\theta) - rk^{NI} = (\theta - r)(\overline{\theta} - r) - \frac{1}{2}(\overline{\theta} - r)^2. \tag{6}$$

Similarly, the quasi-rent-maximizing k in the full-information case satisfies

$$k^{FI} = \theta - r, \tag{7}$$

and the expected quasi-rents associated with full information, denoted by π^{FI}, satisfy

$$\pi^{FI} = \underset{\theta}{E} \max_{k}\left[f(k,\theta) - rk\right] = \frac{1}{2}\underset{\theta}{E}(\theta - r)^2 = \frac{1}{2}\mathrm{var}\,\theta + \pi^{NI}. \tag{8}$$

Equation (8) shows that expected quasi-rents are larger under full information than under no information, the difference being proportional to the volatility of θ. Given information cost, the higher the volatility of θ, the larger will be the incentives to acquire full information.

I denote the ex post return to the fixed factor under full information by w^{FI}, such that

$$w^{FI} = f(k^{FI},\theta) - rk^{FI} = \frac{1}{2}(\theta - r)^2. \tag{9}$$

To analyze whether more information entails higher relative price volatility, as measured by w, I compute *RVol* defined as follows:

$$RVol = \sqrt{\frac{\operatorname{var} w^{FI}}{\operatorname{var} w^{NI}}} = \frac{1}{2(\bar{\theta} - r)}\sqrt{\frac{\operatorname{var}\left[(\theta - r)^2\right]}{\operatorname{var}\theta}}, \tag{10}$$

where the rightmost expression in equation (10) follows from equations (6) and (9). To obtain an explicit expression for *Rvol*, I consider the case in which θ is log-normally distributed with natural log mean μ and natural log standard deviation σ, and assume $r = 0$. Then, as demonstrated in the appendix,

$$RVol = \frac{1}{2}e^{\sigma^2}\sqrt{\frac{e^{4\sigma^2} - 1}{e^{\sigma^2} - 1}} > 1. \tag{11}$$

This example confirms the intuition that better information will result in higher relative price volatility.[19] This may not be welfare reducing if its only effect is to generate an economy operating under better information. However, if firms are debt-ridden (as is likely to be the case after a capital inflow episode), then the resulting higher relative price volatility may bring about financial difficulties, which could more than offset the beneficial effects of better information.[20]

3. Sudden Stop Probability and Price Volatility: Empirical Evidence

This section summarizes the main empirical findings on the sudden stop phenomenon based on Calvo and Reinhart (2000b), Kaminsky and Reinhart (2001), Calvo, Izquierdo, and Talvi (2004), Calvo, Izquierdo, and Mejía (2004), and Calvo, Izquierdo, and Loo-Kung (2006). These papers employ various definitions of sudden stop, but much of the systematic empirical analysis defines sudden stop along the following lines:

—First, capital flows as of month t are defined as the accumulated capital flows in the previous $t - 11$ months;

—Second, a sudden stop episode is said to occur at month t if capital flows in month t are lower than its mean by more than two standard

19. Calvo, Izquierdo, and Loo-Kung (2006) present a similar result is shown in the case in which θ is uniformly distributed, but we have not been able to establish the generality of this result for arbitrary distribution functions.

20. Notice that domestic liability dollarization is not a problem in the present context because firms are implicitly assumed to produce tradable goods.

deviations, where mean and standard deviation are computed from prior history;

—Third, a candidate interval for sudden stop is defined as a time interval that contains a sudden stop episode and, for each month of the interval, capital flows are at least one standard deviation below the mean; and

—Finally, a sudden stop interval is defined as a candidate interval for sudden stop when, in addition, output falls (see Calvo, Izquierdo, and Mejía, 2004) or there is at least one month in the interval in which the regional international interest rate spread exceeds its mean by at least two standard deviations (see Calvo, Izquierdo, and Loo-Kung, 2006).

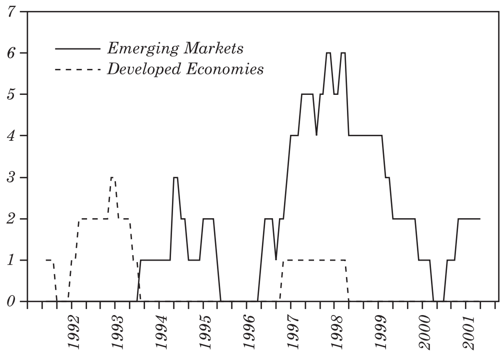
These definitions of sudden stop try to capture situations in which the contraction of capital flows has a large element of surprise and is either associated with an output fall or takes place in an environment in which all emerging market economies are undergoing financial stress.[21]

This definition is in line with the following setup. Sudden stops stem mostly from a malfunctioning of the global capital market. A mishap in the latter leads investors to test all emerging market economies, such that each emerging market is subject to an incipient sudden stop. If the economy bounces back from this test, no (full-fledged) sudden stop takes place; otherwise, a sudden stop (interval) will occur. Whether or not a sudden stop will occur is likely a function of domestic vulnerabilities, as discussed in section 2. Before turning to that issue, I would like to discuss three interesting features of sudden stops.

First, for the case in which the definition of sudden stops requires output contraction, sudden stops tend to bunch together, especially in emerging market economies (see figure 5). This suggests that there is a systemic element to sudden stops (which is one reason why we changed the definition in Calvo, Izquierdo, and Loo-Kung, 2006, and required that sudden stops have a systemic characteristic). this finding reinforces the conjecture that sudden stops could have external roots.

21. The output contraction condition was assumed to exclude cases in which capital flows drop as a result of a large improvement in the terms of trade, a phenomenon that has no connection to capital market difficulties. Criticism of this criterion led us to the alternative definition, in which the requirement is that global capital markets for emerging market economies show signs of trouble.

Figure 5. Bunching of Sudden Stop Episodes in Emerging Market Economies



Source: Calvo, Izquierdo, and Mejía (2004).

Second, more than 60 percent of large devaluations (which are typically associated with balance-of-payments crises) in emerging market economies are accompanied by a sudden stop, while in developed economies less than 20 percent exhibit that feature (see table 1). This reveals a central difference between emerging market and developed economies: balance-of-payments crises in emerging market economies are more likely to be associated with a credit crisis than in developed economies. Thus, while purely monetary models like Krugman (1979) could be relevant for developed economies, one has to look deeper into the roots of credit disruptions in emerging market economies.[22] An implication of these facts is that while simple policy actions like currency devaluation could be very effective in restoring equilibrium for developed economies, they may be ineffective or even counterproductive in emerging market economies.[23]

Third, in Calvo, Izquierdo, and Mejía (2004), and Calvo, Izquierdo, and Loo-Kung (2006), we test the hypothesis that the probability of a sudden stop increases with domestic liability dollarization (defined as local banks' foreign-exchange-denominated loans as a share of GDP) and the current account deficit as a share of tradables output (denoted by $1 - \omega$).[24] In all cases, we find that domestic liability dollarization and ω are significant at conventional levels. Terms of trade are

22. This establishes a connection with section 2, since credit disruptions are at the heart of the theoretical framework discussed there.
23. This issue is further discussed in the next section.
24. The previous section discussed the rationale for these variables.

Table 1. Sudden Stops and Large Currency Depreciation
Percent of total[a]

Type of devaluation	*Emerging markets*	*Developed economies*
Devaluations associated with a sudden stop	63	17
Of which: First sudden stop, then devaluation	42	9
First devaluation, then sudden stop	21	9
Devaluations not associated with a sudden stop	37	83

Source: Calvo, Izquierdo, and Mejía (2004).
a. The total number of large devaluations is nineteen in emerging markets and twenty-three in developed economies.

significant and with the right sign (that is, negative) in some cases but, by far, not in all. Moreover, other a priori relevant macroeconomic variables, like the fiscal deficit and total debt, are not significant. In our interpretation, this does not imply that the probability of a sudden stop is independent of past "bad" policy, but rather that the conditional probability of a sudden stop may exclusively depend on domestic liability dollarization and ω. Domestic liability dollarization, in particular, could reflect past monetary and fiscal mismanagement, which have driven individuals to protect themselves by adopting a more stable foreign currency. Once domestic liability dollarization is placed on the right-hand side of the estimation equation, however, past history becomes irrelevant.

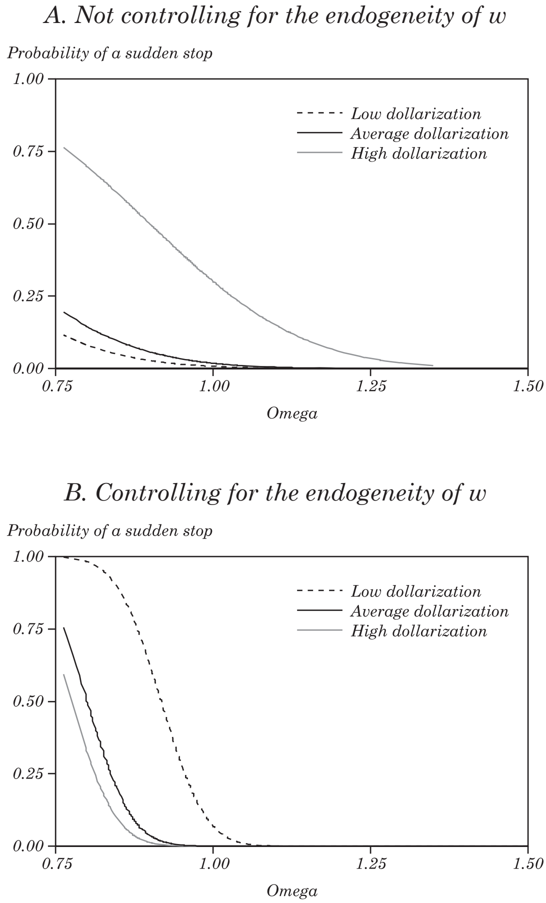
Figure 6 is based on panel probit estimates in Calvo, Izquierdo, and Mejía (2004). The left-hand side in figure 6 corresponds to the standard random effects probit estimation, while the right-hand side corresponds to estimates that adjust for endogeneity à la Rivers and Vuong (1988). The probability of sudden stop clearly falls with $1 - \omega$ and rises with domestic liability dollarization. It is worth noting that the probability of a sudden stop is highly sensitive to domestic liability dollarization values in the sample. This sensitivity is even greater when we adjust for endogeneity.

3.1 Relative Price Volatility

The theoretical model in section 2 suggests that volatility may change during sudden stops. That is precisely what we find in Calvo, Izquierdo, and Loo-Kung (2006).[25] In our sample, the ratio of

25. See also Kaminsky and Reinhart (2001).

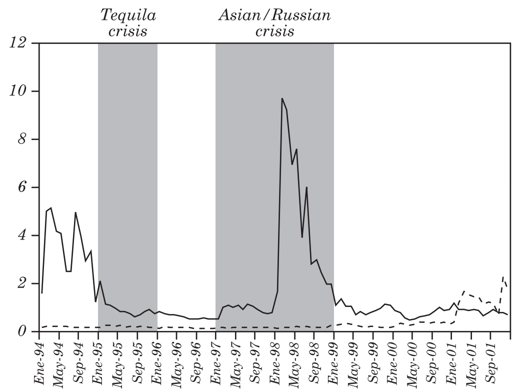
Figure 6. Probability of a Sudden Stop



Source: Calvo, Izquierdo, and Mejía (2004).

the variance of relative prices (measured by the ratio of wholesale to consumer prices indexes) is around three times larger during sudden stops than during tranquil periods (that is, not a sudden stop) for emerging market economies, while for developed economies that ratio is around two. This suggests that the variance of random shocks like θ in the model of section 2 increases during a sudden stop, possibly leading to further volatility and output costs as a result of firms' investment in information. Figure 7 shows that conditional volatility can also exhibit large changes, especially for emerging market economies. The two big spikes in the figure occur around the tequila and Asian/Russian crises, but, again, the Asian/Russian crisis dominates the scene. In Calvo, Izquierdo, and Loo-Kung (2006) we estimate autoregressive conditional heteroskedasticity (ARCH) models with domestic liability dollarization, $1-\omega$, and a dummy for sudden stops as independent variables. We use these models to assess whether arguments similar to those suggesting that such variables may have a role in determining expected changes in relative prices could be used to justify their possible effect on relative price volatility.

Figure 7. WPI/CPI Conditional Variance for the Average Emerging and Developed Economy



Source: Author's calculations, based on estimations from Calvo, Izquierdo, and Loo-Kung (2006).

Our conjecture was confirmed. The coefficients for sudden stop and domestic liability dollarization are always significant (at conventional levels) and positive, showing that conditional relative price volatility increases with domestic liability dollarization and during sudden stops. The significance of $1-\omega$, in contrast, does not always hold, although it does so in a good number of cases, and its point estimate is always negative. In other words, relative price conditional volatility is an increasing function of the current account deficit (as a share of tradables output). Thus, variables that enhance the probability of a sudden stop also seem to contribute to higher relative price volatility. Volatility is not necessarily a negative factor, especially if it reflects better information, but it could be dangerous in a context of, for example, high domestic liability dollarization.

In sum, econometric studies do not reject the hypothesis that sudden stops are largely prompted by external factors, but, at the same time, they strongly suggest that the probability of sudden stops reflects domestic characteristics. Moreover, sudden stops are periods of higher conditional volatility, which may cause financial disorder if contracts are not made state-conditional.

4. Policy Issues

The evidence discussed in section 1 strongly suggests that emerging market economies could be subject to external shocks that, when combined with domestic vulnerabilities, result in major crises. Moreover, the Phoenix Miracle reported at the end of that section indicates that these may be preventable accidents. There must be room for policies and institutions that help reduce the incidence of sudden stops and attenuate their consequences. In this section, I discuss domestic and global policies that relate to the previous sections, although I make no attempt to provide comprehensive coverage of the many issues involved here.[26]

4.1 Domestic Policies

Sudden stops happen in the best of families (see Calvo and Talvi, 2005). To avoid sudden stops altogether or attenuate their effects when they do happen, it is essential to reduce financial vulnerabilities. It is particularly important to maintain low exposure to foreign-currency-denominated debt, especially domestic liability dollarization. Since domestic liability dollarization involves the domestic payments system, financial crises under high domestic liability dollarization may entail serious systemic consequences. These concerns involve both the public and private sectors, because the government is likely to be called upon as lender of last resort if the private sector runs into financial trouble. Thus, for example, public debt in Korea was around 10 percent before the July 1997 crisis and quickly rose to about 40 percent as a result of the mechanisms put in place to ameliorate the effects of the crisis in the private sector. Contingent public debt is hard to control, precisely because government bailouts are effective instruments for attenuating the impact of financial crises. Stern

26. For a complementary policy discussion, see Calvo (2002) and Calvo and Talvi (2005).

statements to the effect that the government will not be a lender of last resort will therefore enjoy little credibility.

An alternative policy would be to discourage large foreign-currency-denominated private debt by levying a tax on total borrowing (not just international borrowing) denominated in foreign exchange. This is not easy to implement, however, and it may have a negative impact on growth.

Another way to discourage foreign-exchange-denominated borrowing is allowing the exchange rate to undergo large fluctuations. This policy, however, is likely to result in a highly volatile real exchange rate, which may have negative effects on trade and output (see Calvo and Reinhart, 2000a). Moreover, if the economy initially exhibits large domestic liability dollarization, real exchange rate volatility may cause serious financial distress, as noted above. Incidentally, forcing dedollarization has proven to be not very effective, since dollarization often returns with a vengeance. Cases of spontaneous dedollarization are few and far between (see Reinhart, Rogoff, and Savastano, 2003). Nevertheless, a small window of opportunity may be opening up. The U.S. dollar, the currency of choice for denominating financial transactions in emerging market economies (until now), is undergoing persistent devaluation vis-à-vis several currencies, including emerging market currencies. This appears to have increased the appetite of international investors for debts denominated in emerging market currencies. Countries like Colombia, Mexico, and Peru are taking advantage of the situation and issuing public debt denominated in their own currencies, which is being acquired by both domestic and foreign investors.

This discussion has been heavily colored by my conjecture that global crises entail major financial difficulties that prevent the effective use of standard countercyclical monetary and fiscal policies. There are exceptions, though, and Chile in 1998 may be one of them. Chile was hit by the largest sudden stop in Latin America (equivalent to more than 7 percent of GDP).[27] However, Chile did

27. See Calvo and Talvi (2005); Cowan and De Gregorio (2005). Chile never lost access to credit markets, although this is not incompatible with suffering an externally driven sudden stop. To be sure, Chile's spread was low compared to the rest of Latin America, but it increased by a factor of three in 1998 like the rest of the region. A large relative increase in interest rates could provoke sizable contraction in the value of loan collaterals, even though the increase is small in absolute terms. For a discussion of this and related topics, see Calvo and Talvi (2005).

not display a high level of liability dollarization, its current account deficit (relative to tradables output) was not large, and public debt was tiny. Why, then, did Chile experience such a large sudden stop? An interesting conjecture is that Chile chose the wrong policy mix in response to the 1998 Russian crisis shock wave, sending the wrong signal to the market. Chile, like every other emerging market, was tested by the markets after the Russian crisis. In response, Chile narrowed the exchange rate band (virtually eliminating the previously large headroom of the exchange rate) and sharply tightened monetary policy, sending interest rates to record-high levels. This policy response revealed to the market that the monetary authority was worried about balance-sheet currency-denomination mismatch (that is, liability dollarization). This signal was wrong because liability dollarization was apparently a problem only for firms providing public services, which primarily involved multinationals that most likely would have been bailed out by their headquarters. This type of policy could have put Chile, in the eyes of investors, in the same basket as Argentina and other liability-dollarized economies–helping to explain the full-fledged sudden stop that followed. Expansive monetary and fiscal policy may have been a better policy response.[28]

Expansionary policy may be counterproductive, however, if the government is also subject to a sudden stop. Under such circumstances, lowering taxes or raising public expenditure is clearly out of the question unless the government resorts to some kind of capital levy, like debt repudiation or a higher inflation tax. Although one can think of costless capital levies, in practice costs could be quite high. The necessary conditions for a capital levy to be costless are that it is largely unanticipated and that it does not seriously affect the credit or payments system. These conditions are unlikely to be satisfied in practice. The first condition generally does not hold, unless capital levies are automatically triggered by sudden stop.[29] The second condition is also hard to satisfy in practice, as collateral constraints play a key role in credit markets.[30] Thus, capital levies would lower collateral values, bringing about a sudden

28. This view was put forward by my IDB colleague and frequent collaborator Alejandro Izquierdo.

29. Automatic mechanisms are interesting policy options, but I do not explore them in this paper.

30. For a discussion in the context of emerging market economies, see Caballero and Krishnamurthy (2002) and Izquierdo (2000).

contraction of bank loans, for example, unless the levy falls entirely on nonresidents. The latter is unlikely because bonds are subject to legal clauses that prevent unequal treatment of bondholders, making it difficult to discriminate in favor of domestic residents.[31]

Could lowering domestic interest rates help after a sudden stop that dries up credit to both the private and public sectors? Under fixed exchange rates, lower interest rates are possible only if effective controls on capital outflows can be implemented (as in Malaysia in 1997). This is not easy, especially in economies with a long history of capital flight: underground institutions and fake transactions (for example, underinvoicing of exports) are quickly put in place. Under floating exchange rates, the low-interest-rate policy may be helpful if price-wage downward inflexibility delays reaching full-employment equilibrium. However, since easy money results in a large devaluation, such a policy may wreak financial havoc in liability-dollarized economies or sharply raise inflationary expectations in economies with a long history of high inflation.[32]

In closing this section, I would like to say a few words about full dollarization, that is, the adoption of a foreign or regional currency for all financial and commercial transactions (except perhaps for “small change” like the balboa in an otherwise fully dollarized economy like Panama). It is not an ideal system if the economy is subject to large fluctuations in relative prices and financial contracts are very rigid (for example, non-state-contingent contracts). However, in economies that are addicted to dollars, to use the expression in Reinhart, Rogoff, and Savastano (2003), full dollarization may dominate a system that stubbornly sticks to high domestic liability dollarization. Moreover, full dollarization considerably lowers the complexity of macroeconomic assessment, given that an easily manipulated variable like the nominal exchange rate will no longer be subject to policy decisions (or, at least, the exchange rate would be much more difficult to manipulate because it would involve a radical change in the policy regime).[33]

31. Moreover, it is hard to know who is a resident. and, even if that were possible and there were no clauses explicitly protecting bondholders from discrimination, the international financial institutions are much against unequal treatment of creditors in case of default (as recently revealed in the context of Argentina’s debt-default negotiations).

32. For a complementary discussion about domestic policies, including controls on capital inflows, see Calvo and Talvi (2005).

33. See Calvo (2001); Mendoza (2005).

4.2 Global Policies

The above discussion shows that emerging market economies have a very limited set of policies for preventing sudden stops and attenuating their effects, especially when they originate in a malfunctioning of the global capital market. This leads the discussion to policies that are directly aimed at the global capital market. In Calvo (2002), I proposed the creation of an emerging market fund (EMF) whose main activity would be to stabilize an emerging market bond price or spread index, like J. P. Morgan's EMBI, whenever it is judged that the latter undergoes unduly large fluctuations. A motivation for the EMF was the large and persistent increase in the EMBI following the 1998 Russian crisis (see figure 1). Russia traded little with the other emerging market economies, and its output and debt were minuscule on a global scale. Its large impact on the EMBI was arguably evidence of shocks coming from the global capital market, as discussed in section 1. The two leading conjectures in this respect are that the large impact on the EMBI were due, first, to margin calls triggered by the Russian crisis (a conjecture discussed in sections 1 and 2 above) and, second, to reverse moral hazard, caused by Russia not being bailed out by the IMF. The latter may have sent a signal that other large emerging market economies, like Brazil, would receive the same treatment—thus decreasing the expected return on emerging market bonds.[34] Whatever explanation one finds most persuasive, the point remains that the shock had a global origin.

Institutions like the EMF would play the role of lenders of last resort, and they would thus be close relatives of national central banks. A salient characteristic of central banks is that they are able to relieve the symptoms at the source, which in this case is the global capital market, not the individual countries. Something like the EMF is thus needed to attenuate globalization hazards. The question that naturally arises, however, is why the EMF would have better information than the capital market, which, after all, is in the business of finding arbitrage opportunities. There are two types of answers to this question. The first is institutional. The capital market is subject to regulations, such as collateral constraints, that prevent

34. I am not very enthusiastic about the reverse moral hazard conjecture, because Brazil got a generous package from the IMF shortly after the Russian crisis (in January 1999). However, it took several years for the EMBI to get back to the levels prevailing before the Russian crisis (see figure 1).

it from taking full advantage of arbitrage opportunities. Mendoza (2004) discusses a dynamic general equilibrium example along these lines. The second type of answer goes to the heart of how the capital market is supposed to operate, even in the absence of institutional or principal-agent constraints. As noted in Grossman and Stiglitz (1980), asset market prices convey information about other market participants' information, and the authors provide an example in which prices costlessly transmit all relevant information across the market. This is an extreme case, but it sharply illustrates how market participants can benefit from costly information collected by others without having to pay for it. Thus, capital market information has features in common with externalities or public goods, so it is likely to be undersupplied in equilibrium. This market failure implies that putting a lender of last resort in charge of collecting better information on emerging market economies may result in a Pareto-enhancing equilibrium. What, then, is the advantage of an EMF over a global bureau of economic research that freely provides information to the market? This is an important question, and it represents a valid objection to setting up a fund that may result in large losses for the international community.[35] My favorite answer is that the EMF would "put its money where its mouth is," thus better aligning incentives with public pronouncements.[36] In addition, if market failure is partly due to institutional constraints, the EMF would help to relieve those constraints by infusing the market with a larger liquidity chest.

A word of caution is in order, however, as international arrangements like the EMF require full and credible support by the involved sovereign countries. This is not a minor complication, and it may represent an impassable roadblock. Nevertheless, even if the EMF and similar global financial institutions are not feasible at present, a thorough understanding of why and how these institutions would operate is useful, because the parties involved will then be much better prepared to set them up when the time comes.

35. Durdu and Mendoza (2005) examine the possible moral hazard implications of asset price guarantees, a close relative of the EMF. The EMF, however, is supposed to lean against the wind to lower contagion, not to give price guarantees. See Calvo (2002).

36. In fact, experience at the IMF and other multilateral institutions shows that the information that these institutions make available to the public is heavily tinted by political opportunism. Do they put their money where their mouths are? Yes, but to a limited extent, because those institutions are senior creditors: they are supposed to be paid back before everyone else! This would not be the case with the EMF.

The discussion above is biased in favor of stabilizing and expanding the emerging bond market. An entirely different conclusion emerges if reverse moral hazard is seen as the main driving force behind the 1997–98 events, particularly the Russian crisis. Reverse moral hazard implies that too much money was flowing to emerging market economies. Thus, if anything, one should devise policies that make it more difficult for emerging market economies to borrow in international markets. Thus, while the margin call and reverse moral hazard views both imply that external shocks are relevant, their policy implications are diametrically opposed. However, reverse moral hazard is just one possible story of how the market read the news that the IMF left Russia twisting in the wind. Another interpretation is that, as the IMF jettisoned its role as lender of last resort, the market became more apprehensive about lending to emerging market economies. There is nothing optimal about this retrenchment if, on the basis of prior discussion, one concludes that informational and frictional considerations call for the existence of a lender of last resort.

In summary, both domestic and global policies are called for to increase the stability of emerging market economies while allowing them to reap the benefits of financial globalization. Success in this area would likely rely on improving both the domestic and global fronts. Traditional fiscal and monetary stabilization policies do not seem very effective. They need to be complemented with structural policies that help lower domestic financial vulnerability, especially in economies suffering from a high incidence of foreign-exchange-denominated domestic bank loans.

Appendix

This appendix derives equation (11) in the text. Variable θ is log-normally distributed with natural log mean μ and natural log standard deviation σ. Thus (see Maddala, 1977),

$$\overline{\theta} = e^{\mu+(1/2)\sigma^2} \text{ and } \operatorname{var}\theta = e^{2\mu+\sigma^2}\left(e^{\sigma^2}-1\right). \tag{A1}$$

Moreover, it follows that θ^2 is log-normally distributed with natural log mean 2μ and natural log standard deviation 4σ. This implies that

$$\operatorname{var}\theta^2 = e^{4(\mu+\sigma^2)}\left(e^{4\sigma^2}-1\right). \tag{A2}$$

By equation (6) in the text and equation (A1), setting $r = 0$,

$$\operatorname{var} w^{NI} = \overline{\theta}^2 \operatorname{var}\theta = e^{4\mu+2\sigma^2}\left(e^{\sigma^2}-1\right). \tag{A3}$$

Moreover, from equation (9) in the text, and setting r = 0,

$$\operatorname{var} w^{FI} = \frac{1}{4} e^{4(\mu+\sigma^2)}\left(e^{4\sigma^2}-1\right). \tag{A4}$$

Equation (11) in the text follows from equations (10), (A3), and (A4).

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Latin America's Access to International Capital Markets: Good Behavior or Global Liquidity?

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Latin America has had an active presence in international markets since independence in the early nineteenth century. Participation has been quite volatile, though. International borrowing financed the wars of independence in the early 1800s, but the boom that started in 1822 with a loan to Colombia ended in 1826 with Peru's default. Other periods of marked expansion in international borrowing occurred in 1867–72, 1893–1913, and 1920–29. As in the 1820s, most of these episodes ended with defaults. International capital markets all but disappeared following the crisis of the 1930s, with Latin America becoming unable to borrow again. Only in the 1970s did Latin America start to participate once more in international capital markets, with capital inflows reaching US$51 billion in 1981. However, when Mexico defaulted in 1982, all Latin American countries lost access to international capital markets. The Brady debt-relief program in 1989 allowed Latin America to tap international capital markets again, and capital flows surged once more, reaching US$112 billion in 1997. Again the boom turned into a bust in the late 1990s following the Russian default, with net capital inflows turning into net outflows in the early 2000s. In contrast to the prolonged inability to access international capital markets following the debt crisis in 1982, many

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Latin American countries started borrowing again in international markets within four years of the Russian crisis.

The boom-bust pattern in Latin America's participation in international capital markets raises the question of whether the problem lies with erratic international capital markets or the volatile nature of the Latin American economies. This is the question we address in this paper. Previous research on this topic focuses on the behavior of net capital flows. We argue in this paper that this is not a good indicator of access to international capital markets. While zero net capital inflows may reflect no international financial integration, they may also reflect complete integration with international diversification, in which inflows are just offset by outflows. We therefore center our analysis on international primary gross issuance.

We cast our net wide and collect issuance data for twenty Latin American countries for the period 1980–2005. The data collected paint a picture of three typical economies. The first group includes countries with active participation in international capital markets. This group includes Argentina, Brazil, Chile, Colombia, Mexico, and Venezuela. The second typical economy has more limited access to international capital markets. This group includes Bolivia, Costa Rica, Dominican Republic, El Salvador, Guatemala, Honduras, Jamaica, Panama, Peru, and Uruguay. Finally, the third typical economy does not participate in international markets. This last group includes Haiti, Nicaragua, and Paraguay, which had no international issuance in bond, equity, or syndicated loan markets in the period studied. Since only the first group has participated fairly consistently in international capital markets, we focus our attention in these six countries and examine whether good country behavior or global liquidity is at the heart of the ins and outs of international markets.

The rest of the paper is organized as follows. Section 1 describes the behavior of the trade account and the patterns of financing in high-, medium-, and low-income countries. We pay particular attention to the evolution of transfers, as well as official and private capital flows. Section 2 presents our new data set of gross issuance in three international capital markets: bonds, equities, and syndicated loans for the twenty countries in Latin America. Section 3 examines in more detail the evolution of international gross issuance by Argentina, Brazil, Chile, Colombia, Mexico, and Venezuela. Using panel estimation techniques, we examine the role of domestic fundamentals and external factors. Section 4 concludes.

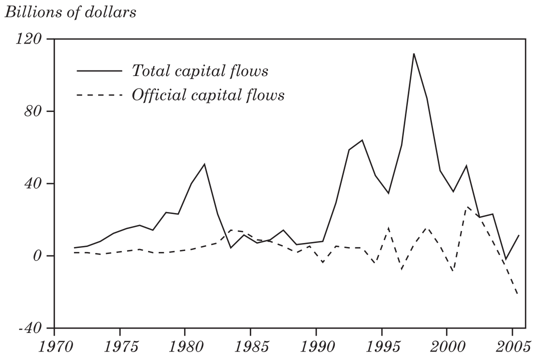
1. The Current Account and Net Capital Flows

We first examine the evolution of net capital inflows and the current account since 1970. Figure 1 shows total capital flows and official capital flows to Latin America; the difference between the two captures private capital flows. On average, most of the capital flows to Latin America have been of a private nature, peaking at US$45 billion in 1981 and at US$105 billion in 1997. The cycles in international capital flows are more pronounced in later periods. During the first capital inflow episode, total capital flows increased about thirteen times, from about US$4 billion in 1970 to US$51 billion in 1981. In the 1990s, total capital inflows increased about twenty-two times, from about US$5 billion in 1983 to US$112 billion in 1997. Reversals also became more pronounced in the 1990s. While the reversal reached 90 percent in the 1980s, it was somewhat more substantial in the 1990s, as capital inflows turned into outflows. In this case, the reversal peaked at 102 percent. Both private and official capital flow cycles have been quite pronounced. Official capital inflows increased from US$ 1 billion in 1972 to US$14 billion in 1983 and reversed to net outflows of US$4 billion in 1990. The behavior of total official flows to Latin America was more irregular in the 1990s, in part because of the bailout packages to the larger economies in the region.[1]

Figure 2 shows the average behavior of the current account as a percent of gross domestic product (GDP) for the twenty countries in our sample. As in the case of capital flows, the current account shows clearly pronounced cycles, with the late 1970s to early 1980s and the mid-1990s being high-deficit episodes. However, unlike the behavior of capital flows, the boom-bust pattern in current account deficits became less pronounced in the latter period. As shown in the figure, the early 1980s recorded the highest deficits, peaking at about 8 percent of GDP in 1981, while the deficits in the mid-1990s peaked at about 5 percent of GDP. During the 1978–81 capital-inflow episode, capital flows mostly financed current account deficits, with the average reserve accumulation only peaking at 1.5 percent of GDP in 1979. In the 1990–97 episode, capital flows financed a higher level

1. For example, Argentina received US$11 billion of official capital flows in 2001 (about 40 percent of all official capital flows to Latin America that year); Brazil received US$11 billion in 1998 (about 90 percent of all official flows to Latin America in 1998) and US$12 billion in 2002 (about 60 percent of all official flows to Latin America that year).

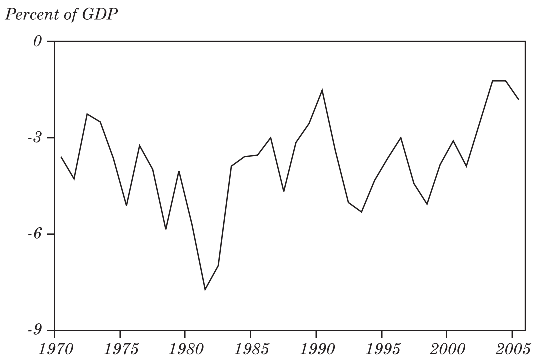
Figure 1. Net Capital Flows: Latin America, 1970–2005[a]



Source: International Monetary Fund (IMF), World Economic Outlook.
a. Total capital flows are the sum of official and private capital flows to twenty Latin American countries: Argentina, Bolivia, Brazil, Chile, Colombia, Costa Rica, Dominican Republic, Ecuador, El Salvador, Guatemala, Haiti, Honduras, Jamaica, Mexico, Nicaragua, Panama, Paraguay, Peru, Uruguay, and Venezuela.

of reserve accumulation. This time, reserves accumulation increased to 2.1 percent of GDP in 1997.[2]

Figure 2. The Current Account: Latin America, 1970–2005[a]



Source: IMF, World Economic Outlook.
a. The current-account-to-GDP ratio is the average for twenty Latin American countries: Argentina, Bolivia, Brazil, Chile, Colombia, Costa Rica, Dominican Republic, Ecuador, El Salvador, Guatemala, Haiti, Honduras, Jamaica, Mexico, Nicaragua, Panama, Paraguay, Peru, Uruguay, and Venezuela.

Table 1 provides a sharper picture of the current account behavior of Latin American countries. The table presents descriptive

2. On average, reserve accumulation during the 1978–81 episode was 0.6 percent of GDP. It increased to 1.1 percent of GDP during the 1990–97 episode. See also Calvo, Leiderman, and Reinhart (1994).

statistics for the current account for the twenty countries in our sample, including the mean, standard deviation, and maximum and minimum values for the current account from 1970 to 2005. This table provides a good picture of the heterogeneity of the countries in the sample and over time. First, the current account average in these countries ranges from a deficit of 15 percent of GDP for Nicaragua to a surplus of 4 percent of GDP for Venezuela. Nicaragua records the highest volatility in current account balances over the sample, from a maximum of 26 to a minimum of –37 percent of GDP. The current account of Venezuela is also quite volatile, oscillating between a maximum of 23 to a minimum of –12 percent of GDP. While still volatile, the richer countries in our sample show smaller fluctuations over time.

Table 1. Current Account: Latin America, 1970–2005
Percent of GDP

Country	*Mean*	*Standard deviation*	*Minimum*	*Maximum*
Argentina	–0.63	3.06	–4.84	8.87
Bolivia	–3.45	4.39	–10.83	9.55
Brazil	–3.10	3.33	–10.40	1.94
Chile	–3.64	3.47	–14.50	1.78
Colombia	–1.50	2.80	–6.36	4.74
Costa Rica	–7.16	3.54	–16.01	–1.68
Dominican Republic	–4.49	4.28	–14.22	6.03
Ecuador	–3.81	3.84	–12.35	5.28
El Salvador	–0.26	3.67	–5.51	7.16
Guatemala	–3.73	2.01	–7.53	0.31
Haiti	–1.55	1.97	–6.28	1.13
Honduras	–5.67	2.76	–12.34	–1.51
Jamaica	–5.81	4.18	–15.20	0.25
Mexico	–2.58	2.43	–7.05	3.75
Nicaragua	–14.90	12.55	–36.50	25.73
Panama	–7.46	8.24	–31.12	6.31
Paraguay	–3.03	4.08	–11.62	7.31
Peru	–5.08	3.54	–14.27	1.36
Uruguay	–1.74	2.29	–7.00	3.16
Venezuela	3.55	7.70	–11.96	22.66

Source: International Monetary Fund (IMF), World Economic Outlook.

Tables 2 and 3 show the evolution of the current account and financial account over the boom-bust cycles in international capital flows. To capture the heterogeneity in our sample of twenty countries, we divide the sample into three groups according to income per capita.[3] The high-income group consists of Argentina, Brazil, Chile, Costa Rica, Mexico, and Uruguay. This group has had the most frequent access to international capital markets. The medium-income group consists of Colombia, Dominican Republic, El Salvador, Panama, Paraguay, Peru, and Venezuela. The low-income group includes Bolivia, Guatemala, Ecuador, Haiti, Honduras, Jamaica, and Nicaragua, which have had less ability to tap international capital markets. We also identify the episodes of booms and busts in capital flows. Based on the data presented in figure 1, we identify two episodes of booms in capital inflows: 1976–81 and 1990–98. The episodes of 1971–75, 1982–89, and 1999–2005 are identified as episodes with less access to international capital markets.

Table 2 presents the total current account and its components: the balance of goods and services, net income, and transfers (private and public). The table reveals some important regularities. First, low-income countries have the largest current account deficits, at about 4 percent of GDP on average. Current account deficits are only around 3 percent of GDP in high-income and medium-income countries. Second, current account deficits in all groups are the highest during the 1976–81 episode of high capital inflows. Third, the large trade imbalances in low-income countries starting in the 1990s were financed by sharp increases in private transfers (namely, workers' remittances) and somewhat higher official transfers.

Table 3 highlights the heterogeneity across Latin American countries with respect to the financing of the current account. For reference purposes, the second column of the table reports total transfers. Two key points emerge. First, net capital flows are the largest for low-income countries, at about 5 percent of GDP since 1970, while they average about 3 percent of GDP for high- and medium-income countries. Second, the composition of capital flows

3. The sample is divided according to the 2005 gross national income per capita, at purchasing power parity (PPP) values, in dollars. High-income countries include all countries with a per capita income higher than US$8,000. Medium-income countries have a per capita income between US$8,000 and US$5,000. The Low-income group includes countries with a per capita income of less than US$5,000.

Table 2. Components of the Current Account: Latin America, 1970–2005
Percent of GDP

Country group and period	*Current account*	*Balance of goods and services*	*Net income*	*Official transfers*	*Private transfers*
High income					
1971–1975	−4.14	−2.69	−1.67	0.04	0.15
1976–1981	−5.27	−2.55	−2.95	0.00	0.20
1982–1989	−2.77	2.64	−6.22	0.51	0.40
1990–1998	−2.82	−0.93	−2.62	0.25	0.48
1999–2005	−1.51	1.45	−3.75	0.10	0.69
1970–2005	−3.02	−0.20	−3.40	0.21	0.39
Middle income					
1971–1975	−3.91	−2.41	−1.98	0.68	−0.18
1976–1981	−5.24	−4.07	−1.90	0.22	0.56
1982–1989	−2.31	−2.80	−3.38	1.70	2.18
1990–1998	−1.90	−3.57	−2.75	0.75	3.67
1999–2005	−0.42	−2.57	−2.81	0.29	4.67
1970–2005	−2.78	−2.74	−2.94	0.85	2.11
Low income					
1971–1975	−2.58	−1.50	−2.73	0.70	1.26
1976–1981	−5.47	−3.69	−3.90	0.79	1.53
1982–1989	−4.83	−1.69	−6.49	1.01	1.81
1990–1998	−3.78	−5.64	−3.81	2.11	3.31
1999–2005	−3.20	−12.35	−3.08	2.35	9.88
1970–2005	−3.97	−4.83	−4.02	1.61	3.37

Source: IMF, World Economic Outlook.

Table 3. The Balance of Payments: Latin America, 1970–2005
Percent of GDP

Country group and period	*Current account*	*Total transfers*	*Errors and omissions*	*Capital account*	*Capital flows*		*Changes in reserves*
					Official	*Private*	
High income							
1971–1975	–4.14	0.22	–0.86	0.00	1.03	2.35	1.63
1976–1981	–5.27	0.23	–0.35	0.00	0.67	5.33	–0.37
1982–1989	–2.77	0.82	1.53	0.00	1.39	0.04	–0.19
1990–1998	–2.82	0.73	0.52	0.00	0.11	3.21	–1.08
1999–2005	–1.51	0.79	0.22	0.01	0.73	0.67	–0.11
1970–2005	–3.02	0.57	–0.24	0.03	0.71	2.21	0.30
Middle income							
1971–1975	–3.91	0.47	–0.52	0.00	1.38	4.49	–1.48
1976–1981	–5.24	0.73	1.71	0.00	1.80	3.55	–1.82
1982–1989	–2.31	3.87	–0.36	0.00	1.97	–0.01	0.77
1990–1998	–1.90	4.42	1.23	0.25	0.65	1.19	–1.51
1999–2005	–0.42	4.96	–0.36	0.56	1.55	–1.03	–0.49
1970–2005	–2.78	2.85	0.37	0.14	1.38	1.32	–0.65
Low income							
1971–1975	–2.58	1.65	–1.66	0.00	2.25	2.92	–0.94
1976–1981	–5.47	2.12	–0.38	0.00	4.16	2.01	–0.32
1982–1989	–4.83	3.36	0.67	0.10	3.28	0.13	0.66
1990–1998	–3.78	5.67	–0.13	1.01	1.46	2.69	–1.25
1999–2005	–3.20	12.22	–0.78	0.50	1.51	3.93	–1.62
1970–2005	–3.97	4.88	–0.33	0.31	2.41	2.35	–0.54

Source: IMF, World Economic Outlook.

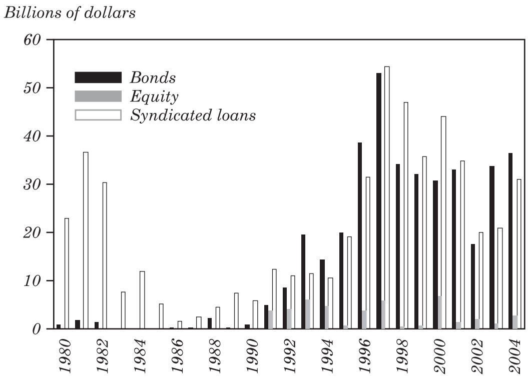
is quite different across the three groups. Private capital flows to high-income countries are about 75 percent of total flows. Private capital flows to medium- and low-income countries are just 50 percent of total capital flows, underscoring their lack of ability to tap international capital markets. In view of the importance of official capital flows to these last two groups of countries, future research needs to examine the behavior of official flows in more detail. In particular, it is important to explore whether official capital flows to each country tend to counterbalance the gyrations of international private capital markets, by providing more official funding in times of illiquid markets, or whether they amplify the boom-bust pattern of private capital flows.

2. International Gross Issuance

The evidence provided by net capital inflows presents an incomplete picture of access to international capital markets. While zero net capital inflows may reflect no access to international capital markets, they may also reflect complete integration with international diversification, in which inflows are just offset by outflows. The growth in the size and complexity of international financial markets in the last decade has redirected economists' attention to assets and liabilities in order to understand international balance sheets. For instance, Lane and Milesi-Ferreti (2006) define financial globalization as "the accumulation of larger stocks of gross foreign assets and liabilities." Even stocks of international assets and liabilities can only provide a partial measure of integration and do not necessarily capture which countries have more and frequent access to international markets, because large borrowings could be offset by equally large repayments. Market access can be assessed more clearly by looking at gross issuance. Thus, to attain a better grasp of financial integration, we look at gross issuance in three international markets: bonds, equities, and syndicated loan markets from 1980 to 2005. The data we use are obtained by Dealogic, which compiles information on issuance (at the security level) in international bond, equity, and syndicated loan markets. The database starts in 1980 (1983 for equity issuance).

Figure 3 shows Latin America's gross international issuance in the three markets. Issuance in the international bond market includes euro market offerings, global bonds, and foreign offerings.[4] International equity issuance includes the issue of common or preferred equity in the international market, issues targeted at a particular foreign market, and registered stocks traded on foreign markets as domestic instruments (for example, American Depository Receipts, or ADRs). Finally, international gross issuance in the syndicated loan market includes all the loans granted by two or more financial institutions in which the nationality of at least one of the syndicate banks is different from that of the borrower.[5] As shown in the figure, during the first episode of international capital inflows, access to the international capital market took the form of syndicated bank loans. Gross issuance in this market peaked at US$37 billion in 1981, but it basically disappeared after the 1982 debt crisis. By 1986, Latin American total gross issuance in international capital markets was just 5 percent of the 1981 level.

Figure 3. Latin American Gross Issuance in International Capital Markets



Source: Dealogic.

4. Eurobonds are bonds issued and sold outside the country of the currency in which they are denominated, for example, dollar-denominated bonds issued in Europe or Asia. Global bonds are single offerings structured to allow simultaneous placement in major markets, including Europe, the United States, and Asia. Foreign bonds are bonds issued by firms and governments outside the issuers' country, usually denominated in the currency of the country in which they are issued. For example, Samurai bonds are yen-denominated bonds issued in Tokyo by a non-Japanese company. Similarly, Yankee bonds are bonds denominated in U.S. dollars and issued in the United States by foreign banks and corporations.

5. The facilities included in our data consist of term loans, revolving credits, cofinancing facilities, export credit bridge facilities, construction loans, mezzanine loans, and multiple options facilities.

In the late 1980s, the Brady Plan put an end to developing countries' isolation from international capital markets. First, this plan provided debt relief to emerging markets. Second, it created a market for sovereign emerging market bonds almost overnight with its initiative to restructure defaulted loans into bonds collateralized by U.S. Treasury bonds.[6] As investor confidence in emerging market countries gradually recovered, both the government and the private sector started issuing bonds in international capital markets, with bond issuance by Latin American countries increasing from US$1 billion in 1990 to US$53 billion in 1997. The Brady Plan, with its initiative of restructuring distressed commercial bank loans, also provided a new impetus to the syndicated loan market, and issuance rapidly climbed to US$54 billion in 1997[7]. A new feature of financial integration in the 1990s was the forceful development of an international equity market. In this decade, Latin American corporations not only started to raise capital in the highly unregulated international bond and syndicated loan markets, but also began to participate in regulated equity markets in various financial centers. Many firms raised capital in the United States through the creation of ADR programs, with ADRs being traded on U.S. stock markets in lieu of the firms' foreign shares.[8] Between 1990 and 2005, Latin American international annual equity issuance averaged US$3 billion.[9]

The crises in Asia and Russia in the late 1990s triggered a reversal in capital flows. This time around, however, the reversal in gross issuance was less pronounced than that following the 1982 debt crisis. At that time, Latin America's gross issuance in international markets crashed to about 4 percent of the levels attained in the early 1980s. In the late 1990s, total issuance declined only to about 40 percent of its

6. For most of the bonds, the principal was collateralized by specially issued U.S. Treasury 30-year zero-coupon bonds purchased by the debtor country with funding from the International Monetary Fund, the World Bank, and the countries' own foreign exchange reserves. Interest payments on Brady bonds were sometimes also guaranteed by securities of at least an AA-rated credit quality held with the New York Federal Reserve Bank.

7. With the Brady Plan, commercial banks were allowed to exchange their claims on developing countries into tradable instruments, eliminating the debt from their balance sheets.

8. See de La Torre and Schmukler (2004) for an excellent description of Latin America's participation in international capital markets.

9. The magnitude of equity issues is not directly comparable to the magnitude of debt issues because, unlike equity, bonds and loans have finite maturities. Firms typically roll over bonds and loans at maturity, so part of the debt issue goes toward refinancing old debt and only the remaining share represents new capital.

peak in 1997, suggesting a more continuous access to international capital markets.[10]

Tables 4 and 5 focus on access to international capital markets by the public and private sectors. Table 4 reports the number of issues, while table 5 reports the value of total issuance. The two tables expose some interesting features of market access in the region. First, as shown in table 4, in the 1980s most issues were public (65 percent of total issues), while in the 1990s they were mostly private (75 percent of total issues). In value terms, public issuance amounted to 75 percent in the 1980s and only 50 percent after 1990 (see table 5). Second, while private corporations entered international capital markets more massively in the 1990s relative to the 1980s, private access to international capital markets displays a more pronounced boom-bust behavior than the public sector. For example, following the booms in the 1990s, total issuance collapsed from US$113 billion in 1997 to US$40 billion in 2002 (35 percent of the peak), but private issuance fell from US$65 billion to US$18 billion (28 percent of the peak).

Figures 4 and 5 graph this data at the country level. Figure 4 reports number of issues; figure 5 presents the total value of gross issuance. Haiti, Nicaragua, and Paraguay have not participated in these markets, so they are not included in the figures. We divide all the issuing countries into two groups. The first group includes Argentina, Brazil, Chile, Colombia, Mexico, and Venezuela, which register 1,043, 1,903, 535, 358, 1,522, and 486 issues, respectively. The second group comprises Bolivia, Costa Rica, Dominican Republic, El Salvador, Guatemala, Honduras, Jamaica, Panama, Peru, and Uruguay which have less than 200 issues each. While the first group participates frequently in international capital markets (although with several interruptions), the second group has only started to participate somewhat more frequently in the last ten years. Interestingly, even low-income countries such as Guatemala and Honduras have issued international bonds in the last ten years. In the next section, we use panel estimation to identify the fundamentals that affect international issuance.

10. The evidence from gross issuance contrasts starkly with the evidence from net capital flows. While gross issuance data suggest continuous access to international capital markets, data on capital flows indicate a complete loss of access to international capital markets following the Russian crisis, as discussed in section 1.

Table 4. Latin American Access to International Capital Markets: Total Issuance
Number of issues

	Bonds		*Equities*		*Syndicated loans*	
Year	*Public*	*Private*	*Public*	*Private*	*Public*	*Private*
1980	12	7	0	0	147	97
1981	13	14	0	0	234	174
1982	12	5	0	0	214	95
1983	0	0	0	0	40	21
1984	0	0	0	0	117	16
1985	0	1	0	0	65	9
1986	1	2	0	1	14	8
1987	2	0	0	0	25	9
1988	8	0	0	0	16	19
1989	0	2	0	0	15	18
1990	7	6	0	2	29	41
1991	22	17	0	29	42	53
1992	18	71	0	39	61	78
1993	46	149	0	52	64	78
1994	28	95	4	79	27	106
1995	37	77	0	13	34	147
1996	71	108	1	43	56	162
1997	72	135	3	35	62	291
1998	63	69	1	4	50	244
1999	77	57	0	6	31	236
2000	51	50	2	13	36	313
2001	61	38	1	2	33	254
2002	29	14	0	4	45	153
2003	40	40	0	7	56	134
2004	40	35	0	16	80	243

Source: Dealogic.

Table 5. Latin American Access to International Capital Markets: Value of Total Issuance
Billions of U.S. dollars

	Bonds		*Equities*		*Syndicated loans*	
Year	*Public*	*Private*	*Public*	*Private*	*Public*	*Private*
1980	0.6	0.3	0.0	0.0	17.7	5.3
1981	1.1	0.7	0.0	0.0	28.3	8.3
1982	1.0	0.3	0.0	0.0	24.2	6.3
1983	0.0	0.0	0.0	0.0	6.4	1.2
1984	0.0	0.0	0.0	0.0	11.4	0.6
1985	0.0	0.1	0.0	0.0	4.3	0.9
1986	0.2	0.1	0.0	0.0	0.8	0.8
1987	0.2	0.0	0.0	0.0	1.7	0.9
1988	2.3	0.0	0.0	0.0	2.2	2.2
1989	0.0	0.3	0.0	0.0	5.7	1.8
1990	0.6	0.3	0.0	0.1	3.4	2.4
1991	3.3	1.6	0.0	3.9	8.4	4.0
1992	2.7	5.9	0.0	4.0	5.2	6.0
1993	7.0	12.6	0.0	6.1	6.4	5.0
1994	6.1	8.3	0.4	4.3	3.8	6.9
1995	13.3	6.6	0.0	0.6	6.1	13.1
1996	28.2	10.4	0.1	3.7	15.3	16.3
1997	34.0	18.9	0.9	5.0	13.7	40.7
1998	25.4	8.7	0.1	0.4	9.6	37.3
1999	26.9	5.3	0.0	0.6	5.6	30.2
2000	24.6	6.2	2.6	4.2	5.1	39.0
2001	26.9	6.0	0.7	0.6	4.9	29.9
2002	16.1	1.5	0.0	2.0	5.7	14.3
2003	25.2	8.5	0.0	1.2	8.7	12.3
2004	28.6	7.9	0.0	2.7	7.7	23.3

Source: Dealogic.

Figure 4. Number of Issues in International Capital Markets[a]

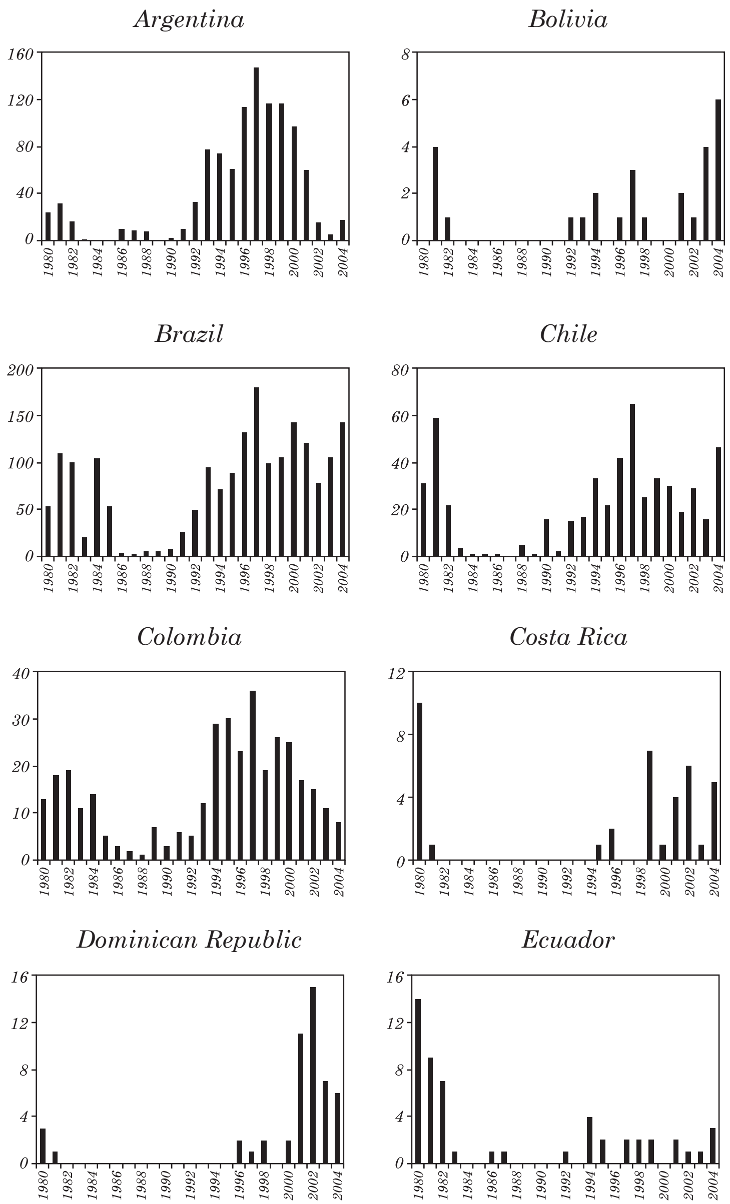


Figure 4. (continued)

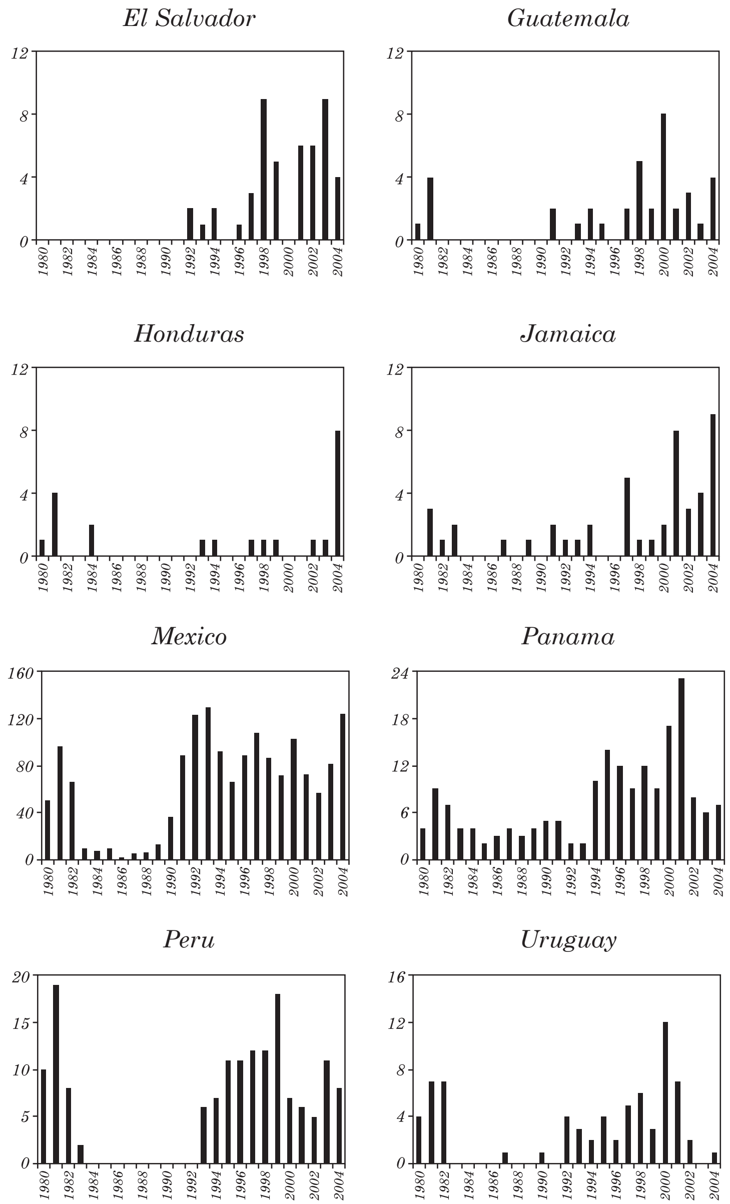
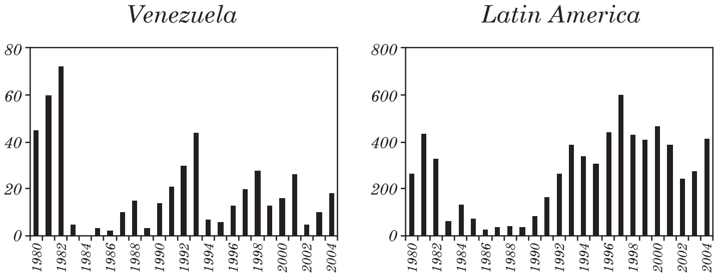


Figure 4. (continued)



Source: Dealogic.
a. Total Issuance includes bond, equity, and syndicated loan issuance. Haiti, Nicaragua, and Paraguay have not issued in these markets

Figure 5. Value of Total Gross Issuance in International Capital Markets

Billions of U.S. dollars[a]

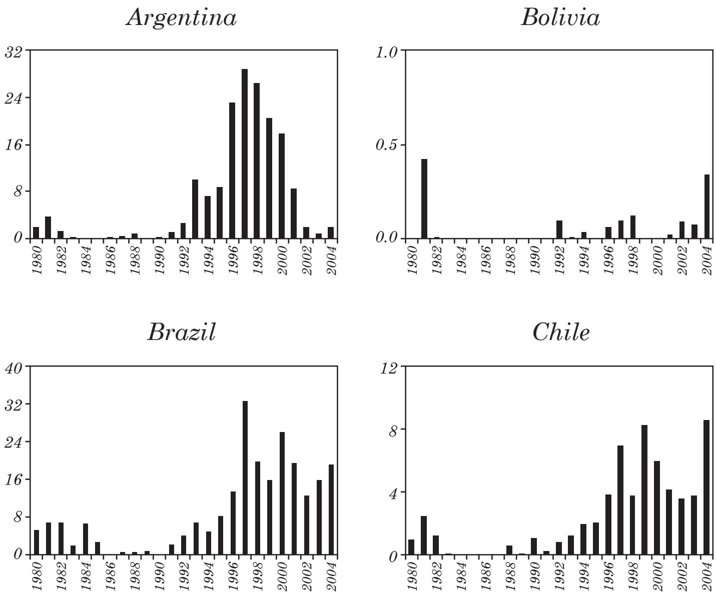


Figure 5. (continued)

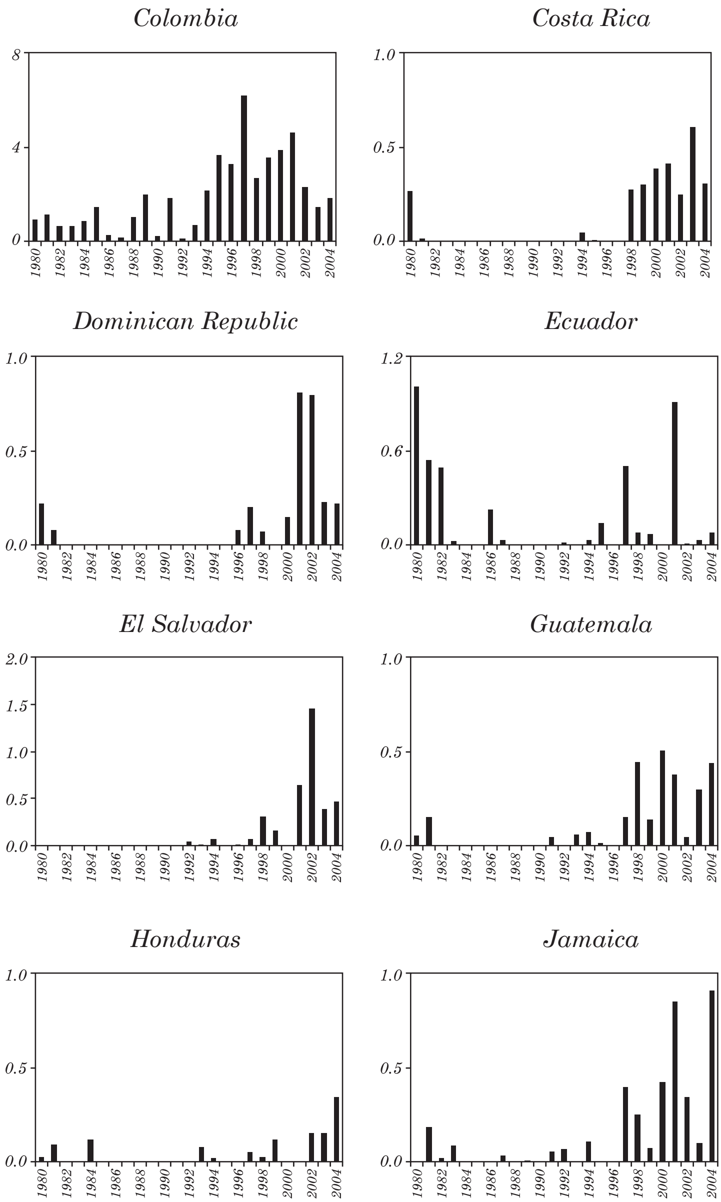
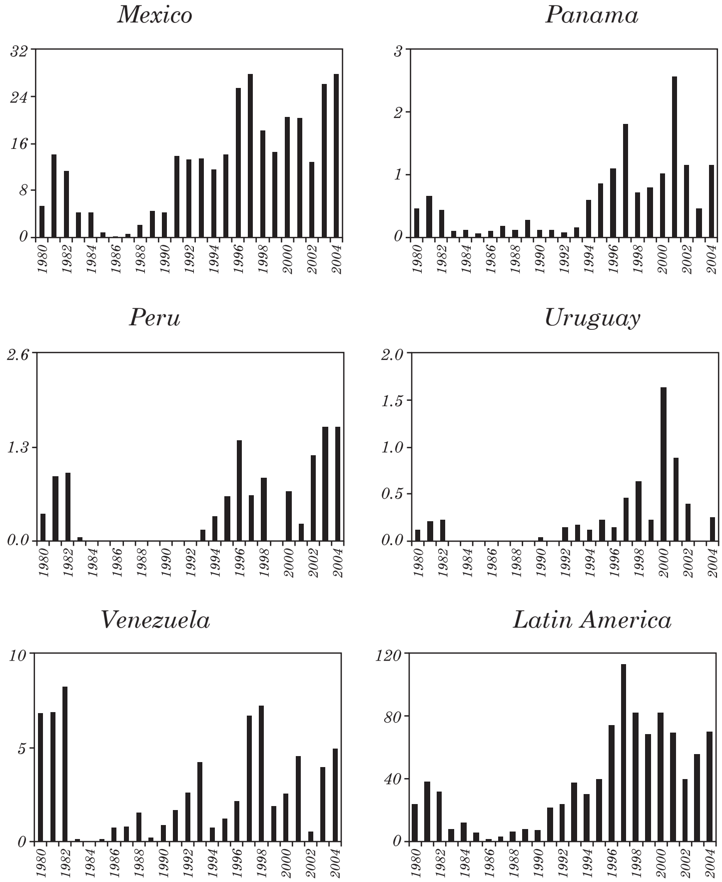


Figure 5. (continued)



Source: Dealogic.

a. Total Issuance includes bond, equity, and syndicated loan issuance. Haiti, Nicaragua, and Paraguay have not issued in these markets.

3. Good Behavior or Global Liquidity?

The goal of this section is to understand the role of domestic factors (which we term good behavior) and external factors (or global liquidity) on the ability of Latin American countries to access international capital markets. Past studies traditionally analyze capital flows to emerging markets by stressing the demand side (of funds)—that is, by showing how domestic fundamentals are responsible for the direction of these flows. For example, the three generations of models of currency crises explain the reversal in capital flows by pinpointing fiscal and monetary causes (Krugman, 1979), unemployment and overall loss of competitiveness (Obstfeld, 1994), and banking fragility and overall excesses in financial markets (Kaminsky and Reinhart, 1999; Chang and Velasco, 2000). More recently, the economics profession has started to explore global factors. The focus of this new literature is on financial centers and how shocks in mature economies are transmitted to emerging economies. Examples of this supply (of funds) approach include Caballero and Krishnamurthy (2002), Calvo (1999), Calvo, Izquierdo, and Mejía (2004), and Fostel (2005).

We incorporate this literature in the following simple model of supply and demand of financial funds to emerging economies.

$$S = f(r, r^*, \theta^*, l^*, \text{CRISES}^*, y, \text{TOT}, \text{MP}, \text{PR}, \text{OP}); \quad (1)$$

$$D = g(r, OP, \sigma, y, \text{TOT}); \quad (2)$$

where the asterisk identifies world fundamentals, r is the country return, r^* is the world interest rate, θ^* is investors' risk aversion, l^* is world liquidity, CRISES* indicates crises in other countries, y is domestic output growth, TOT is terms of trade, MP is domestic macroeconomic policy, PR is domestic political risk, OP is the degree of openness of the economy, and σ is the real exchange rate volatility.

The effect of shocks in world capital markets on the supply of funds to emerging economies is quite intuitive. Low world interest rates lead to higher supply, assuming that emerging market assets and world (financial centers) assets are substitutes. Also, the supply of risky emerging market assets will be negatively related to investors' risk aversion and positively related to world liquidity. The contagion literature (for example, Kaminsky and Reinhart, 2000) suggests that crises may rapidly affect the ability of emerging markets to access international capital markets as investors rebalance their portfolio, recalling loans not only from crisis countries but also from other countries to which they are exposed. The literature on currency and sovereign debt crises suggests that certain fundamentals can be taken as signals of reduced probability of a speculative attack or a default.[11] High output growth or better terms of trade signals better future repayment ability; macroeconomic policy stability reduces the probability of crises; and low political risk indicates a low probability of default. In all cases, the supply of funds will increase. Finally, a more open the economy will be more integrated with international markets. The costs of default in these circumstances will increase, triggering a larger supply of world funds.

On the demand side, the literature on currency mismatches suggests that the more open the economy is, the higher its ability to generate foreign-currency-denominated assets (see, for example, Jeanne, 2003). Since this reduces the likelihood of currency mismatches, demand for foreign-currency-denominated liabilities will increase. In contrast, currency mismatches will increase when the volatility of the real exchange rate increases, making domestic firms less inclined to borrow overseas.[12] Finally, the effects of output growth and the terms of trade are ambiguous. While higher output growth or better terms of trade could lead to more domestic savings, crowding out the need for outside funding, it can also lead to a Fisherian motive for borrowing today.

To estimate the relative contribution of external and domestic factors, we solve for the equilibrium in the system of equations described above to obtain a reduced-form equation that relates issuance with the rest of the variables. Hence, the equation to be estimated is

$$\frac{\text{ISSUANCE}}{\text{GDP}} = h(r^*, \theta^*, l^*, \text{CRISES}^*, y, \text{TOT}, \text{MP}, \text{PR}, \text{OP}, \sigma), \tag{3}$$

where the dependent variable is total issuance in international capital markets as a share of GDP to control for country size.

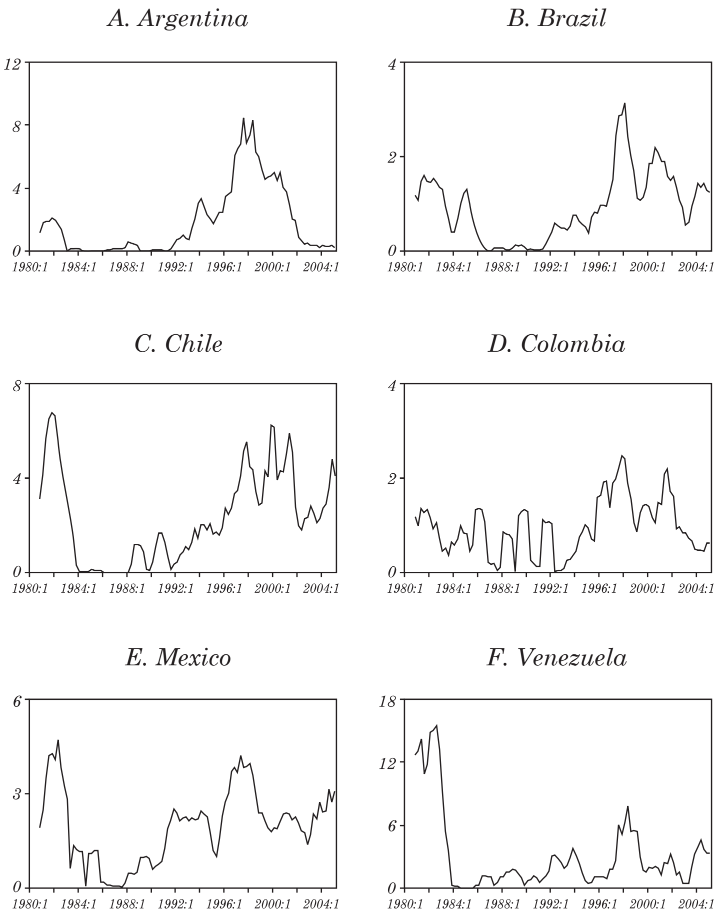
3.1. Data

As we just discussed, we use total gross international issuance as a percent of GDP to capture Latin America's access to international capital markets.[13] We focus on Argentina, Brazil, Chile, Colombia,

11. See, for example, Bulow and Rogoff (1989).
12. See also Catão, Fostel, and Kapur (2007).
13. GDP is measured in dollars at PPP levels to avoid identifying the aftermath of large devaluation episodes as periods with increased access to international capital markets.

Mexico, and Venezuela. Figure 6 illustrates the evolution of gross issuance. As examined in the previous section, these six countries have had the most access to international capital markets in Latin America.

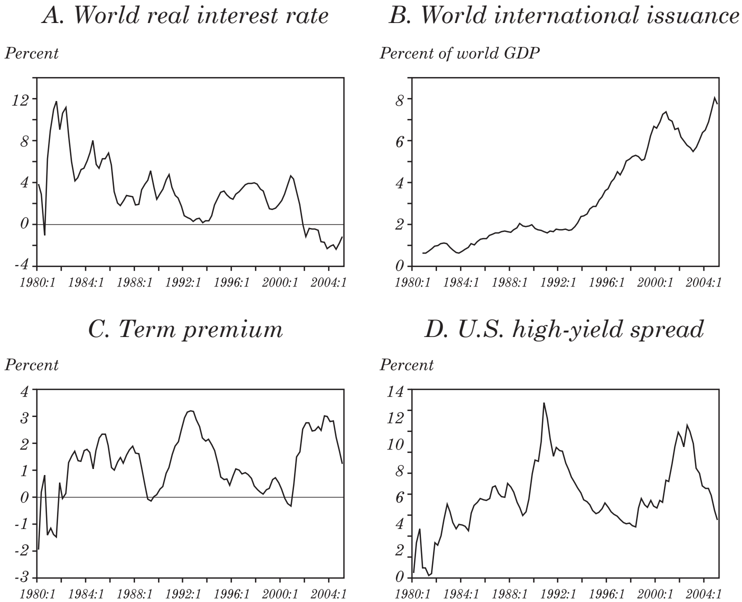
Figure 6. Total Gross Issuance in International Capital Markets as a Proportion of GDP[a]



Source: Dealogic; IMF, World Economic Outlook.

a. For each quarter, total issuance is the sum of issuance in the quarter plus the issuance in the three previous quarters divided by annual GDP in dollars evaluated at PPP exchange rates.

Figure 7. External Indicators[a]



Source: Dealogic; Board of Governors of the Federal Reserve System database; IMF, International Financial Statistics; Merrill Lynch.

a. The world interest rate is captured with the one-year U.S. real interest rate. World International issuance over world GDP is total issuance in the bond, equity, and syndicated loan markets as a percent of world GDP evaluated at PPP. The term premium is the difference between the U.S. ten-year-note yield minus the U.S. one-year Treasury bill rate. The high-yield spread is the difference between the yield of U.S. high-yield bonds and the one-year U.S. Treasury bill rate.

We capture the evolution of global liquidity and risk aversion with four indicators, shown in figure 7, and with an indicator of emerging market crises. First, we follow the literature and use the U.S. real interest rate to capture the degree of liquidity of international capital markets.[14] As shown in figure 7, Latin America's loss of access to international capital markets in 1982 is clearly linked to the hike in U.S. real interest rates. However, fluctuations in the world real interest rate cannot completely capture the extent of liquidity in international

14. For example, Calvo, Leiderman, and Reinhart (1993) link the evolution of foreign exchange reserves and the real exchange rate of developing countries to fluctuations in the U.S. real interest rate and U.S. output; they find that fluctuations in these indicators account for about 50 percent of the forecast error variance of official reserves and the real exchange rate of ten Latin American countries.

capital markets. While the international capital market was quite fragmented in the 1970s, it became quite developed in the 1990s, with a dramatic increase in the number of instruments offered. To capture this evolution, we construct three other measures of liquidity.

Our second indicator of global liquidity is world gross primary issuance in international capital markets as a share of world GDP.[15] As shown in figure 7, world international issuance (as a share of world GDP) increased from 0.6 percent in 1980 to 8.0 percent in 2005. This dramatic increase in world liquidity is largely the product of the collapse of the Bretton Woods system in 1973 and the capital account liberalization process it triggered. When countries do not need to defend the peg, they can choose their own monetary policy without having to restrict capital mobility. The United States eliminated capital account restrictions as early as July 1973. The liberalization process also involved other industrial countries, with Germany and Great Britain partially eliminating capital controls in 1973 and Japan joining the group in 1979. Latin American countries opened their capital account in the mid-1970s, benefiting from a large inflow of capital. Eventually, the debt crisis in 1982 closed this episode of Latin American financial integration for about a decade. In the mid-1980s, the wave of international financial liberalization also embraced western European countries as they removed restrictions on capital flows to comply with the movement toward a common European currency.[16] Financial integration was further energized in 1989 by the Brady Plan and its initiative to restructure defaulted loans into bonds collateralized by U.S. Treasury bonds. This program created, almost overnight, a market for sovereign emerging market bonds. As investor confidence in emerging market countries gradually recovered, both the government and the private sector started issuing bonds in international capital markets. This time around, Asian countries joined Latin America in removing controls on capital mobility.[17] Emerging markets' issuance in international capital markets increased eightfold from US$42 billion in 1989 to about US$350 billion in 1996. While international capital markets suffered in 2001 with the worldwide stock market crash, they have since recovered with total issuance increasing to about US$5 trillion in 2005.

15. World output is measured in dollars (based on PPP valuation of country GDP).

16. World primary issuance in international capital markets increased more than sixfold, from US$82 billion in 1980 to US$500 billion in 1989.

17. See Kaminsky and Schmukler (2003) for a chronology of financial liberalization in industrial and emerging countries.

Our third indicator for capturing liquidity in international capital is the evolution of investors' term premium, which we estimate as the difference between the U.S. ten-year-note yield minus the U.S. one-year Treasury bill rate.

Investors' risk aversion can also explain emerging market issuance and overall global liquidity. Our fourth indicator approximates this variable using the fluctuations in yields of risky firms (relative to the yield on a safe asset). The indicator shown in figure 7 is the yield spread between U.S. high-yield bonds and the one-year U.S. Treasury bill rate. This index is constructed by Merrill Lynch.[18]

Finally, currency crises in emerging markets can trigger a liquidity crunch as investors rebalance their portfolios by recalling loans not only from the crisis country, but also from other countries to which they have exposure. To evaluate whether Latin American issuance was seriously disturbed by financial crises in other emerging markets, we include in our estimation an indicator that takes the value of one during major currency crises, such as the Asian crisis in 1997 and the Russian crisis in 1998.[19]

We also incorporate seven indicators that capture domestic fundamentals: namely, growth, inflation, openness, political risk, real exchange rate volatility, the terms of trade, and default. With regard to growth, economic activity may signal a stronger ability to repay debts in the future. Since GDP data are not available at the quarterly frequency, we use industrial production from the *International Financial Statistics* (IFS) database, maintained by the International Monetary Fund (IMF).

Our second domestic indicator is inflation. Macroeconomic stability may be at the heart of the countries' ability to tap international capital markets. The fiscal accounts would provide an excellent indicator of macroeconomic policy, but most countries in our sample do not have quarterly information on their fiscal accounts. Similarly, market interest rates can help to identify episodes of expansionary and contractionary monetary policy, but market-determined interest rates are not available because all the countries in our sample had restrictions on deposit and loan interest rates

18. Fostel (2005) studies the relationship between emerging market bond spreads and high-yield spreads in financial centers. Her model explains why prices of risky assets in financial centers and in emerging economies move together in the presence of liquidity constraints even when fundamentals in emerging countries and financial centers are not correlated.

19. See also Broner and Rigobon (2005).

following the debt crisis through the early 1990s. Thus, to capture the stance of fiscal and monetary policies, we use the consumer price index (CPI) inflation rate.

We calculate openness as the sum of exports and imports over GDP. The source is quarterly data from the IMF's *International Financial Statistics*.

Our next indicator of domestic fundamentals is political risk. The quality of institutions, the extent of corruption, a government's ability to carry out its declared programs, and its ability to stay in office may influence international issuance. To capture this possibility, we use the index of political risk published in the *International Country Risk Guide* (ICRG). This is a composite index that assesses a country's political stability and quality of governance. The political stability indicators provide rankings on socioeconomic pressures that could constrain government action or fuel social dissatisfaction, as well as rankings of domestic political violence or ethnic tensions. The indicators on governance provide rankings on corruption within the political system, as well as assessments of the strength and impartiality of the legal system and of popular observance of the law. The index also includes information on the institutional strength and quality of the bureaucracy. A country ranked in the 80–100 percent range is considered a very low risk, while a country ranked below 50 percent is considered a very high risk.

The real exchange rate is the effective real exchange rate from the IMF's *World Economic Outlook* database. Volatility is measured by the standard deviation of the real exchange rate (in logs). The standard deviation is computed over a moving window of eight quarters.

To capture a country's ability to pay and thus its access to international capital markets, we use data on the terms of trade. Our data for terms of trade are from the IMF's International Financial Statistics.

Finally, some of the countries in the sample were in default for part of the period studied. To capture the effect of default on exclusion from international capital markets, we construct an indicator that takes a value of one when the country is in default or arrears and zero otherwise. The various episodes of default and arrears are taken from Catão, Fostel, and Kapur (2007).[20]

20. Default and arrears events in this study are based on Beim and Calomiris (2000), Lindert and Morton (1989), Standard and Poor's *Credit Week* (various issues), and events identified by the International Monetary Fund.

3.2. Estimation

We estimate equation (3) using panel data models with fixed effects. Our data are sampled at quarterly frequencies. The dependent variable, issuance/GDP, is shown in figure 6. Issuance includes bond, equity, and syndicated loan issuance in international capital markets. To mitigate potential endogeneity biases, some of the variables enter the regressions lagged one period. This is the case of exchange rate volatility and inflation, since capital inflows can create appreciation and price movements via fluctuations in the money supply. We also use openness lagged one period, because more issuance (especially trade credits) can also facilitate more trade. Given that feedback from issuance to political risk and output growth takes more than one period, we use current values of these variables as explanatory variables. Finally, all the variables capturing external factors are exogenous, so we also use current values of these factors as explanatory variables in the regressions. To account for country-specific first-order autocorrelation and heteroskedasticity, we adjust standard errors using the Huber-White sandwich procedure.

Table 6 reports the regression estimates for a variety of alternative specifications. Regression 1 includes growth, inflation, political risk, real exchange volatility, the term premium, and world issuance (as a percent of world GDP) as explanatory variables. All the variables have the correct sign, and, with the exception of inflation, they are significantly different from zero at all conventional significance levels. Issuance increases with higher growth, better institutions (as captured by a high political risk index), and larger world issuance. As expected, issuance declines with higher real exchange rate volatility and a higher term premium. Regression 2 adds a control for the states of default. Increases in world liquidity will not affect a country's ability to borrow in international capital markets if the country is in default. We therefore not only include our measure of international liquidity as an explanatory variable, but we also interact international liquidity with the default index. As expected, the variable that captures the interaction effect between the default indicator and world issuance over world GDP has a negative sign, and it is significant at the 1 percent confidence level. Regression 3 examines whether crises are of a contagious nature. We find that major crises such as the 1997 Asian crisis and the 1998 Russian crisis have a negative (and significant) effect on Latin American issuance in international capital markets. Regressions 4–7 include other controls, such as the terms of trade, the U.S. high-yield spread, and the world real interest rate. As expected,

Table 6. Panel Estimation with Fixed Effects: 1984–2005[a]

Explanatory variable	*(1)*	*(2)*	*(3)*	*(4)*	*(5)*	*(6)*	*(7)*
Growth	0.01 (2.06)**	0.01 (1.62)	0.01 (1.58)	0.01 (1.59)	0.01 (1.73)	0.01 (1.15)	0.01 (1.80)
Inflation	−0.18 (−1.43)	−0.19 (−1.11)	−0.02 (−1.60)	−0.02 (−1.02)	−0.02 (−1.16)	−0.01 (−0.70)	−0.02 (−0.82)
Openness				−0.02 (−1.05)			
Political risk	0.07 (4.00)***	0.06 (4.67)***	0.06 (4.66)***	0.06 (5.23)***	0.06 (3.92)***	0.06 (4.42)***	0.06 (4.26)***
Real exchange rate volatility	−8.30 (−3.00)**	−2.73 (−1.13)	−2.90 (−1.19)	−3.34 (−1.75)	−3.47 (−1.74)	−2.35 (−1.14)	−3.25 (−1.22)
Terms of trade					−0.01 (−0.80)		
Emerging market crises			−0.24 (−1.99)*	−0.25 (−2.08)*	−0.27 (−2.28)**	−0.24 (−1.98)*	−0.20 (−1.66)
High-yield spread						−0.14 (4.85)***	
Term premium	−0.27 (−1.95)*	−0.27 (−2.59)**	−0.27 (−2.60)**	−0.28 (−2.54)**	−0.27 (−2.46)**		
U.S. real interest rate							0.12 (1.70)
World issuance / world GDP	0.29 (4.37)***	0.26 (4.81)***	0.26 (4.84)***	0.29 (4.15)***	0.26 (4.91)***	0.30 (5.03)***	0.35 (5.46)***

Table 6. (continued)

Explanatory variable	*(1)*	*(2)*	*(3)*	*(4)*	*(5)*	*(6)*	*(7)*
(World issuance / world GDP) * Default		−0.42	−0.40	−0.43	−0.41	−0.40	−0.40
		(−5.33)***	(−5.24)***	(−4.91)***	(−5.69)***	(−6.50)***	(−4.57)***
Constant	−3.19	−2.25	−2.30	−2.18	−1.70	−2.17	−3.50
	(−4.20)***	(−3.07)***	(−3.05)***	(−2.45)	(−1.65)	(−2.60)	(−3.20)
Summary statistic							
No. observations	510	510	510	510	510	510	510
Within R^2	0.50	0.58	0.58	0.58	0.59	0.59	0.58
Between R^2	0.39	0.10	0.11	0.05	0.15	0.12	0.12
Overall R^2	0.50	0.53	0.53	0.50	0.54	0.54	0.53

Source: Authors'estimations.
* Statistically significant at the 10 percent level. ** Statistically significant at the 5 percent level. *** Statistically significant at the 1 percent level.
a. T statistics are in parentheses.

higher international risk aversion, as captured by the U.S. high-yield spread, adversely affects Latin America's issuance in international capital markets. In contrast, the world real interest rate, captured by the U.S. real interest rate, and the terms of trade do not have a significant effect on total issuance.

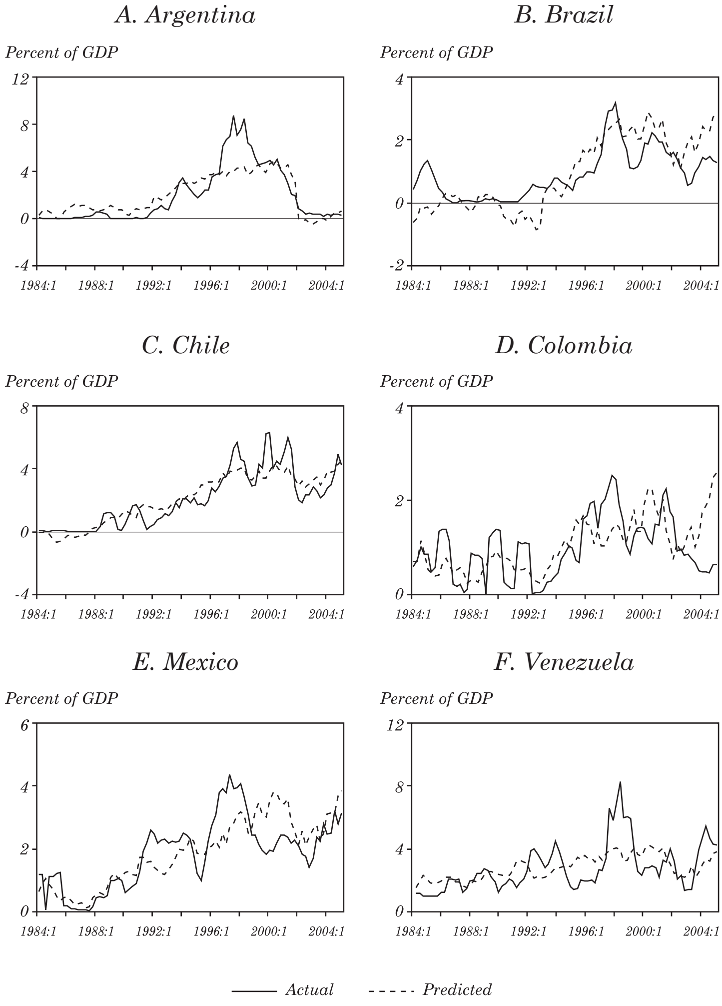
Across all regressions, political risk is the domestic factor with the highest economic significance. An increase in the index of about 20 points, which moves the median Latin American country to the political standards of industrial countries, produces an increase in issuance of about 1.2 percent of GDP. However, we think we should not interpret this variable in a narrow way as an indicator of only "political institutions." This index is highly correlated with the economic and financial indices also published in the International Country Risk Guide, suggesting that the fluctuations in the political risk index also encompass information on a broad range of economic and financial indicators. The presence of colinearity may also explain the lower significance of the other domestic economic variables. The world factors with the strongest effect on the ability of Latin American countries to tap international markets are world liquidity, as captured by world issuance over world GDP, and the term premium. A one-percentage point increase in world issuance over world GDP or a similar decline in the term premium increases Latin American issuance by 30 basis points of GDP.

The model also performs well in capturing the fluctuations in international issuance, with overall R2 ranging between 0.50 and 0.60. Most of the explanatory power originates from the time variation as captured by the within R2, which ranges from 0.48 to 0.57, while the between R2 varies from 0.06 and 0.38.

Figure 8 shows the actual dependent variable and the linear prediction of regression 3 (our baseline regression from here on), including the fixed effects. Our model does well in predicting the boom-bust pattern in international access of Latin American countries, although it underpredicts somewhat the boom in the mid-1990s. Also, with the exception of Colombia, our model captures quite well the decline in issuance following the Russian crisis in 1998 and the recovery in issuance starting in 2002.[21]

21. Argentina and Colombia did not participate in the recovery in international issuance starting in 2002. While Argentina could not access international capital markets following the default in 2001, it is not clear why Colombia's issuance declined in the last three years of the sample. One possible explanation is that Colombia benefited from a large increase in development assistance loans in those years, which might have dramatically reduced its need to tap international private capital markets.

Figure 8. Total Gross Issuance in International Capital Markets over GDP: Actual and Predicted Values[a]



Source: Dealogic; IMF, World Economic Outlook.

To check the robustness of the results in regression 3, we performed augmented Dickey-Fuller unit root tests on the residuals, all of which rejected the null hypothesis at the 10 percent significance level. We also included quarter dummies to control for seasonality in issuance; all these variables proved insignificant. We tested for dynamic effects by introducing various lags of all the variables, but we found insignificant effects. Finally, we tested for other nonlinearities, such as interaction effects between the emerging market crisis indicator and the various indicators capturing liquidity in international capital markets, but they were not statistically significant.

In light of the potential criticisms regarding the panel methodology itself, we estimated all the regressions using two other methodologies. First, we used pooled ordinary least squares estimation. The results are shown in table 7. The exercise proves robust to this specification. Real exchange rate volatility loses significance and inflation becomes more significant, but all the variables still yield the right sign and significance consistent with the fixed effects estimation. Second, since gross issuance (our dependent variable) cannot be negative, we estimated the regression using a censored Tobit model estimation procedure. The results can be seen in table 8. The results prove robust to the sign constraint. All the variables yield coefficients with the right sign, and all the most important variables still prove significant.

We now resume our discussion about the relative importance of domestic and external factors. In the context of this estimation, domestic factors include growth, inflation, openness, political risk, real exchange rate volatility, terms of trade, and the interaction between world issuance over world GDP with the default indicator. External factors include emerging market crises, the high yield spread, the term premium, the U.S. real interest rate, and world issuance over world GDP. Using the coefficients of regression 3, we calculate the path of the domestic component for each country and the evolution of the common external factor. They are shown in figures 9 and 10. A quick glance at these figures reveals two interesting patterns. First, countries differ greatly in their domestic characteristics (figure 9). With the exception of Colombia, all the countries in our sample show a strong improvement in domestic fundamentals in the early 1990s. Only Chile, however, shows continuous strong improvement in domestic performance in the late 1990s. Brazil and Mexico continue to show sound domestic fundamentals in the late 1990s, but their improvement slows. Argentina and Venezuela, in turn, quickly deteriorate in the latter part of the sample. Second, the influence of external factors increased after the mid-1990s (figure 10).

Table 7. Pooled OLS Estimation: 1984–2005[a]

Explanatory Variables	*(1)*	*(2)*	*(3)*	*(4)*	*(5)*	*(6)*	*(7)*
Growth	0.01 –1.78	0.01 (1.15)	0.06 (1.11)	0.01 (0.97)	0.01 (1.15)	0.00 (0.42)	0.01 (1.32)
Inflation	–0.03 (–9.28)***	–0.03 (–10.32)***	–0.03 (–11.35)***	–0.02 (–3.08)**	–0.02 (–10.44)***	–0.02 (–3.15)**	–0.02 (–10.28)***
Openness				0.01 (0.57)			
Political risk	0.07 (4.33)***	0.07 (4.53)***	0.07 (4.52)***	0.07 (3..42)**	0.07 (4.13)***	0.07 (4.84)***	0.07 (4.41)***
Real exchange rate volatility	–5.93 (–2.43)**	–0.74 (–0.29)	–0.87 (–0.34)	–0.88 (–0.38)	–1.28 (–0.45)	–0.54 (–0.23)	–1.32 (–0.46)
Terms of trade					–0.01 (–2.41)**		
Emerging market crises			–0.21 (–1.58)	–0.20 (–1.50)	–0.26 (–1.96)*	–0.21 (–1.55)	–0.15 (–1.29)
High-yield spread						–0.14 (3.87)**	
Term premium	–0.29 (–1.99)*	–0.30 (–2.39)**	–0.29 (–2.39)**	–0.28 (–2.31)**	–0.28 (–2.19)**		
U.S. real interest rate							0.13 –1.71
World issuance / world GDP	0.26 (4.00)***	0.25 (4.06)***	0.25 (4.08)***	0.25 (3.53)**	0.25 (3.88)***	0.28 (4.29)***	0.33 (5.00)***

Table 7. (continued)

Explanatory Variables	*(1)*	*(2)*	*(3)*	*(4)*	*(5)*	*(6)*	*(7)*
(World issuance / world GDP) * Default		−0.31	−0.31	−0.30	−0.30	−0.30	−0.30
		(−3.71)**	(−3.68)**	(−3.8)**	(−3.61)**	(−4.15)***	(−3.23)**
Constant	−3.24	−3.09	−3.10	−3.90	−2.62	−2.80	−4.29
	(−4.94)	(−3.74)	(−3.7)	(−3.96)	(−2.68)	(−3.55)	(−3.44)
Summary statistic							
No. observations	510	510	510	510	510	510	510
R^2	0.50	0.54	0.54	0.55	0.55	0.55	0.54

Source: Authors'estimations.
* Statistically significant at the 10 percent level. ** Statistically significant at the 5 percent level. *** Statistically significant at the 1 percent level.
a. T statistics are in parentheses.

Table 8. Tobit Estimation: 1984–2005[a]

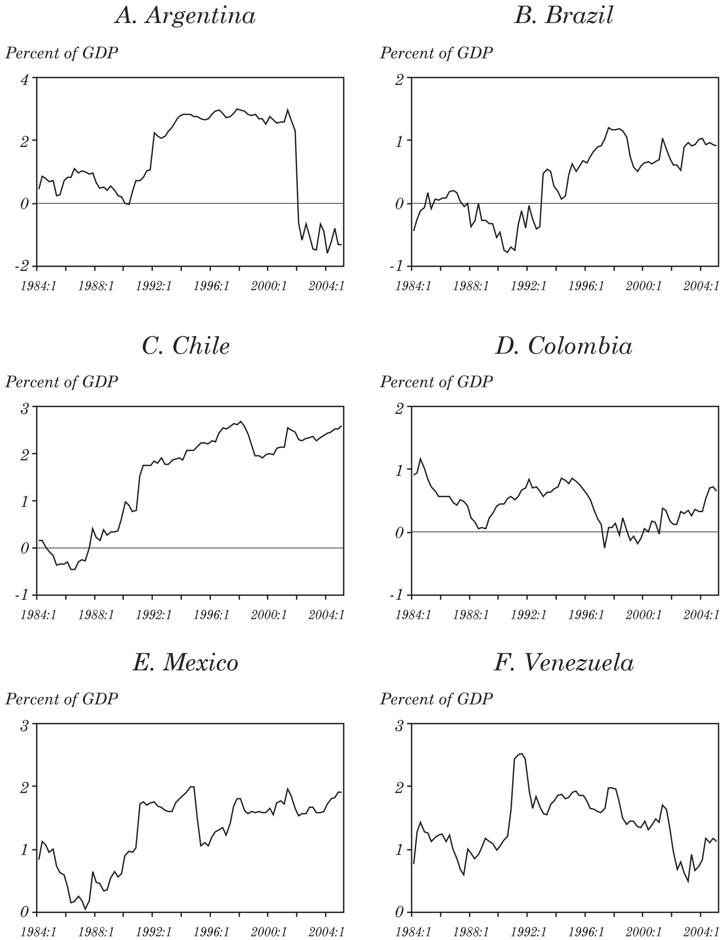
Explanatory Variables	*(1)*	*(2)*	*(3)*	*(4)*	*(5)*	*(6)*	*(7)*
Growth	0.01 (1.73)	0.01 (1.42)	0.01 (1.38)	0.01 (1.30)	0.01 (1.70)	0.01 (0.78)	0.01 (1.33)
Inflation	−0.04 (−4.64)***	−0.03 (−4.42)***	−0.03 (−4.40)***	−0.03 (−3.81)**	−0.02 (−3.86)**	−0.03 (−3.48)**	−0.03 (−3.94)**
Openness				0.01 (1.83)*			
Political risk	0.08 (11.39)***	0.07 (11.79)***	0.07 (12.13)***	0.07 (11.34)***	0.07 (12.14)***	0.08 (12.72)***	0.08 (12.37)***
Real exchange rate volatility	−5.97 (−3.34)**	−0.64 (−0.34)	−0.76 (−0.41)	−0.76 (−0.41)	−1.25 (−0.68)	−0.58 (−0.31)	−1.32 (−0.71)
Terms of trade					−0.01 (−4.13)***	−0.01 (−4.25)***	
Emerging markets crises			−0.20 (−0.84)	−0.20 (−0.82)	−0.24 (−1.08)	−0.19 (−0.83)	−0.13 (−0.60)
High-yield spread						−0.13 (−5.79)***	
Term premium	−0.29 (−5.45)***	−0.29 (−5.71)***	−0.29 (−5.73)***	−0.29 (−5.68)***	−0.28 (−5.61)***		
U.S. real interest rate							0.12 (4.00)**
World issuance / world GDP	0.29 (11.00)***	0.26 (10.77)***	0.26 (10.80)***	0.26 (10.44)***	0.26 (10.82)***	0.28 (11.77)***	0.34 (12.57)***

Table 8. (continued)

Explanatory Variables	*(1)*	*(2)*	*(3)*	*(4)*	*(5)*	*(6)*	*(7)*
(World issuance / world GDP) * Default		−0.30	−0.32	−0.31	−0.31	−0.31	−0.30
		(−7.01)***	(−7.02)***	(−6.87)***	(−6.94)***	(−6.87)***	(−6.63)***
Constant	−3.50	−3.30	−3.30	−3.30	−2.82	−3.10	−4.48
	(−8.03)	(−8.04)	(−8.06)	(−8.05)	(−6.53)	(−7.25)	(−10.38)
Summary statistic							
No. observations	510	510	510	510	510	510	510
Pseudo R^2	0.20	0.21	0.22	0.21	0.23	0.22	0.21

Source: Authors'estimations.
* Statistically significant at the 10 percent level. ** Statistically significant at the 5 percent level. *** Statistically significant at the 1 percent level.
a. T statistics are in parentheses.

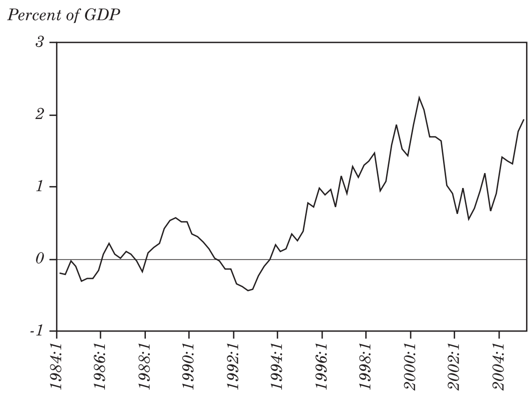
Figure 9. Estimated Domestic Component, by Country[a]



Source: Authors'estimations.

a. Domestic factors are predicted issuance as a percent of GDP.

Figure 10. Estimated External Factor[a]



Source: Authors'estimations.
a. The external factor is predicted issuance as a percent of GDP.

To provide more detail on the relative contribution of the domestic and external factors to the booms and busts in international issuance starting in 1990, we examine separately three episodes: 1990–98, 1999–2001, and 2002–05. The first and the third episodes are periods of a boom in international issuance, whereas the second is an episode of pronounced decline in issuance. Table 9 shows, for each country, the total predicted growth rate in issuance, as well as the growth rate of the domestic and external components. In Argentina, Brazil, and Chile, the boom of the early 1990s is mostly driven by superb domestic fundamentals. Domestic fundamentals have a less important role in Mexico and Venezuela during this episode. Domestic fundamentals deteriorate in Colombia, fueling a decline in international issuance in the early 1990s. In contrast, with the exception of Argentina, the booms and bust in international issuance starting in 1999 are driven mostly by external factors. This result is consistent with the findings of the empirical studies that focus on spreads instead of issuance. They find that external factors are also very important in determining emerging market spreads, especially since 2002. To conclude, good behavior seems to be at the core of the boom in Latin America's participation in international capital markets in the early 1990s, but the evidence from the later periods suggests that global liquidity has played a more important role.

Table 9. The Role of Domestic and External Factors[a]

Country and episode	*External factors*	*Domestic factors*	*Total change*
Argentina			
1990–1998	0.93	2.74	3.67
1999–2001	–0.37	–0.44	–0.81
2002–2005	1.03	–3.60	–2.57
Brazil			
1990–1998	0.93	1.46	2.39
1999–2001	–0.57	–0.12	–0.69
2002–2005	1.23	0.03	1.25
Chile			
1990–1998	0.93	1.57	2.50
1999–2001	–0.57	–0.23	–0.79
2002–2005	1.23	0.25	1.48
Colombia			
1990–1998	0.93	–0.70	0.23
1999–2001	–0.57	0.55	–0.01
2002–2005	1.23	0.35	1.58
Mexico			
1990–1998	0.93	0.50	1.43
1999–2001	–0.57	0.26	–0.31
2002–2005	1.23	0.24	1.47
Venezuela			
1990–1998	0.93	0.59	1.51
1999–2001	–0.57	–1.03	–1.59
2002–2005	1.23	0.50	1.73

Source: Authors'estimations.

a. The last column shows the total change in gross issuance (as a percent of GDP) for each episode. The first two columns show the part explained by external and domestic factors.

4. Conclusions

We have studied the participation of Latin American countries in international capital markets using data for twenty countries for the period 1970–2005. We first looked at the main stylized facts on net capital flows. We then turned our attention to data on gross issuance since 1980. Much more analysis is needed on the links between domestic economic conditions, global market liquidity, and access to international capital markets. We have not even attempted to address in estimations the issue of the less integrated group's access to international markets, mostly because of the endemic data limitations. With these considerations in mind, our main findings can be summarized as follows.

Looking at gross issuance data may be a more accurate approach to studying Latin America's financial integration to world capital markets than focusing on net flows. Whereas data on net capital flows suggest a complete loss of market access after the Russian and Asian crises, data on gross issuance indicates that Latin American countries continue to tap international capital markets even in times of lower global liquidity.

Overall, the small economies of Latin America have basically not had access to international capital markets, suggesting the presence of a size effect. There seems to be a minimum required liquidity to attract international investors.

For the larger economies of Latin America, the evidence in the 2000s suggests that the boom-bust pattern in international issuance has mainly been driven by fluctuations in global liquidity and investors' changing risk behavior. This is specially the case in the resurgence of international issuance since 2002.

Still, good behavior matters. The superb performance of Argentina, Brazil, and Chile in capital markets in the 1990s was largely driven by improved fundamentals—from better governance to higher growth and macroeconomic stabilization. This is also the case for the more moderate Mexican performance during the same period. Finally, Argentina's dramatic fall in 1999–2001 can be explained by a pronounced deterioration in institutions and, most importantly, by the sovereign default in 2001.

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Financial Diversification, Sudden Stops, and Sudden Starts

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The financial crises of the second half of the 1990s have led to renewed interest in the causes and consequences of international capital flows. Sudden stops, defined as large drops in net capital inflows, have received particular attention, given the collapses in output and investment commonly associated with these events.[1]

The premise in most of the recent literature on sudden stops is that emerging market economies are exposed to large fluctuations in the supply of international capital, as a result of imperfections in international financial markets (see Calvo, Izquierdo, and Mejía, 2004; Guidotti, Sturzenegger, and Villar, 2004; Frankel and Cavallo, 2004). In this literature, Wall Street is either the carrier of financial contagion or the originator of the shock itself. The origin of the stop in capital inflows is not a shift in either the mean or variance of the marginal productivity in the domestic economy, but rather a change

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1. Edwards (2004) finds that the current account reversals associated with sudden stops lead to a decline in GDP growth of approximately 4 percent. Other estimates of the cost of sudden stops are presented in Guidotti, Sturzenegger, and Villar (2004).

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in the willingness of foreign savers to invest in the domestic economy. In sudden stop episodes, net capital inflows are drastically curtailed, forcing the domestic economy to adjust via some combination of expenditure reduction and expenditure switching, a real exchange rate depreciation, and falling output.

The existence of these imperfections—usually stemming from informational asymmetries—is certainly plausible, and it has recently received considerable empirical support.[2] However, an identification problem makes it difficult to gauge just how important these factors are in explaining the sudden stops to net capital flows that have been observed in recent years. For a start, in the absence of a massive reserve accumulation and drawdown, the balance in the current account will move almost one to one with the balance in the capital account, making it impossible to determine whether the sudden stops are capital account developments or domestic savings-investment movements. Moreover, even when the sudden stop originates in the capital account, it could be driven by a sudden stop of gross capital inflows by foreigners (capital inflows) or by the decision of domestic agents to invest abroad (capital outflows).

Identifying the relative importance of the different underlying shocks causing sudden stops has key policy implications. If the main source of capital account volatility is shocks to capital inflows, then vulnerability to external financial shocks becomes a central policy issue.[3] On the other hand, a sudden stop in the capital account could simply reflect changes in savings and investment, which lead to balancing the current account after a period of persistent deficits as emphasized in the literature on current account reversals (Milesi-Ferretti and Razin, 1998). This could be expected from an economy after years of rapid expansion, where the current account deficit contributes to the financing of high investment rates, or the result of an

2. The role of international financial markets in contagion is evident in the transmission of shocks from a crisis country to one belonging to the same asset class (Rigobon, 2001), borrowing from the same international banks (van Rijckeghem and Weder, 2000), or sharing a set of overexposed mutual funds (Broner and Gelos, 2003). Evidence of international financial markets as a source of instability can be found in the recent literature that explores the role of risk premiums on emerging market bonds spreads in developed capital markets (García-Herrero and Ortiz, 2006; Daude and Ramos-Ballester, 2006).

3. Holding international reserves as a means of self-insuring against sudden stops is one example of the type of policy being adopted by emerging market economies; see Calvo (2005); García and Soto (2006); Jeanne and Rancière (2006); Caballero and Cowan (2006). The use of contingent instruments that provide flows offsetting these sudden stops is a second example (Caballero and Panageas, 2005).

improvement in the terms of trade. Alternatively, the current account reversal could be the result of policy mismanagements. For example, it might be triggered by an exchange rate misalignment, which could result in an unsustainable expansion of expenditure followed by a currency crisis and a curtailment in foreign financing. In this latter case, rather than pursuing a strategy of insurance, authorities should concentrate mainly on avoiding policies that can become a source of shocks, as emphasized in much of the crisis literature prior to the Mexican and Asian crises. Finally, understanding the causes and optimal responses to portfolio shifts by domestic agents leads to a third (and less understood) set of policy issues.

Unfortunately for the policymaker, the jury is still divided as to the relative role of fundamentals and external financial factors in explaining recent crises. The Asian financial crisis is a clear example, with two opposing sets of explanations. One view is that excessive reliance on short-term external debt left Asian emerging market economies vulnerable to shocks (and panics) from international financial markets.[4] The alternative view is that the Asian financial crisis largely reflected policy distortions in the region, in particular distortions that led to excessive (mainly short-term), borrowing by corporations and excessive lending by domestic banks (Corsetti, Pesenti, and Roubini, 1999). A second example is the range of explanations for current account fluctuations in emerging market economies. Aguiar and Gopinath (in this volume) emphasize the time series patterns of productivity in emerging market economies to explain the current account anomalies documented in these countries, whereas Guajardo (in this volume) focuses on the role of financial frictions.[5]

The central theme of this paper is that additional information on the characteristics of international adjustments can be obtained by breaking net capital inflows into capital inflows (which correspond to the changes in the stocks of international liabilities of domestic residents) and outflows (which measure changes in the stocks of international assets of domestic residents).[6] The key assumption is

4. Furman and Stiglitz (1998); Radelet and Sachs (1998); Chang and Velasco (1998).

5. See also Aguiar and Gopinath (2007) and Neumeyer and Perri (2005).

6. A small but growing literature explores gross capital flows and capital account reversals. Faucette, Rothenberg, and Warnock (2005) separate capital account reversals into outflow- and inflow-induced shares, arguing that only the former correspond to sudden stops. Cowan and De Gregorio (2006) focus on the behavior of gross capital flows to Chile in the 1998 capital account reversal. Finally, Rothenberg and Warnock (2007) follow a route similar to ours (see section 1, below) by looking at sudden stops caused by a large drop in inflows.

that the returns expected from international liabilities are driven by the shocks in international markets discussed above, whereas gross international assets are not directly affected by these variables. We can therefore use the relative variance and covariance of gross inflows and outflows to obtain information on the structure of shocks hitting both emerging and developed economies.

We use gross flows to study two closely related issues: the role played by reversals of inflows in recent sudden stops and the overall pattern of gross inflows and outflows across emerging and developed economies.[7] Specifically, the first section of the paper focuses on sudden stops, separating them according to the importance of gross inflows in the overall reversal of net capital flows.[8] We find that one in five sudden stops corresponds to surges in capital outflows (sudden starts) rather than stops in inflows. This suggests that the importance of external financial shocks has been overestimated in the literature, with implications for optimal reserve management, the design of state contingent instruments, and so forth. We also find that the distinction between varieties of sudden stops matters: sudden starts are associated with smaller drops in output and investment than inflow-driven sudden stops. Finally, we show that the probability of experiencing a sudden start (conditional on a sudden stop) is higher in economies that have more developed domestic financial systems and are more open to trade. Although not conclusive, this last finding suggests an alternative explanation for the fact that the output cost of sudden stops (or current account reversals) is smaller for more open economies (see Edwards, 2004; Guidotti, Sturzenegger, and Villar, 2004).

Next, the paper looks at inflow reversals and discusses the degree of coincidence between these and the sudden stop episodes identified in the literature. The main finding is that large inflow reversals are prevalent in both emerging and developed economies, but a much smaller share of them coincide with sudden stops in developed countries because of offsetting changes in outflows.

Whereas the first part of the paper, section 1, concentrates on the lower tail of the distribution of changes in the net capital account (and

7. The former objective is motivated by the finding, reported in Cowan and De Gregorio (2006), that the Chilean sudden stop of 1998 was atypical of sudden stops in Latin America in the 1990s, as it was almost completely driven by a surge in capital outflows instead of an abrupt reduction in inflows.

8. Throughout the paper, we refer to large drops in net capital flows as sudden stops. In doing so, we follow the literature without judging the appropriateness of the expression, although it may be misleading, as should be clear from our discussion.

gross inflows), the second part, section 2, characterizes capital flows in general. Not surprisingly, we find that emerging market economies have more volatile capital accounts than developed economies. This higher variance is not the result of more volatile capital inflows to emerging market economies, however, since the volatility of gross inflows is remarkably similar across country groups. Rather, it reflects a higher covariance between inflows and outflows in developed countries. This is the continuous counterpart to the finding that reversals of the capital account are highly correlated with stops to inflows in emerging market economies but not in developed countries. Indeed, we find that the correlation between gross inflows and outflows decreases with per capita income and financial integration.

A simple conceptual framework provides a possible explanation for this empirical finding. We argue that sudden stops to inflows are prevalent in international financial markets, and that international assets holdings by residents provide the first line of defense against these non-fundamental-driven shocks to capital flows. The key price variable is the expected return in the domestic economy. Drops in inflows must push up domestic returns if domestic assets invested abroad are to return to the domestic economy. An economy's ability to absorb shocks to capital inflows will depend on its level of financial development (which will affect the interest rate response) and the stock of gross international assets (which places bounds on the size of the shock that can be absorbed). Arguably, developed economies are better prepared to face financial shocks along both dimensions. The second line of defense is provided by productive assets, capable of generating export revenues that offset the inflows. This is the role of the tradables sector in the Calvo, Izquierdo, and Mejía (2004) model. The key price variable for this second line of defense is the real exchange rate.

This interpretation of the stylized facts on gross capital flows has several policy implications. The first relates directly to the current debate on global imbalances. Our results suggest that when shocks to the demand for U.S. assets arising from the portfolio decisions of foreign investors are not accompanied by changes in U.S. returns, they will be offset by shifts in U.S. foreign asset positions. The United States will not have to adjust its current account, and the impact on output will be small. The flip side is that countries outside the United States will experience a sudden stop to inflows from U.S. investors, leading to an unwinding of gross international asset positions in economies with gross asset positions and a capital account reversal in poorer economies. The second policy implication is that in setting optimal reserve and contingent asset policies, governments need to take into consideration both the total foreign asset positions of the private sector and the level of development of the domestic financial system before deciding the optimal level of coverage against external financing shocks. The importance of the financial system stems from the fact that foreign assets and liabilities are not likely to be held by the same agents in the economy, so they will need to be redistributed in times of distress. Financial underdevelopment will therefore distort the decision to save abroad in the first place, and it will then distort the decision to repatriate assets in case of a sudden stop.

A second key issue is to correctly separate external financing shocks from shocks to the domestic marginal product of capital when determining the optimal reserve strategy. When faced by a productivity shock, pumping reserves into the domestic economy will simply lead to larger outflows (and rich speculators).

The rest of the paper proceeds as follows. Section 1 discusses sudden stops and the role played by inflows and outflows. Section 2 describes the main stylized facts characterizing gross and net capital flows to developed and emerging market economies. It also presents a simple model to interpret the facts. Finally, section 3 concludes.

1. Sudden Stops and Sudden Starts

This section classifies sudden stop episodes according to the relative importance of rising gross capital outflows and falling gross inflows. It also looks at large reversals in gross capital inflows and categorizes them according to their coincidence with sudden stops. The section starts with a brief description of the data and definitions used, before presenting and discussing the main results.

1.1 Data and Definitions

Following balance-of-payment conventions, we define capital inflows as changes in the stock of international liabilities owed by domestic residents. These liabilities include equity (foreign direct investment and portfolio), bonded debt held by nonresidents, and loans from nonresident banks. Since they are changes in stocks, inflows can either be positive (a capital inflow) or negative (a reversal). Capital outflows, in turn, are changes in the foreign assets of domestic residents. International assets include offshore foreign direct investment (FDI), foreign equity and bonds held by resident, and loans to nonresidents (or offshore deposits). The capital account is simply the sum of net inflows (negative) and net outflows (positive). We use annual data on inflows and outflows from the International Monetary Fund's *International Financial Statistics* (IFS) for the period 1975 to 2004.

As we are primarily concerned with changes in private capital flows, we follow the literature on sudden stops in limiting our sample to emerging market economies (that is, those economies with access to voluntary private capital flows) and developed economies.[9] For most of the exercises reported in this paper, we scale capital flows (inflows, outflows, and net capital flows) by a linear trend of dollar gross domestic product (GDP).[10] This allows us to disentangle capital account volatility from the volatility of real output and the real exchange rate.

1.2 Identifying Different Types of Capital Account Reversal

We follow Guidotti, Sturzenegger, and Villar (2004) in defining a sudden stop as a year in which the annual change in the capital account (scaled by GDP) is one standard deviation below the average and also below 5 percent of GDP. We take this definition because it is fairly representative of what the literature in this area has termed sudden stops. Both the standard deviation and the average are country specific. This leads us to identify a hundred sudden stop episodes in our sample of 1,580 observations (roughly 6 percent of the sample). We then build a measure of the contribution of the fall in inflows to each sudden stop episode:

$$S_t^I = \frac{\Delta I_t}{\Delta I_t + \Delta O_t}, \tag{1}$$

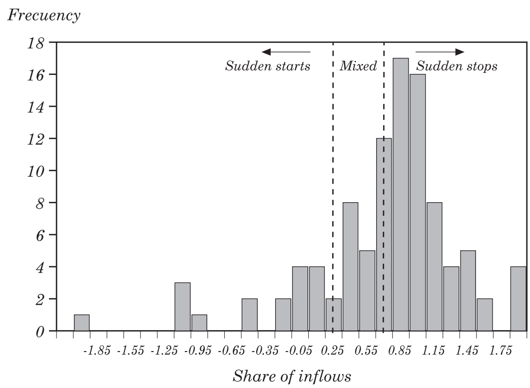
where ΔI_t and ΔO_t are the changes in inflows and outflows, respectively, between t – 1 and the current (sudden stop) period, *t*.

9. Appendix A lists the countries in our sample, which is based on the Organization for Economic Cooperation and Development (OECD) and the countries listed in the EMBI+ index.

10. Alternative measures that scale gross and net inflows by lagged GDP or a lagged moving average generate very similar results.

Figure 1 plots the histogram of for all hundred episodes. Most observations (56 percent) are between 0 and 1, indicating that inflows and outflows moved in the same direction: foreign liabilities fell, and foreign assets rose. Values above 1 (31 percent) mean that outflows undid the reversal of inflows, offsetting their impact on the financial account. Values below 0 (13 percent) imply that inflows actually rose during the sudden stop episode.

Figure 1. Share of Inflows, StI, in Capital Account Reversals[a]



Source: Authors' calculations, based on IFS data.

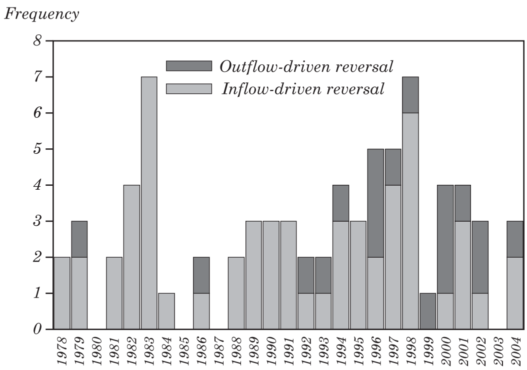
a. The share of inflows in the capital account is defined by equation (1). The dashed vertical line identifies the categories of different types of reversals. A value between 0 and 1 means that both outflows and inflows contributed to the reversal. Values above 1 and below 3 imply that outflows and inflows, respectively, undid the reversal of the capital account.

We split the sudden stop episodes into three categories: outflow-driven sudden stops, which we define as $S_t^I < 0.25$, inflow-driven sudden stops ($S_t^I > 0.75$), and mixed cases. Figure 1 illustrates the split with dashed vertical lines. Our premise is that reversals driven by outflows do not correspond to external financing shocks, since changes in domestic residents' portfolios are driving the net flow.

Of the hundred sudden stops in the sample, just over half (fifty-seven) correspond to inflow-driven sudden stops, whereas slightly below a fifth (eighteen) are outflow driven. These ratios change considerably when we split the sample into emerging and developed economies. Of the thirty-six sudden stops in developed economies, only 40 percent are inflow driven. This ratio rises to 65 percent for emerging market economies. Sudden stops (as defined in the literature) are a better proxy for external financing shocks in emerging market economies than in developed countries. On the flip side, even in emerging market economies inflow-driven sudden stops are considerably less frequent than the net sudden stop measure suggests. In other words, many experiences that are called sudden stops are better described as a domestic shock that leads to a joint reaction of domestic and foreign agents. From the policy perspective, if external insurance decisions are based on sudden stop probabilities, then countries are overinsuring.

Figure 2 plots the different types of reversal by year. As the figure shows, inflow-driven sudden stops are clustered around 1982–83 and 1997–98, as one would expect if indeed these events are driven by events in international financial markets. The figure also shows that outflow starts are a fairly recent phenomenon and are spread out evenly from the early 1990s onward. This may be related to portfolio diversification by domestic residents, possibly as the result of capital account liberalization.

Figure 2. Reversals in Time, by Main Source[a]



Source: Authors' calculations, based on IFS data.

a. Inflow-induced reversals (sudden stops) are those in which $S_t^I > 0.75$; outflow-induced reversals (sudden starts) are those in which $S_t^I < 0.25$. Reversals in which both inflows and outflows are responsible ($0.25 < S_t^I < 0.75$) are not shown and represent 25 percent of all reversals identified.

1.3 Does the Distinction Matter?

The next step is to investigate whether this distinction between types of sudden stop matters for macroeconomic outcomes. We explore this issue by looking at the behavior of key macroeconomic variables in a six-year window around the date of the net capital account reversal. Figure 3 shows the average path of output growth and investment before and after the sudden stop. Panel A indicates that per capita GDP growth diminishes in both cases. However, in the case of an inflow-driven sudden stop, growth plummets from an average of 2.1 percent in the preceding three years to –1.1 percent and –1.2 percent in the year of the reversal and the following one, respectively. The decline in growth is smaller for outflow-driven sudden stops, from 2.3 percent before to 1.9 percent afterward. This is four times less than in inflow-driven sudden stops, where the drop was from 2.1 percent to 0.6 percent average growth in the following years. Furthermore, table A2 shows that the average cumulative growth loss is 5.9 percent for inflow-driven sudden stops, while outflow reversals led to a reduction in growth of only –1.4 percent after three years.

Panel B reveals that investment falls by less in outflow-led reversals than in inflow-led sudden stops. In fact, the average cumulative loss in investment in the period following the sudden stop is almost twice as large in inflow stops (–15 percent) than in outflow starts (8 percent).

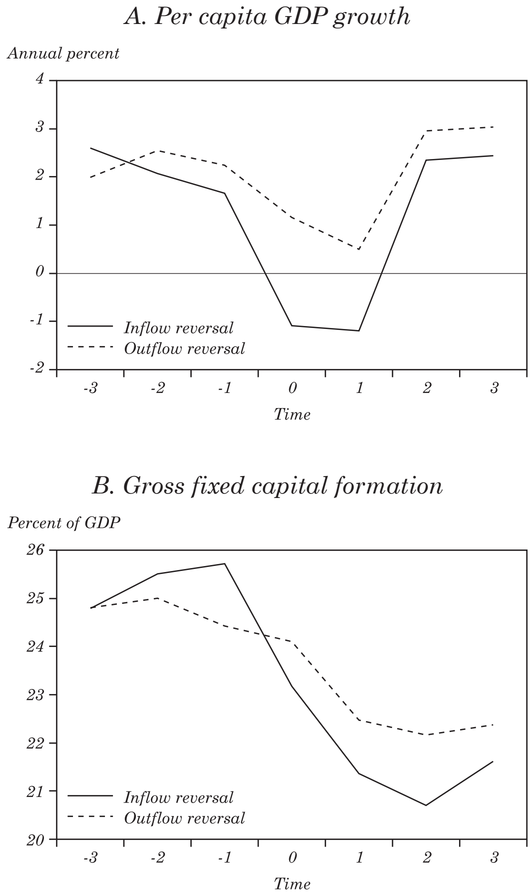
The larger impact of inflow reversals in figure 3 is corroborated by the results presented in the growth regression in equation (2), where growth (*g*) is regressed on its own lag and dummies for sudden stops (*ss*) and inflow reversals (*ins*). Inflow reversals are significantly associated with longer crises in which output growth recovers slowly.[11]

$$\begin{aligned} g_t &= 1.7 + 0.31 \cdot g_{t-1} - 3.0 \cdot ss_t - 0.8 \cdot ss_{t-1} \\ &\quad + 1.1 \cdot ss_{t-2} - 0.45 \cdot inss_{t-1} + \varepsilon. \end{aligned} \tag{2}$$

Table A2 in the appendix reports the following additional descriptive statistics for both varieties of sudden stop: GDP growth, investment, domestic credit over GDP, exports over GDP, and the exchange rate. When comparing inflow- and outflow-driven episodes, we find that exports and domestic credit to the private sector are larger in countries that experience outflow reversals. The results reported in figure 3 suggest an alternative explanation for the fact that more open countries experience lower output drops following sudden stops (Guidotti, Sturzenegger, and Villar, 2004): more open countries are more likely to experience an outflow-induced sudden stop. More research is needed, however, to fully address this issue. An interesting additional extension

11. All coefficients are significant at 5 percent confidence. The results were robust for several specifications in which inflow-led sudden stops caused greater damage than mixed stops and outflow reversals.

Figure 3. Heterogeneity in Impact of Sudden Stops and Sudden Starts[a]



Source: Authors' calculations, based on IFS data.

a. Growth and investment are averages over the sample of episodes identified in the previous section. Reversals in which both inflows and outflows are responsible ($0.25 < S_t^I < 0.75$) are not shown and represent 25 percent of all reversals identified.

to this work would be to analyze the extent to which the determinants of net sudden stops differ from the determinants of inflow stops. Our previous results suggest they are different. In particular, the bunching of sudden stops in figure 2 suggests that inflow stops are driven more by events in global financial markets than are outflow starts, but a definite conclusion can not yet be reached.

1.4 Gross versus Net Inflow Reversals

The previous subsection split sudden stops according to the importance of the inflow drop in the change in the net capital account. This procedure, however, excludes episodes in which inflows to a country are curtailed, but outflows adjust to offset the stop. To explore this possibility, we build a direct measure of gross inflow reversal and compare the incidence of these events with the net reversal (*SS*) discussed above.

We define an inflow reversal as a period in which the change in non-FDI inflows, net of the average country change (scaled by trend GDP), is below –5 percent, which parallels our definition of sudden stops. We exclude FDI because we are interested in shocks originating in financial markets and because, as documented by Levchenko and Mauro (2006), FDI is remarkably stable even during sudden stops.

Based on this definition, we identify 147 gross inflow reversals.[12] Only sixty-two of these (42 percent) coincide with the sudden stops defined as net reversals in the previous section. This suggests that outflows mitigate the effects of a sudden stop of inflows in most of the cases (eighty-five inflow reversals). The most interesting fact is that a much higher share of gross inflow reversals coincide with net reversals in emerging market economies (forty-four out of sixty-six) than in developed countries (eighteen out of eighty-one).

Table 1. Coincidence of Net and Gross Inflow Reversals[a]

Sample group	*Both coincide*	*Only net reversal*	*Only gross reversal*
Developed economies	18	18	63
Emerging market economies	44	20	22
Total	62	38	85

Source: Authors' calculations, based on IFS data.
a. The first column indicates the number of episodes that were defined as a net reversal as defined in section 1.1 and a gross reversal defined using non-FDI inflows. The second and third columns show the number of episodes that did not coincide.

12. The 147 gross inflow reversals consist of eighty-five that are gross reversals only and sixty-two in which the inflow reversal coincides with a net reversal. According to the standard definition of sudden stops, however, there are only a hundred episodes, of which thirty-eight are net reversals only (that is, without an inflow reversal) and thus are sudden starts rather than sudden stops. The remaining sixty-two are net reversals and gross inflow reversals. The same computations can be made across rows for developed and emerging market economies.

This simple analysis suggests that the key distinction between developed and emerging market economies is not in the volatility of non-FDI inflows, but in the covariance between inflows and outflows. Both groups have considerable amounts of gross inflow reversals (eighty-one in developed economies and sixty-six in emerging markets), but in emerging market economies, outflows do not offset the reversal of inflows. Of course, causality could be running in the opposite direction, with changes in outflows in developed economies leading to offsetting changes in inflows. We investigate this aspect of gross capital flows further in the following section.

2. Gross versus Net Capital Flows: Stylized Facts

The previous section focused on the lower tails of the distributions of net and gross capital inflows, and it further reduced the analysis of the tails to a set of arbitrary binary variables. Using these dummy variables is a reasonable approach if one thinks that the world behaves in a nonlinear way, with economies running into vertical supply constraints, as in the work of Caballero and Krishnamurthy (2001) and others. By focusing on these episodes, however, we are disregarding a lot of information on gross and net capital flows from our sample. Moreover, defining episodes necessarily involves discretionary choices in the establishment of thresholds, which may not coincide with the vertical episodes of theoretical models. With these concerns in mind, in this section we characterize gross and net capital flows for our sample of developed and emerging market economies. We begin by identifying the differences and similarities between these two (also arbitrary) groups of countries. We then move to a more general (and robust) approach that differentiates the behavior of capital flows across income levels and degrees of financial integration.

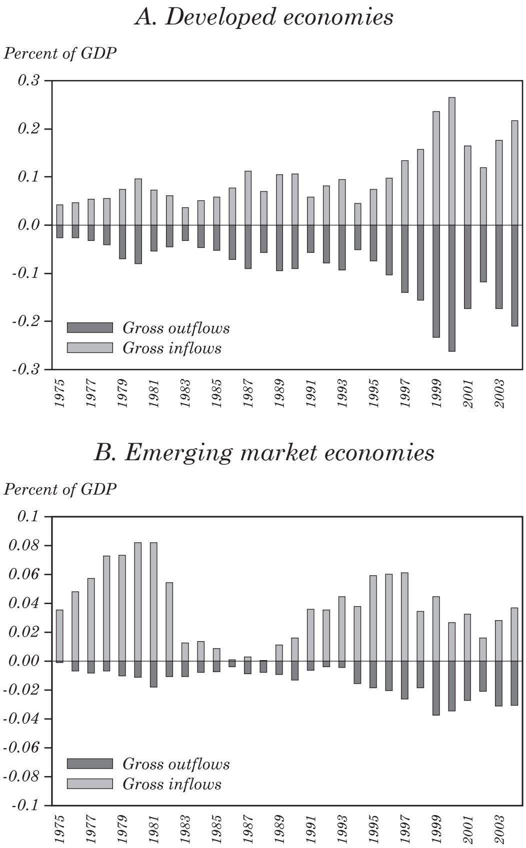
2.1 Capital Flows in Emerging and Developed Economies

Figure 4 plots the average gross capital flows in emerging and developed economies.[13] The figure reveals at least three notable

13. The group averages presented in figure 4 hide considerable cross-country variation, as is evident in figure A1. We exclude offshore financial centers, in which inflows and outflows are automatically matched, since capital is raised and funneled offshore once again. We therefore decided to exclude Ireland, Belgium, Great Britain, and Switzerland from our sample at this point, because they are outliers in terms of the size of average inflows and outflows.

trends. First, gross flows swamp net flows in developed economies. This is the flow counterpart of the increasing level of financial integration documented by Lane and Milesi-Ferretti (2003). Second, gross inflows and outflows in developed economies took off in earnest in the second half of the 1990s and leveled off in the current decade, while outflows are a very recent feature in emerging markets. Finally, gross flows in emerging market economies lag considerably behind

Figure 4. Yearly Average Gross Inflows and Outflows through Time[a]



Source: Authors' calculations, based on IFS data.

a. Gross inflows and outflows are shown as a percent of trend GDP. Note the difference in y-axis for developed and emerging market economies.

those of developed economies, so that the average gross flows of emerging market economies in 2004 were similar to the average gross flows of the developed economies in the mid-1970s. Until the second half of the 1990s, emerging market economies mostly had net capital inflows. This changed in the current decade, as many emerging market economies countries have been accumulating reserves and posting current account surpluses.

We turn now to the variance of the changes in gross inflows and outflows and net flows. Our working with changes instead of levels is motivated by the literature on sudden stops and reversals that emphasizes the macroeconomic consequences of these reversals. Gross and net flows are normalized by trend GDP. We also remove the (usually insignificant) country mean of the changes to separate country trends from volatility. We denote the change in the net capital account ΔF, changes in inflows ΔI, and changes in outflows ΔO.

Our first result is that emerging market economies have more volatile net capital flows than developed economies, as expected. Table 2 shows that the standard deviation of ΔF in the average (median) emerging market economy is 80 percent (110 percent), higher than in the average (median) developed economy. This is in line with the results from the previous section, which found that large negative values of ΔF (sudden stops) are more common in emerging market economies than in developed countries. This result is confirmed in figure 5, which plots the negative segment of the cumulative distribution functions for ΔF.

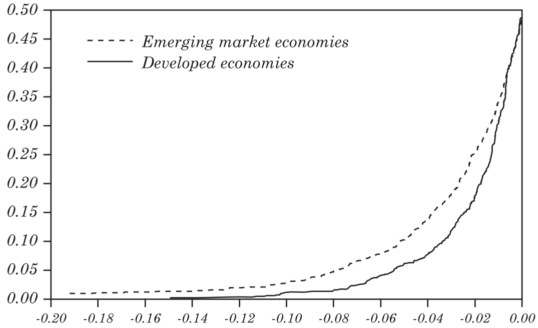
Table 2. Volatility of Capital Flows[a]

	$\sigma\Delta F$		$\sigma\Delta I$	
Sample group	*Mean country*	*Median country*	*Mean country*	*Median country*
(1) Developed economies	0.027	0.021	0.044	0.041
(2) Emerging market economies	0.048	0.043	0.049	0.043
(2)/(1)	–1.8	2.1	1.1	1.0

Source: Authors' calculations, based on IFS data.

a. σ represent the standard deviation and ΔF, ΔI represent the change in net capital flows and inflows, respectively.

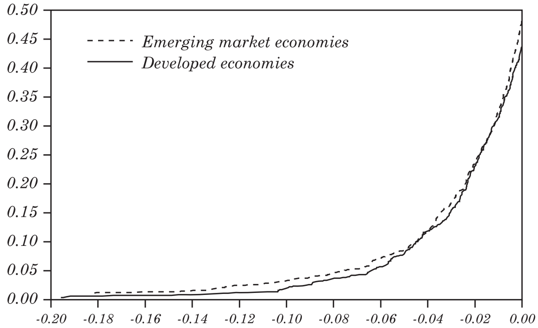
Figure 5. Change in Net Capital Flows[a]



Source: Authors' calculations, based on IFS data.
a. The above figure ignores the positive section of the cumulative distribution of net capital flows. Net flows are lower in emerging market economies.

Our second finding is that the volatility of inflows is remarkably similar across emerging market and developed economies. Large reversals in inflows are equally as likely in the two groups. We find this to be true for both FDI and non-FDI inflows. To corroborate this point, figure 6 plots the cumulative distribution functions of ΔI in both developed and emerging market economies.

Figure 6. Change in Gross Non-FDI Inflows[a]



Source: Authors' calculations, based on IFS data.
a. The above figure ignores the positive section of the cumulative distribution of non-FDI inflows. Gross non-FDI inflows have a similar distribution across country groups

This result is at odds with the presumption that volatile inflows cause emerging market economies to face a larger flux of net capital flows, which then leads recurrently to sudden stop episodes. To investigate this issue further, we separate the determinants of the volatility of ΔF using a simple variance-decomposition exercise. We split the variance in both groups of countries into the variance of non-FDI inflows (σ^2_{nfdiI}), FDI inflows (σ^2_{fdiI}), outflows (σ^2_{O}), and their respective covariances. Table 2 confirms that the volatility of inflows is of similar magnitudes in emerging market and developed economies, although the volatility of net capital flows is much higher in emerging market economies than developed countries. Moreover, table 3 shows that outflows are more volatile in developed than in emerging market economies. Most of the volatility of ΔF, however, is explained by the much larger negative covariance between non-FDI inflows and outflows in developed than in emerging market economies (row 5).

We can thus conclude that what makes reversals much less common in developed countries relative to emerging market economies is the strongly negative correlation between inflows and outflows in the first group of countries. In developed economies, capital outflows mitigate the effect of a sudden reversal of inflows (or vice versa).

Table 3. Variance Decomposition[a]

Source of Variance	*Emerging market economies*	*Developed economies*	*Emerging – developed*	*Share of total*
Var (Δ Non-FDI inflows)	26.3	20.9	5.3	0.30
Var (Δ FDI inflows)	1.6	3.1	–1.5	–0.08
Var (Δ Outflows)	7.9	16.1	–8.3	–0.45
2Cov (Δ Non-FDI inflows, Δ FDI inflows)	0.4	–1.1	1.5	0.08
2Cov (Δ Non-FDI inflows, Δ Outflows)	–8.5	–25.6	17.0	0.95
2Cov (Δ FDI inflows, Δ Outflows)	–1.0	–4.4	3.4	0.19
Var (Δ Financial account)	26.6	8.5	18.0	1.00

Source: Authors' calculations, based on IFS data.
a. Numbers are × 10,000 for expositional purposes.

2.2 Discussion of Results: A Simple Framework of Gross Flows

In this section, we present a simple mean-variance portfolio framework to help explain the stylized facts documented in the previous subsection.[14] Consider a small open economy in which there is a premium between domestic returns and international returns. We assume that this premium ($\rho + \xi I$) is the loss to foreign investors from selective defaults on debt contracts or expropriation risk. This premium is increasing in the level of foreign liabilities held by domestic agents (I). The higher the level of foreign debt, the larger the incentive to default. More generally, it is not important that only foreigners bear these costs; what is crucial in our framework is that the costs are perceived to be higher for foreigners. The risk premium, ρ, is stochastic with a mean equal to μ_ρ and variance of $\sigma^2{}_\rho$.

Domestic residents have a stock of wealth ($W \geq 0$) that they can invest in a risky technology at home ($H \geq 0$) or abroad at a riskless rate R^* ($O \geq 0$). Returns to the domestic technology are a decreasing function of total capital, K, such that

$$R = A - \alpha K,$$

and A is random productivity term, with a time-varying mean, μ, and constant variance, σ^2. Productivity in this case is a broad expression for profitability, which should also include terms of trade shocks, macroeconomic policies, and so forth. In addition, ρ and μ are realized before domestic and foreign investors make their portfolio decisions. The only remaining source of uncertainty is the realized return on domestic output, A.

International investors are risk neutral, so the following international arbitrage condition holds for capital inflows, I:

$$\mu - \alpha K = R^* + (\rho + \xi I). \tag{3}$$

We assume that domestic productivity is such that $\mu - \alpha W > \rho + R^*$, over the whole support of ρ, so that there are nonzero capital inflows even when all domestic wealth is invested domestically. Equation (3), pins down total capital in the domestic economy:

$$K = \frac{\mu - (\rho + \xi I) - R^*}{\alpha}.$$

14. Tille and van Wincoop (2007) and others incorporate portfolio choice into a dynamic stochastic general equilibrium (DSGE) macroeconomic framework that generates a general equilibrium with meaningful capital flows.

Domestic agents maximize a mean variance utility function, which after substituting for returns is:

$$U = H(\mu - \alpha K) + (W - H)R^* - \frac{1}{2}\gamma (H\sigma)^2,$$

where γ represents risk aversion and $(H\sigma)^2$ is the variance of the portfolio of domestic agents. From the first order condition for H, we obtain the following optimal portfolio allocation for local residents:

$$H = \min\left\{\frac{\rho + \xi I}{\gamma\sigma^2}, W\right\}, \text{ and} \tag{4}$$

$$I = \frac{1}{1+\xi\phi}\left(\frac{\mu - \rho - R^*}{\alpha} - \frac{\rho}{\gamma\sigma^2}\right), \tag{5}$$

where $\phi = [(1/\alpha) + (1/\gamma\sigma^2)]$.

Next we analyze two possible outcomes for this model, depending on total domestic wealth being above or below

$$\overline{W} = \frac{1}{\gamma\sigma^2}\left\{\frac{\rho + \xi\left[(\mu - R^*)/\alpha\right]}{1+\xi\phi}\right\},$$

which is obtained by using I from equation (5) in H from equation (4).

2.2.1 Case 1: $\overline{W} < W$

This is the case of financial diversification, in which a nonzero share of domestic wealth is invested offshore. Using the previous results we can find expressions for the stock of international assets (O)—which, following the balance-of-payment conventions, is negative—and the net capital account (F):

$$O = -W + \frac{1}{\gamma\sigma^2}\left\{\frac{\rho + \xi\left[(\mu - R^*)/\alpha\right]}{1+\xi\phi}\right\}; \tag{6}$$

$$F = \frac{1}{\alpha}\left[\frac{1}{1+\xi\phi}\left(\mu - \rho - R^* + \xi\frac{\mu - R^*}{\gamma\sigma^2}\right)\right] - W. \tag{7}$$

Here, O is the difference between demand for capital and domestic wealth, the remainder being owned by foreigners. In this case, $I > 0$ because of the assumption made above on the parameters. Foreign assets are decreasing (in absolute terms) in the country risk premium and in the sensitivity of foreign investment to the level foreign liabilities (ξ), and they are increasing in wealth.[15]

Using the above expressions, we can check that the following equations hold for the variance and covariance of inflows and outflows in the face of shocks to expected domestic productivity, μ, and the risk premium, ρ:

$$\sigma_I^2 = \frac{1}{(1+\xi\phi)^2}\left[\frac{\sigma_\mu^2}{\alpha^2} + \sigma_\rho^2\left(\frac{1}{\alpha} + \frac{1}{\gamma\sigma^2}\right)^2\right],$$

$$\sigma_O^2 = \left(\frac{1}{1+\xi\phi}\frac{1}{\gamma\sigma^2}\right)^2\left[\sigma_\rho^2 + \left(\frac{\xi}{\alpha}\right)^2\sigma_\mu^2\right], \text{ and}$$

$$\sigma_{IO} = \frac{1}{\gamma\sigma^2}\frac{1}{(1+\xi\phi)^2}\left[\frac{\xi}{\alpha^2}\sigma_\mu^2 - \left(\frac{1}{\gamma\sigma^2} + \frac{1}{\alpha}\right)\sigma_\rho^2\right],$$

where $\sigma_\mu{}^2$ is the variance of μ. The covariance between inflows and outflows is more negative the larger are the shocks to the risk premiums, $\sigma_\rho{}^2$, but it is closer to zero the larger the shocks to productivity, $\sigma_\mu{}^2$. This is intuitive: when facing a rise in ρ, domestic agents will repatriate part of their savings to take advantage of higher domestic returns. If the shock is to productivity, however, then domestic agents and foreigners will move their funds in the same direction.

2.2.2 Case 2: $\overline{W} \geq W$

In this case, all of domestic wealth is invested at home. Returns are high enough to compensate for the increased risk domestic investors face. Here, $O = 0$, and $F = I = K - W$.

15. The fraction $dO / d\xi$ is positive when $[(\mu - \rho - R^*) / \alpha] - \rho / \gamma\sigma^2 > 0$, ($\Leftrightarrow I > 0$).

$$I = \frac{1}{1+(\xi/\alpha)}\left(\frac{\mu-\rho-R^*}{\alpha}-W\right).$$

The structure of variances and covariance is given by

$$\sigma_I^2 = \frac{1}{(1+\xi/\alpha)^2}\frac{1}{\alpha^2}\left(\sigma_\mu^2+\sigma_\rho^2\right);$$

$$\sigma_O^2 = 0;$$

$$\sigma_{IO} = 0.$$

This simple framework illustrates several plausible differences between emerging and developed economies that may explain the stylized facts reported in the previous section. First, emerging market economies are more likely than developed economies to have low wealth, high ρ, high ξ, or large foreign liabilities that push up the total risk premium, and they are also more likely to hold no or few international assets. This being the case, emerging market economies will have a lower covariance (in absolute terms) between inflows and outflows. Matching the similar σ_I^2 across emerging and developed economies is not so simple in this setting, however. Indeed, which σ_I^2 is higher is ambiguous.

A second possibility that is often discussed in the literature puts emerging market economies in the $\overline{W} < W$ region, but with a more volatile production technology (that is, a higher σ_μ^2). In this model the higher σ_μ^2 leads to a covariance of inflows and outflows that is closer to zero (or even positive), which matches the stylized facts. A higher σ_μ^2, however, also translates into a higher σ_I^2 for emerging market economies, a fact that is not supported by the data.

The final possibility is closest to the sudden stop literature. Consider the case in which emerging market economies face more volatile financing (that is, a higher σ_ρ^2) or a steeper supply curve for international capital. Both correspond to imperfections in international capital markets. Note, however, that higher σ_ρ^2 in emerging market economies would actually lead to a larger (absolute) covariance between inflows and outflows. A higher ξ, in turn, has an ambiguous effect on σ_{IO} and dampens σ_I^2.

This simple model illustrates how several differences (financial or productive) between emerging and developed economies are consistent with the differences in moments reported above. Moreover, simply splitting countries into emerging and developed economies, does not clarify which specific variable is driving the differences. With this in mind, we use the following section to characterize differences in σ_{IO}, the key component in the variance decomposition. Our main objective is to disentangle the productive and financial differences.

2.3 Income Levels, Risk Premiums, and Assets Abroad

A first implication of the model presented above is that the stock of foreign assets held by domestic residents (equation 6) is increasing in wealth and decreasing in the spread charged by foreign investors on domestic assets. To evaluate this implication, table 4 estimates the correlation between gross international assets over GDP, per capita income (a proxy of financial wealth), and the Emerging Markets Bond Index (EMBI) spread or Moody's country debt rating (a proxy for risk premium). The sample is limited to countries for which data on the EMBI or debt rating is available. The first column reports the simple cross-section correlation for 2001 between external assets over GDP and the log of the EMBI spread. As expected, the correlation is negative and significant: countries with a low risk premium have more assets abroad. To control for wealth, we include the log of per capita GDP in the second column. The estimated signs are as expected, although significance is lost. The results are similar when we use country debt ratings instead of the EMBI spread (column 3).[16] The next two columns pool all available years and run country fixed-effects regressions using the EMBI spread and country debt ratings, respectively. In both regressions, as the model predicts, the correlation between the proxy for country premium and gross international assets is negative, even after controlling for a country fixed effect. As a country's investment premium falls, the gap between domestic and foreign returns falls, and thus investment abroad increases.

2.4 Capital Flows, Income Levels, and Financial Integration

A second implication of the model is that countries that are more likely to be in the internationally diversified region will have a more negative covariance of inflows and outflows, so that international

16. Ratings fall with risk, which explains the positive coefficient in this case.

Table 4. Country Risk and Gross International Asset Positions[a]

Explanatory variable	*(1)*	*(2)*	*(3)*	*(4)*	*(5)*
Log EMBI	−0.300 (0.158)*	−0.219 (0.161)		−0.086 (0.038)**	
Rating			0.293 (0.120)**		0.018 (0.008)**
Log GDPt−1		0.131 (0.155)	0.029 (0.029)		
Summary statistic					
No. observations	22	22	29	156	313
R^2	0.16	0.19	0.2	0.91	0.91
Period	2001	2001	2001	1992–2004	1986–2004
Fixed effects				Country and year	

Source: Authors' estimations.
* Statistically significant at the 10 percent level. ** Statistically significant at the 5 percent level. *** Statistically significant at the 1 percent level.
a. The dependent variable is external assets over GDP. Rating ranges from 1 to 16. Robust standard errors are in parentheses.

diversification reduces the volatility of the net capital account. We start by analyzing the covariance of $\Delta I_{i,t}$ and $\Delta O_{i,t}$ across levels of international financial assets and overall levels of economic development (as measured by per capita income). We include per capita income as a catch-all term, which is likely to be correlated with the structure of shocks hitting the economy, $\sigma_\mu{}^2$, or with access to international capital markets (higher $\sigma_\rho{}^2$ or higher ξ).

Specifically, we estimate

$$\sigma_{IO} = \gamma_1 + \gamma_2 y_{i,t-1} + \gamma_3 A_{it-1} + \mu_{it}. \tag{8}$$

The first two columns of table 5 report the results for the full sample, while the next two columns provide the results for the subsamples of emerging and developed economies, respectively. We find that σ_{IO} is decreasing in the level of assets abroad in all specifications (with significant coefficients). This suggests that part of the difference between emerging and developed economies stems from their level of financial integration. Moreover, we also obtain a negative coefficient for per capita income (significant in the median regression in the second column), which is consistent with either larger productivity shocks or potentially less financial integration (in the form of higher ξ).

Table 5. Covariance Changes on Outflows and Inflows (over GDP)[a]

Explanatory variable	*(1)*	*(2)*	*(3)*	*(4)*
Assets abroad (avg ln)	−7.351 (2.848)**	−4.234 (1.516)***	−7.303 (3.791)*	−8.602 (4.824)*
Per capita GDP (avg ln)	−0.219 (1.532)	−1.708 (0.841)**	−0.886 (2.805)	−1.22 (3.045)
Summary statistic				
No. observations	48	49	31	17
R^2	0.22		0.17	0.2
Method	OLS	Median	OLS	OLS
Sample	All countries	All countries	Emerging markets	Developed

Source: Authors' estimations.
* Statistically significant at the 10 percent level. ** Statistically significant at the 5 percent level. *** Statistically significant at the 1 percent level.
a. Dependent Variable is σ_{IO}. Standard errors are in parentheses.

Next, to use time variation in the main independent variables, we study the yearly comovement of changes in outflows ($\Delta O_{i,t}$) and inflows ($\Delta I_{i,t}$), allowing the comovement to vary across levels of gross foreign assets and per capita income. Specifically, we estimate

$$\Delta O_{it} = \delta + \Delta I_{it}\,(\gamma_1 + \gamma_2 y_{i,t-1} + \gamma_3 A_{i,t-1}) + \theta_1 y_{i,t-1} + \theta_2 A_{i,t-1} + \mu_{it}, \tag{9}$$

where $y_{i.t-1}$ is the lagged log of per capita GDP. We are interested in γ_2, which measures the impact of per capita income on the correlation between $\Delta O_{i,t}$ and $\Delta I_{i,t}$ and γ_3, where the latter captures the effects of foreign assets on this correlation. The results of this estimation are presented in table 6.

Our results are qualitatively identical to those reported in the previous table. The first column present the result for the full sample, while the next two columns report the results for the subsamples of emerging and developed economies, respectively. In all cases we obtain a negative coefficient for γ_2, which is significant for the full sample and for developed economies. The correlation between inflows and outflows falls with the income level, even within emerging and developed economies and after controlling for foreign assets. More importantly, we obtain negative and significant coefficients for γ_3 in all samples. Countries holding more gross foreign assets (that is, that

Table 6. Baseline Regression: Changes in Outflows and Changes in Gross Inflows

Explanatory variable	*(1)*	*(2)*	*(3)*
A. Inflows are changes in non–FDI inflows over trend GDP			
Interactions			
Δ Inflows x ln (GDP) (–1)	–0.096	–0.09	–0.094
	(0.048)**	(0.091)	(0.055)*
Δ Inflows x Gross assets to GDP (–1)	–0.185	–0.174	–0.214
	(0.055)***	(0.073)**	(0.063)***
Main effects			
Δ Inflows	–0.235	–0.231	–0.207
	(0.024)***	(0.048)***	(0.100)**
ln (GDP) (–1)	0.000	0.000	–0.001
	(0.001)	(0.001)	(0.003)
Gross assets to GDP (–1)	0.000	0.000	0.000
	(0.001)	(0.002)	(0.002)
B. Inflows are changes in all inflows over trend GDP			
Interactions			
Δ Inflows x ln (GDP) (–1)	–0.101	–0.074	–0.111
	(0.042)**	(0.085)	(0.041)***
Δ Inflows x Gross assets to GDP (–1)	–0.203	–0.183	–0.251
	(0.048)***	(0.069)***	(0.052)***
Main effects			
Δ Inflows	–0.243	–0.224	–0.176
	(0.022)***	(0.045)***	(0.092)*
ln (GDP) (–1)	0.000	0.000	–0.002
	(0.001)	(0.001)	(0.003)
Gross assets to GDP (–1)	0.000	0.000	0.000
	(0.001)	(0.002)	(0.001)
Summary statistic			
No. observations	1,271	770	501
Sample	All countries	Emerging	Developed

Source: Authors' estimations.
* Statistically significant at the 10 percent level. ** Statistically significant at the 5 percent level. *** Statistically significant at the 1 percent level.
a. The dependent variable is the change in outflows. Robust standard errors are in parentheses.

are more financially integrated) show lower correlations between gross inflows and gross outflows.

In the simple model presented above, after we control for the level of financial integration, the remaining differences across countries were captured by productivity shocks, σ_{μ}^2, and financial variables, ξ.

The difference in the volatility of productivity certainly is one plausible explanation, as suggested by Aguiar and Gopinath (in this volume). It also seems reasonable that the risk premiums grow faster with debt in emerging market economies. However, this is not an exhaustive list of explanations for the results reported in the previous three tables. For a start, in the model, σ_{μ}^{2} can also be thought to capture shifts in the perceptions of productivity common to domestic and foreign savers. If these are more likely to change in lower-income countries, as has been emphasized by the "wake-up call" literature, then information asymmetries and updating of priors explain the stylized facts, not true productivity patterns. Per capita income may also be capturing variations in financial development that condition how inflows and outflows covary. As emphasized by Caballero and Krishnamurthy (2001), agents holding foreign assets are not usually the agents borrowing from international markets. The extent to which O will respond to a shock to I that drives up the marginal product of domestic borrowers will depend on the ability of the domestic financial system to intermediate resources from one agent to another. It remains to be seen, for example, whether the Chilean institutional investors that currently hold large stocks of foreign assets will repatriate their foreign assets in the event of a shock to the cost of Chilean external financing. Finally, the model presented above assumes that domestic productivity rises when foreign investors withdraw, as a result of a decreasing marginal product of capital. This is probably true in economies that are financially robust—which is not always the case in lower-income economies. Indeed, an extensive literature emphasizes the financial vulnerabilities that arrive from currency and maturity mismatches. This being the case, the fact that outflows in low-income economies accompany inflows may be the optimal response to domestic financial distress.

3. Conclusions

This paper provides a broad empirical characterization of gross and net capital flows to emerging and developed economies. The first part of the paper centers on reversals—either large changes in net capital flows or large changes in gross inflows. The second part of the paper looks at gross inflows and outflows and analyzes the variance and covariance of gross inflows and outflows more generally. Accordingly, the conclusions of the paper also fall into two groups. We discuss each in turn.

A large (and growing) literature examines the causes and effects of large reversals in the capital account (sudden stops), as these events are usually associated with output loss or financial distress. This paper argues that by concentrating on the full set of reversals, we are bunching too many phenomena together. The reversal could be a current account reversal, driven by changes in the saving-investment decisions. Shocks to the terms of trade or productivity, or even policy shocks such as changes in public savings or exchange rate misalignments, all fall into this category. Alternatively, the reversal could be triggered on the financial side, driven by the capital account. It is therefore is necessary to distinguish two types of reversal. The event could be a true curtailment of capital inflows (the idea behind the sudden stop literature), or it could be driven by the decision of domestic residents to diversify their portfolios and invest abroad.

With these distinctions in mind, we split sudden stops—that is, large reversals in the capital account—into inflow-driven and outflow-driven reversals. We then argue that it is the former that corresponds to shocks originating in international capital markets emphasized by much recent literature, and these inflow reversals are the true sudden stops. This distinction narrows the number of episodes substantially, suggesting that the incidence of sudden stops may have been overstated. Moreover, we show that the inflow-driven sudden stops have the largest output and investment costs, and we confirm that this form of shock is truly costly for merging market economies.

In the second part of the paper, we show—contrary to what is often proposed—that international financial markets for developed economies are as turbulent as those for emerging markets, with large reversals in gross flows. The key distinction appears to be that for emerging market economies, shocks to inflows (or outflows) are not offset by an opposing movement from outflows (inflows). This may be due to differences in the nature of shocks (productivity shocks versus risk premium shocks) or simply to a lack of international assets with which to accommodate a reversal of inflows. Moreover, we find that the negative covariance between inflows and outflows is higher for countries with high initial stocks of international assets and higher per capita income. We take the first variable as a proxy for the capacity to smooth portfolio shocks, and the second as a broad proxy for the willingness to smooth shocks. Taken together, this implies that emerging market economies are less able to accommodate sudden stops in inflows because they hold much smaller stocks of foreign assets, on average, and they are often less willing to do so because the inflow is responding to lower realized or expected domestic productivity, because domestic financial markets are subject to failures, or because domestic and foreign agents anticipate the costs of a gross flow reversal if the economy is financially vulnerable.

The results presented in this paper motivate a series of additional research questions that are relevant for emerging market economies. First, analysts need to develop models that link optimal reserve levels to total foreign assets and domestic financial development. Countries with large stocks of foreign assets would likely need fewer reserves, particularly if the financial system operates properly. Second, further research is needed to determine whether the determinants of sudden stops are the same as the determinants of inflow-driven sudden stops. If differences are found, the preventive policies will differ. Third, additional research is needed to understand gross outflow shocks in developed and emerging market economies that are not fully offset by capital inflows. A key issue in this regard is identifying the set of domestic or international conditions, such as regulatory changes or macroeconomic policies, that leads to sudden outflows of capitals.

Appendix

Supplemental Data, Stylized Facts, and Regression Results

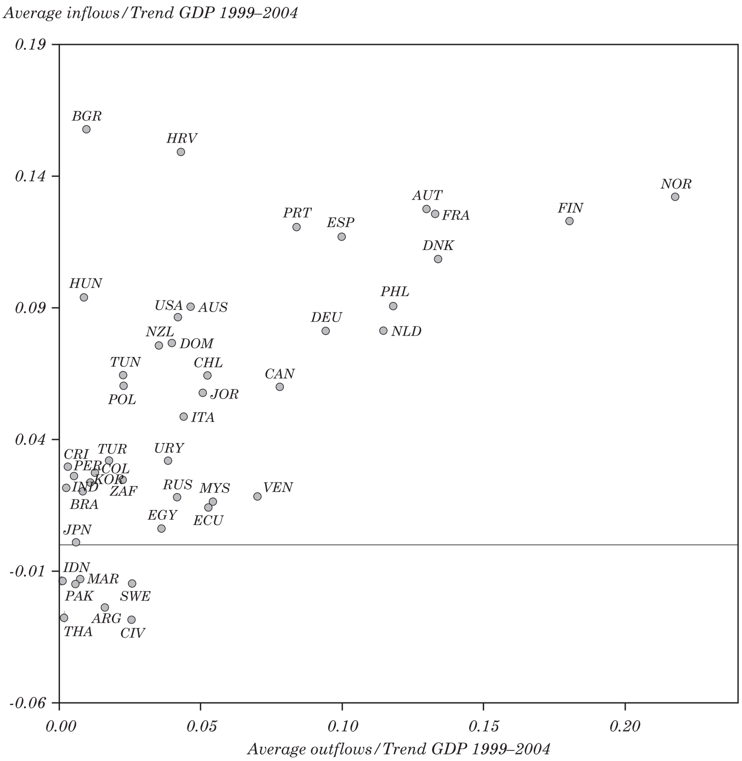
Table A1. Sample of Countries[a]

Developed economies			*Emerging market economies*		
Country	*IFS code*	*World Bank code*	*Country*	*IFS code*	*World Bank code*
Australia	193	AUS	Algeria	612	DZA
Austria	122	AUT	Argentina	213	ARG
Belgium	124	BEL	Brazil	223	BRA
Canada	156	CAN	Bulgaria	918	BGR
Denmark	128	DNK	Chile	228	CHL
Finland	172	FIN	Colombia	233	COL
France	132	FRA	Costa Rica	238	CRI
Germany	134	DEU	Côte d'Ivoire	662	CIV
Iceland	176	ISL	Croatia	960	HRV
Ireland	178	IRL	Dominican Republic	243	DOM
Italy	136	ITA	Ecuador	248	ECU
Japan	158	JPN	Egypt	469	EGY
Netherlands	138	NLD	Hungary	944	HUN
New Zealand	196	NZL	India	534	IND
Norway	142	NOR	Indonesia	536	IDN
Portugal	182	PRT	Jordan	439	JOR
Spain	184	ESP	Korea	542	KOR
Sweden	144	SWE	Malaysia	548	MYS
Switzerland	146	CHE	Mexico	273	MEX
United Kingdom	112	GBR	Morocco	686	MAR
United States	111	USA	Nigeria	694	NGA
			Pakistan	564	PAK
			Peru	293	PER
			Philippines	566	PHL
			Poland	964	POL
			Russia	922	RUS
			South Africa	199	ZAF
			Thailand	578	THA
			Tunisia	744	TUN
			Turkey	186	TUR
			Uruguay	298	URY
			Venezuela, R.B.	299	VEN

Source: Authors' construction.

a. The sample was selected by starting with the Organization for Economic Cooperation and Development (OECD) and adding countries from the EMBI index of emerging economies. Countries that were present in both groups were considered emerging economies. Hungry, Korea, Mexico, Poland, and Turkey thus fell into the category of emerging economies, although they are members of the OECD. The Czech Republic, Greece, Luxembourg, Panama, and the Slovak Republic were dropped owing to data limitations.

Figure A1. Heterogeneity in Average Gross Inflows and Outflows, 1999–2004[a]



Source: Authors' calculations, based on IFS data.

a. Gross inflows and outflows are shown as a percent of trend GDP. Ireland, Belgium, Great Britain, and Switzerland have been excluded as outliers. All have inflows/outflows well above 25 percent of trend GDP.

Table A2. Impact of Outflow and Inflow Sudden Stops[a]

	GDP growth		*Investment*		*Domestic Credit*		*Exports*		*Exchange Rate*	
Measure of Impact	*Inflows*	*Outflows*	*Inflows*	*Outflows*	*Inflows*	*Outflows*	*Inflows*	*Outflows*	*Inflows*	*Outflows*
(1) Maximum before	2.6	2.6	25.7	25.0	0.52	0.75	28.9	41.8	100.0	100.0
(2) Minimum after	–1.2	0.5	20.7	22.2	0.51	0.73	31.8	41.5	53.1	81.4
(3) (1) – (2)	3.8	2.1	5.0	2.8	0.02	0.02	–2.9	0.2	46.9	18.6
(4) Mean before	2.1	2.3	25.3	24.7	0.50	0.73	28.8	41.4	91.7	97.5
(5) Mean after	0.6	1.9	21.7	22.8	0.53	0.77	32.9	45.3	61.2	86.5
(6) (4) – (5)	1.5	0.4	3.6	2.0	–0.03	–0.04	–4.1	–3.8	30.5	11.0
(7) Cumulative loss	–5.9	–1.4	–14.5	–7.9	0.10	0.20	16.3	15.4	–122.0	–44.0

Source: Authors' calculations.

a. Sudden stop episodes cover the three years before the reversal and the three years after, resulting in a total of seven years including the sudden stop year. All statistics denominated after include $t = 0$. Cumulative loss is calculated as the sum of deviations from $t = 0$ to $t = 3$, subtracted from the average of the three years preceding the sudden stop. Sudden stop episodes determined to have mixed causes, $0.25 < StI < .075$, were omitted.

Table A3. Volatility of Capital Flows and GDP[a]

Dependant variable	*Standard dev net flows* ($\sigma_{\Delta net}$)	*Cov non-FDI inflows versus infows* ($\sigma_{\Delta nfdiI}$)	*Cov FDI inflows versus inflows* ($\sigma_{\Delta fdiI}$)	*Standard dev outflows* ($\sigma_{\Delta O}$)	*Cov FDI inflows* versus outflows ($\sigma_{fdiI\ ,\Delta O}$)	*Cov non-FDI inflows versus outflows* ($\sigma_{nfdiI\ ,\Delta O}$)
ln (GDP)	–58.280	10.127	9.82	50.870	–0.653	–4.001
	(25.025)**	(26.195)	(26.975)	(19.352)***	(0.281)**	(1.443)***
Constant	0.089	0.037	0.039	–0.013	0.000	0.003
	(0.021)***	(0.022)	(0.023)*	(0.016)	(0.000)*	(0.001)**
R^2	0.103	0.003	0.003	0.128	0.103	0.141

Source: Authors' estimations.
* Statistically significant at the 10 percent level. ** Statistically significant at the 5 percent level. *** Statistically significant at the 1 percent level. Robust standard errors are in parenthesis.
a. In the table, ln(GDP) is the log of the average purchasing power parity (PPP) per capita during the sample period divided by 10,000.

Table A4. Change in Outflows versus Change Inflow: Regression Results[a]

	Regression results				Sample					
					Group		Period		Sudden stop episodes	
	Estimated coefficients	*Standard errors*	*N*	R^2	*Emerging*	*Developed*	*1975–89*	*1990–2004*	*SS = 1*	*SS = 0*
A. Right-hand-side variable is Δ non-FDI inflows										
(1)	–0.165	0.051***	781	0.09	x		x	x	x	x
(2)	–0.583	0.046***	506	0.47		x	x	x	x	x
(3)	–0.069	0.044	342	0.03	x		x		x	x
(4)	–0.214	0.070***	439	0.12	x			x	x	x
(5)	–0.234	0.063***	236	0.14		x	x		x	x
(6)	–0.653	0.048***	270	0.54		x		x	x	x
(7)	–0.326	0.128**	64	0.31	x		x	x	x	
(8)	–0.251	0.066***	717	0.14	x		x	x		x
(9)	–0.765	0.079***	31	0.76		x	x	x	x	
(10)	–0.672	0.042***	475	0.55		x	x	x		x
B. Right-hand-side variable is Δ inflows										
(1)	–0.171	0.048***	781	0.1	x		x	x	x	x
(2)	–0.620	0.038***	506	0.58		x	x	x	x	x
(3)	–0.065	0.042	342	0.03	x		x		x	x
(4)	–0.223	0.065***	439	0.14	x			x	x	x
(5)	–0.243	0.063***	236	0.15		x	x		x	x
(6)	–0.689	0.039***	270	0.67		x		x	x	x
(7)	–0.346	0.129***	64	0.34	x		x	x	x	
(8)	–0.264	0.062***	717	0.17	x		x	x		x
(9)	–0.803	0.070***	31	0.88		x	x	x	x	
(10)	–0.697	0.033***	475	0.67		x	x	x		x

Source: Authors' estimations.
* Statistically significant at the 10 percent level. ** Statistically significant at the 5 percent level. *** Statistically significant at the 1 percent level.
a. The dependent variable in all regression is the change in the financial account. Standard errors are robust.

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Valuation Effects and External Adjustment: A Review

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Ever since David Hume introduced his price-specie flow mechanism in 1752, the question of external adjustment has been a classic issue for international macroeconomists. In 1968 Robert Mundell asked "To what extent should surplus countries expand; to what extent should deficit countries contract?" (Mundell, 1968). The debate in those days was about the relative merits of expenditure-switching and expenditure-reducing policies, analyzed within the useful template of the Mundell-Fleming model. Subsequent research introduced microfoundations, added an explicit dynamic dimension borrowed from optimal growth theory, and highlighted the role of expectations. Throughout this process, understanding the adjustment of a country's external balances remained a key issue. By the early 1980s a modern synthesis had emerged, in the form of the intertemporal approach to the current account. It characterized the dynamics of external debt as the result of forward-looking decisions by households and investment decisions by firms, set in market structures of varying degrees of complexity. As Obstfeld remarks:

> [This approach] provides a conceptual framework appropriate for thinking about the important and interrelated policy issues of external balance, external sustainability, and equilibrium real exchange rates… [and shifts] attention from automatic adjustment mechanisms and dynamic stability considerations to intertemporal budget constraints and transversality conditions for maximization (Obstfeld, 2001, p. 12).

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According to this intertemporal approach, a country's current account at time t, CA_t reflects expectations of changes in that country's future economic circumstances, as follows:

$$CA_t = -E_t\left[\sum_{s=t+1}^{\infty} R^{-(s-t)} \Delta NY_s\right], \tag{1}$$

where NY_t denotes net income (output minus investment and government expenditures), Δ is the difference operator ($\Delta NY_s = NY_s - NY_{s-1}$), R is the gross real return on a one-period risk-free international bond, and $E_t[.]$ is the expectation operator, conditional on information available at time t. According to equation (1), countries run current account deficits when future net income, NY_s, is expected to improve, and run current account surpluses when future net income is expected to deteriorate. The smoothing motive at the heart of the intertemporal approach is immediate: countries run surpluses to offset future unwelcome developments, and run deficits in anticipation of future improvements in their standard of living.

This class of models provides useful insights about short-run dynamic issues, for example, the response to transitory and permanent shocks. In most empirical studies, however, it falls short of explaining the dynamics of the current account.[1] Many empirical tests have been devised over the years. The most convincing ones—the present value tests—rely on a direct econometric verification of equation (1) using reduced-form vector autoregressions (VAR). The results often indicate that the implied current accounts—that is, the right-hand side of equation (1)—are too smooth compared to actual current accounts. In other words, the intertemporal approach accounts for only a small fraction of the movements in the current account.

Recent research argues that the focus on current accounts and fluctuations in future net income is misguided. Instead, one should focus on the determinants of a country's net foreign asset position. The two are identical in the standard intertemporal model, since, by definition, the change in the net foreign asset position equals the current account. In reality, however, the change in a country's net foreign asset position need not equal its current account. The reason is that the current account does not track unrealized capital gains arising from local-currency asset price and currency movements. To be more precise, define NA_{t+1} as a country's net foreign asset position at the

1. See Nason and Rogers (2006) for a recent assessment.

end of period t. The change in the net foreign asset position from one period to the next is given by the following accumulation equation:

$$NA_{t+1} = R_t NA_t + NX_t, \tag{2}$$

where NX_t represents the balance on goods, services, and net transfers, and R_t represents the gross portfolio return on the net foreign portfolio between the end of period $t - 1$ and the end of period t.[2] Adding and subtracting the net investment income balance, NI_t, yields

$$\begin{aligned} NA_{t+1} - NA_t &= (R_t - 1)NA_t - NI_t + NX_t + NI_t \\ &= \left[(R_t - 1)NA_t - NI_t\right] + CA_t \\ &\equiv VA_t + CA_t \end{aligned} \tag{3}$$

where the second line uses the following definition of the current account: $CA_t = NX_t + NI_t$. The change in the net foreign position equals the current account, CA_t, plus a valuation adjustment, VA_t. This valuation adjustment (the term in brackets on the right-hand side of the second equation) equals the capital gain on the net foreign asset portfolio: the total net return minus income, dividends, and earnings distributed.[3] In many countries, this valuation component has greatly expanded in the last two decade, following the sharp surge in cross-border holdings of financial securities.

This paper reviews the evidence on the empirical relevance of this valuation component. Section 1 surveys the existing literature on patterns of cross-border asset holdings, in particular the pattern that emerges from the seminal empirical work of Philip Lane and Gian-Maria Milesi-Ferretti. It discusses the evolution over time and across countries of net and gross foreign asset positions since 1970 for industrial countries and emerging markets. It then assesses the evidence on the importance of valuation effects, relative to the

2. To be complete, the accumulation equation should also include the capital account, KA_t, and errors and omissions, EO_t. I abstract from these components in this discussion and bring them back in when necessary. Capital account transactions are typically small in many countries, especially industrialized countries. Errors and omissions are also excluded from the financial account in the U.S. Bureau of Economic Analysis estimates of the U.S. international investment position. Similarly, errors and omissions are reported separately in Lane and Milesi-Ferretti (2006).

3. Technically, the net investment income balance also includes reinvested direct investment earnings. See Gourinchas and Rey (2007a) for a discussion of how to treat this component.

current account, both for a large sample of countries and, more specifically, for Australia, Canada, the United Kingdom, and the United States, based on more detailed evidence from Gourinchas, Lopez, and Rey (2006).

Section 2 focuses on the United States, summarizing the empirical evidence on the role of valuation effects for the external adjustment presented in Gourinchas and Rey (2007b, 2007a). This section introduces the important conceptual distinction between expected and unexpected valuation effects. It argues that while valuation effects seem to be important, expected valuation effects may remain small for most countries other than the United States. Section 3 turns to a discussion of the theory, with a review of some of the recent international portfolio models that give rise to unexpected and expected valuation effects. I essentially classify the literature into two strands: the complete markets setup, in which valuation effects are mostly unexpected and valuation terms reflect mostly the transfer payments associated with perfect risk sharing; and portfolio balance models (and their modern incarnation), in which predictable valuation terms play an important role. The final section then concludes.

1. Patterns of Net Foreign Assets

None of the research presented in this paper would have been possible without the huge international effort in data collection of the last fifteen years. While data on balance of payments are generally available, for the reasons discussed above, they typically don't provide accurate estimates of a country's net foreign asset position. Starting in the 1980s, a number of national statistical agencies started to collect the information necessary to build estimates of net and gross external assets and liabilities at market value. For instance, the U.S. Bureau of Economic Analysis has provided annual data on the U.S. net international investment position at market value since 1991, with data going back to 1982 (see Landefeld and Lawson, 1991). Unfortunately, data for most countries remained fragmentary until quite recently.

The first important breakthrough came from the data collection efforts initiated by the International Monetary Fund (IMF). While the fourth edition of the IMF's *Balance of Payments Manual* (BPM4), published in 1977, introduced the concept of international investment position, it did not present a systematic framework for measuring its components. By contrast, the fifth edition of the manual (BPM5), published in 1993, provides a set of comprehensive guidelines. In subsequent years, the IMF started to report member countries' international investment positions (IIP). The initial coverage was limited (twenty-five countries in 1995), but it expanded rapidly through the Fund's outreach efforts. By 2002, the Fund collected partial or complete information on eighty countries, with annual data going back to 1980, at best.

The second breakthrough occurred with the work of Philip Lane at Dublin's Trinity College and Gian-Maria Milesi-Ferretti at the International Monetary Fund. Their database on the external wealth of nations, which was first published in 1991 (Lane and Milesi-Ferretti, 2001), provided scholars with a set of very useful annual estimates of net and gross international investment positions for a sample of sixty-seven industrial and developing countries. Their database covered the period 1970–98, thus adding at least ten years of data to the IMF's IIP database (and often much more than that, since many countries in the IMF database had only partial coverage). To construct net investment position at market value, Lane and Milesi-Ferretti devised ways to estimate the valuation component, VA_t, from balance-of-payments (flows) data, auxiliary data sources on world equity returns and exchange rates, and data on external debt from the World Bank, the OECD, and the BIS.[4] A major update to the data set, released in 2006 (Lane and Milesi-Ferretti, 2006), extends the sample to 140 countries with data through 2004.[5]

Next, I review the evidence on net and gross foreign asset positions that emerges from this data set. I then focus more specifically on the importance of valuation effects in a few industrial countries for which more detailed data are available.

1.1 Pattern of Net Foreign Assets from the External Wealth of Nations

What does the External Wealth of Nations data set reveal about international investment positions? The first well-known fact is

4. Given the lack of data, Lane and Milesi-Ferretti (2001) estimate foreign direct investment at book value, that is, correcting for currency fluctuations and assuming that the pattern of holdings of direct investment assets mimics the trade pattern.

5. The Mark II dataset differs from the original database along three main dimensions: errors and omissions are now reported separately; portfolio data uses data from the IMF's Coordinated Portfolio Investment Survey, when available; and direct investment is reported at market value when available.

the dramatic increase in financial integration since 1970. Figure 1 reports a commonly used measure of financial integration, the sum of gross assets and gross liabilities normalized by output, for a sample of industrial countries and a sample of emerging markets.[6] For the sample of industrial countries, the index of financial integration increased from 45 percent of output to 302 percent. For the emerging sample, the index increased from 15 percent to 120 percent. The log-scale of the graph reveals that the index of financial integration has increased at roughly the same pace for both industrial and emerging countries, about 6 percent per year. Figure 2 breaks down the series into gross assets and gross liabilities by group. The figure reveals a close match between gross assets and liabilities for industrial countries: each series grew at roughly 5.5 percent a year, from 20 percent of output in 1970 to 150 percent in 2004. Closer inspection uncovers a modest build-up in imbalances, with net foreign assets decreasing from 3.4 percent of output to –6.5 percent. By contrast, the sample of emerging countries displays a closing of imbalances. These countries are net borrowers throughout the period. However, the ratio of gross assets to output increases from 3.4 percent to 54 percent of output (a growth rate of 8 percent per year), while the ratio of gross liabilities increases from 12 percent to 66 percent (a growth rate of "only" 5 percent per year).[7] Thus, despite greater access to international financial markets, there is no evidence that emerging markets could increase their collective net borrowing. This closing of net imbalances for emerging countries is the focus of much recent literature.[8]

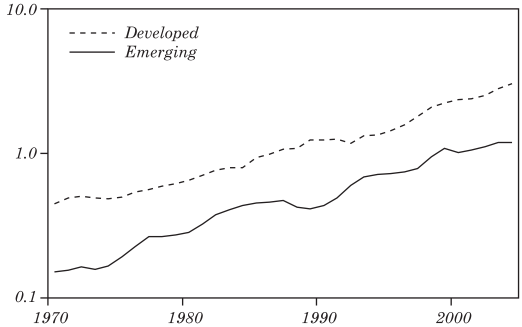
While financial integration seems to have proceeded at a fairly constant rate, individual country experiences have grown more disparate. Figure 3 reports the cross-country dispersion in gross positions, as measured by the standard deviation of our financial integration index. The industrial countries in the sample record a dramatic increase in this measure after 1995, from roughly 118 percent of output to 393 percent. This is driven in part by the spectacular explosion in cross-border asset holdings of countries like Ireland (1,880

6. See the appendix for a list of countries in each sample.

7. The fact that gross assets grew much faster than gross liabilities is consistent with an increase in net foreign liabilities (from 8 to 12 percent of output) for the emerging markets sample. The point is that net foreign liabilities increased much less than they would have if both gross assets and gross liabilities had been growing at the same rate.

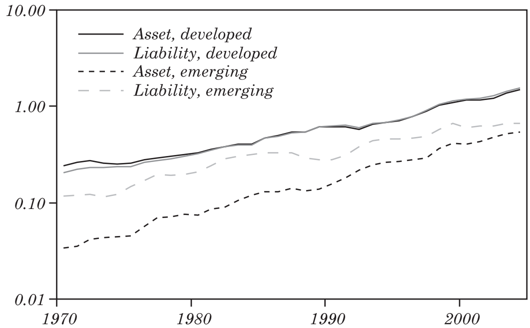
8. See Reinhart, Rogoff, and Savastano (2003), for a discussion of debt intolerance; see also Gourinchas and Jeanne (2007) for a discussion of the allocation puzzle.

Figure 1. International Financial Integration: (A + L) / Y (log scale)



Source: Author's calculations.

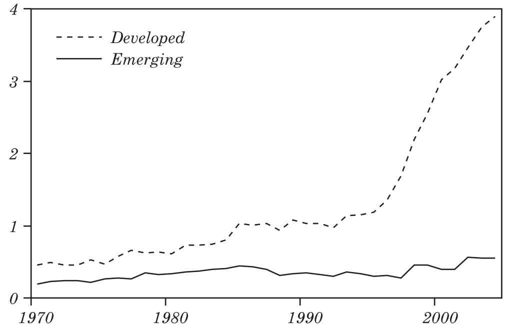
Figure 2. Gross Positions: A/Y, L/Y (log scale)



Source: Author's calculations.

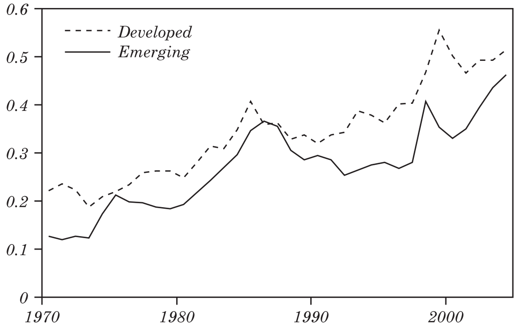
percent of GDP in 2004), Switzerland (1,010 percent), and Belgium (819 percent). By contrast, the pattern of cross-country dispersion for emerging countries remains quite stable, at around 40 percent. On the other hand, figure 4 reveals a growing pattern of cross-country net external imbalances for both emerging and industrial countries. The cross-country dispersion increased from 22 percent in 1970 to 51 percent in 2004 for industrial countries and from 12 percent to 46 percent for emerging economies.

Figure 3. Cross-Country Dispersion in Gross Positions: σ[(A + L) / Y]



Source: Author's calculations.

Figure 4. Cross-Country Dispersion in Net Positions: σ[(A − L) / Y]



Source: Author's calculations.

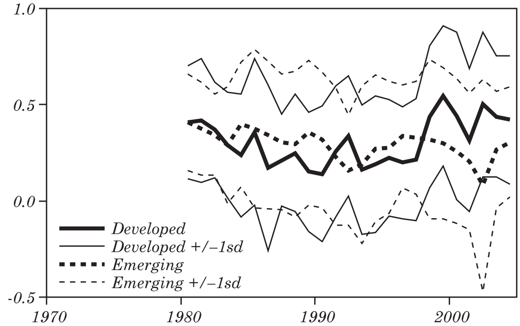
The next four figures characterize the change in the time-series process of gross assets and liabilities. I estimate the following process:

$$\ln a_{i,t+1} = \overline{\rho}^{a}_{i,t} \ln a_{i,t} + \overline{\delta}^{a}_{it} t + \varepsilon^{a}_{i,t+1} \tag{4}$$

$$\ln l_{i,t+1} = \overline{\rho}^{l}_{i,t} \ln l_{i,t} + \overline{\delta}^{l}_{it} t + \varepsilon^{l}_{i,t+1}$$

where $a_{i,t} = A_{i,t}/Y_{i,t}$ is the ratio of gross external assets to output and $l_{i,t} = L_{i,t}/Y_{i,t}$ is the corresponding ratio of gross external liabilities to output. This specification allows for a first-order autoregressive, or AR(1), component and also for a deterministic time trend that captures the gradual process of financial globalization. The AR coefficient, $\overline{\rho}_{i,t}$, and the trend coefficient, $\overline{\delta}_{i,t}$, are estimated by rolling regressions, with a ten-year window.[9] Figures 5 and 6 report the average serial correlation of gross asset and gross liabilities, while figures 7 and 8 report the average volatilities $\sigma_{\varepsilon,t}$. In figures 5 and 6 each data point represents the cross-country average of $\rho_{i,t}$ for a rolling regression over the previous ten years (so the value in 1980 represents the coefficient estimated over 1970–80). Figures 5 and 6 also report the two-standard-deviation bands around the point estimates. The serial correlation of gross positions does not seem to have changed significantly over that period: it remains close to 0.5 and takes similar values for gross assets and gross liabilities. By contrast, the time-series volatility of log gross asset and liability positions (expressed as a percent of output) has increased significantly throughout the period, from about 3 percent to 13 percent of output for industrial countries' gross assets and gross liabilities, from 3 percent to 6 percent for emerging countries' gross assets, and from 5 percent to 9 percent for emerging countries' gross liabilities. This means that over the last ten years, a one-standard-deviation innovation to gross assets or gross liabilities represents between 12 and 14 percent of output for industrial countries and between 6 and 9 percent of output for emerging countries!

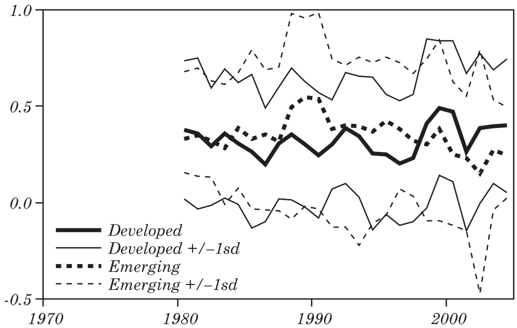
Figure 5. Serial Correlation of Gross Asset Positions[a]



Source: Author's calculations.
a. Ten-year rolling regressions; gross asset position measured as ln $a_{i,t}$.

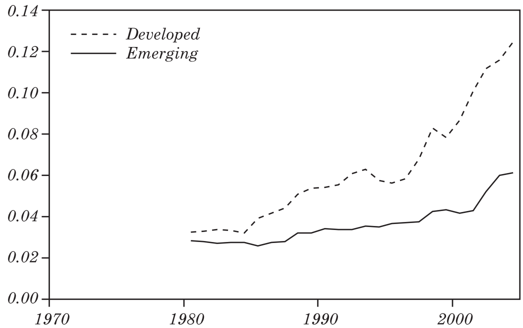
9. It is rather hazardous to estimate an AR process with only ten observations. This is meant only as an illustration of the change in the empirical process for gross assets and liabilities.

Figure 6. Serial Correlation of Gross Liability Positions[a]



Source: Author's calculations.
a. Ten-year rolling regressions; gross liability position measured as ln $l_{i,t}$.

Figure 7. Volatility of Gross Asset Positions[a]



Source: Author's calculations.
a. Ten-year rolling regressions; gross asset position measured in logs, and gross asset positions is expressed as

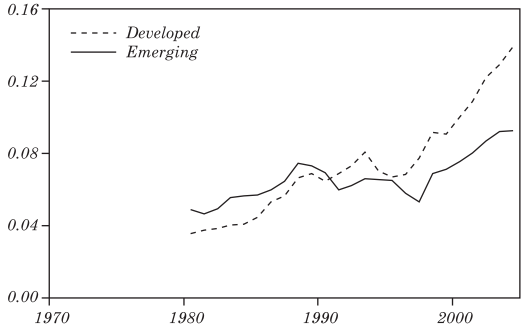
This increase in the time-series volatility of gross foreign assets reflects the growing importance of valuation effects. This can be illustrated most dramatically by looking at a slightly different process:

$$\Delta na_{i,t+1} = \overline{\rho}^{n}_{i,t} \Delta na_{i,t} + \varepsilon^{n}_{i,t+1} \tag{5}$$

$$ca_{i,t+1} = \overline{\rho}^{c}_{i,t}\, ca_{i,t} + \varepsilon^{c}_{i,t+1}$$

where $na_{i,t}$ denotes the ratio of net foreign assets to GDP, $ca_{i,t}$ the ratio of the current account to GDP, and Δ the difference operator. Figures 9 and 10 report the standard deviation of the innovations as

Figure 8. Volatility of Gross Liability Positions[a]
Percent of GDP



Source: Author's calculations.
a. Ten-year rolling regressions; gross liability position measured in logs, and gross liability positions is expressed as percent of GDP.

a fraction of GDP. Most of the increase in the time-series volatility of the change in net foreign assets can be attributed to the valuation component.[10] For industrial countries, innovations to the current account increased from 0.5 percent of output to 2.5 percent. Over the same period, innovations to the change in net foreign assets increased from 1.5 percent of output to 21.6 percent. Innovations to the change in net foreign asset positions were thus up to ten times larger than innovations to the current account between 1994 and 2004 (the last data point). For emerging countries, the volatility of innovations to the current account remained remarkably stable at around 2 percent, whereas innovations to the change in net foreign asset increased from 2 percent to about 6.4 percent.

1.2 Deconstructing the Valuation Component: Currency and Asset Price Movements

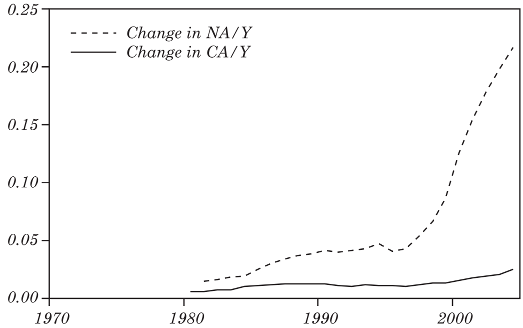
The net foreign asset portfolio is a leveraged portfolio: it is short in domestic assets (the gross liabilities) and long in foreign assets (the gross assets). For instance, the U.S. net foreign asset portfolio is short in, for example, U.S. equities, U.S. bonds, bank deposits held by

10. The decomposition is not exact since

$$na_{t+1} - na_t = ca_t + \left[va_t . Y_t / Y_{t+1} + (Y_t / Y_{t+1} - 1)(na_t + ca_t)\right],$$

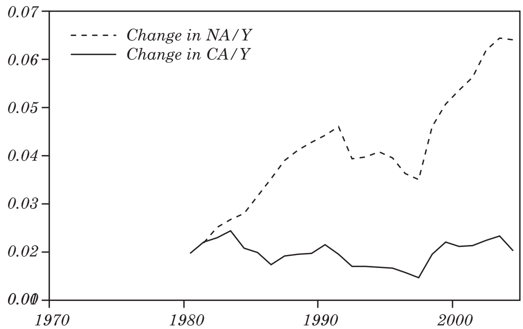
so the difference between the two curves also reflects the second term inside the brackets. This term is often negligible, however, since annual growth rates remain quite small.

Figure 9. Volatility of the Innovations to the Change in Net Foreign Assets and the Current Account: Industrial Countries[a]
Percent of GDP



Source: Author's calculations.
a. Ten-year rolling regressions; net foreign assets and the current account are measured as percent of GDP.

Figure 10. Volatility of the Innovations to the Change In Net Foreign Assets and the Current Account: Emerging Markets[a]
Percent of GDP



Source: Author's calculations.
a. Ten-year rolling regressions; net foreign assets and current account are measured as percent of GDP.

foreigners, and direct investment in the United States. It is long in, for example, Japanese equity, direct investment in Ireland and China, bank deposits in Switzerland, German government bonds, and U.K. guilds. The real total gross return on that portfolio, R_{t+1}, is defined as a weighted average of the return on gross assets and gross liabilities:

$$R_{t+1} = \mu_t^a R_{t+1}^a - \mu_t^l R_{t+1}^l, \tag{6}$$

where R^a_{t+1} and R^l_{t+1} denote the total real return on gross assets and gross liabilities, respectively, μ^a_t and μ^l_t the portfolio weights A_t/NA_t and L_t/NA_t, respectively, and $\mu^a_t - \mu^l_t = 1$.[11] As with any leveraged portfolio, the weights μ^a and μ^l can be significantly larger then one, so even relatively small changes in asset prices can have a disproportionate effect on the overall net foreign asset position. To fix ideas, consider the case of the Chile. According to the Lane and Milesi-Ferretti data set, as of 2004, gross assets represented 81 percent of GDP, while gross liabilities represented 118 percent of GDP. The weights μ^a and μ^l thus equal –2.19 and –3.19 percent.[12] Hence, a ten-percent excess return on gross foreign assets translates into a 22 percent improvement in the net position, or about 8 percent of GDP![13]

Beyond the impact of asset movements, Tille (2003) and Gourinchas and Rey (2007b) emphasize the role of currency movements. To illustrate how this might matter, I approximate the compounded return on the net foreign portfolio as follows:

$$\begin{aligned} r_{t+1} \equiv \ln R_{t+1} \quad &\approx \quad \mu^a_t r^a_{t+1} - \mu^l_t r^l_{t+1} \\ &= \mu^a_t\,(\omega^{ah}_t r^{ah}_{t+1} + \omega^{af}_t r^{af}_{t+1}) - \mu^l_t\,(\omega^{lh}_t r^{lh}_{t+1} + \omega^{lf}_t r^{lf}_{t+1}) \\ &= (\mu^a_t \omega^{ah}_t r^{ah}_{t+1} - \mu^l_t \omega^{lh}_t r^{lh}_{t+1}) + (\mu^a_t \omega^{af}_t r^{af}_{t+1} - \mu^l_t \omega^{lf}_t r^{lf}_{t+1}) \end{aligned} \tag{7}$$

where ω^{ih} and ω^{if} represent the share of asset i denominated in home and foreign currency, respectively, and $r^i_{t+1} = \ln R^i_{t+1}$. The last line rearranges the portfolio terms according to the currency of denomination of the various returns. The first term in brackets on the right-hand side represents the contribution of domestic-currency-denominated assets, while the second term in brackets represents the contribution of foreign-currency-denominated assets.

To make further progress, the real return on foreign-currency-denominated asset can be written as $r^{if}_{t+1} = \tilde{r}^{if}_{t+1} + \Delta\lambda_{t+1}$, where $\tilde{r}^{if}_{t+1}$ is a real return expressed in terms of the relevant foreign basket of goods, and $\Delta\lambda_{t+1}$ is the rate of depreciation of the real exchange rate between t and $t + 1$, equal to $\Delta e_{t+1} + \pi^f_{t+1} - \pi^h_{t+1}$, where π^i_{t+1}

11. These weights are well defined as long as the net foreign position is different from zero. Even in that case, the total real return, $R_{t+1}NA_t$, is well defined.

12. To see this, note that $\mu^a = 81/(81 - 118) \approx -2.19$.

13. The appendix reports the values of A/Y, L/Y and μ^a in 2004 for each country in the sample.

represents the inflation rate in country i. Substituting into the above expression yields:

$$\begin{aligned} r_{t+1} = {} & (\mu_t^a \omega_t^{ah} r_{t+1}^{ah} - \mu_t^l \omega_t^{lh} r_{t+1}^{lh}) + (\mu_t^a \omega_t^{af} \tilde{r}_{t+1}^{af} - \mu_t^l \omega_t^{lf} \tilde{r}_{t+1}^{lf}) \\ & + (\mu_t^a \omega_t^{af} - \mu_t^l \omega_t^{lf})(\Delta e_{t+1} + \pi_{t+1}^f - \pi_{t+1}^h). \end{aligned} \tag{8}$$

The first two terms in brackets on the right-hand side represent the contribution of local real asset returns. The last term in brackets provides a measure of currency exposure of the net foreign asset position: holding everything else constant, the coefficient $\left[\mu_t^a \omega_t^{af} - \mu_t^l \omega_t^{lf}\right]$ measures the impact of a depreciation of the real exchange rate on the net foreign asset position of a country. It highlights that a measure of currency exposure must include the currency weights in addition to the portfolio weights. Unfortunately, this information is currently available only for a small number of countries. The next frontier in terms of data collection will be to compile information on the geographic and currency composition of gross external asset holdings, along the lines of the IMF's Coordinated Portfolio Survey.

In the meantime, detailed data are available for a few countries, like the United States, thanks to the work of Tille (2003, 2005) and Gourinchas and Rey (2007a). Table 1 reports Tille's (2005) currency decomposition for the United States in 2004. At the end of 2004, the overall net foreign position represented –21.7 percent of GDP (85

Table 1. Currency Composition of U.S. External Positions, 2004
Billions of U.S. dollars

Currency	*Assets*	*Liabilities*	*Net (A–L)*	*Percent GDP*
Total	9,973	12,515	–2,542	–21.7
U.S. dollar	3,476	11,869	–8,393	–71.5
Foreign currencies	6,497	646	5,851	49.9
Euro	1,784	296	1,488	12.7
U.K. pound	1,039	71	968	8.3
Canadian dollar	557	1	556	4.7
Japanese yen	506	61	445	3.8
Swiss franc	304	18	286	2.4
Other	2,307	199	2,108	18

Source: Tille (2005).

percent in gross assets and 107 percent in gross liabilities), with dollar weights of 35 percent on gross assets (ω^{ah} = 3.48/9.97) and 95 percent on gross liabilities (ω^{lh} = 11.869/12.515). This asymmetry implies that the United States holds a short position in U.S. dollars (to the tune of 71.5 percent of GDP) and a long position in foreign currency (roughly 50 percent of GDP). In terms of net foreign asset returns, the United States has a foreign currency exposure of –2.37 (obtained as [0.85*0.65–1.07*0.05]/0.21).

It is instructive to inspect equation (8) for different configurations of the currency denomination of assets and liabilities. If all assets are denominated in foreign currency while all liabilities are local, the exposure coefficient is maximized and equal to μ_t^a. The above calculations indicate that even for a country like the United States this is a substantial overestimate of the true currency exposure ($\mu^a = -3.92$). A fortiori, consider the situation of an emerging country with foreign-currency-denominated assets and, more importantly, foreign-currency-denominated liabilities (or dollarized liabilities), that is, a country with $\omega_t^{af} = \omega_t^{al} = 1$. In that case, $\mu_t^a \omega_t^{af} - \mu_t^l \omega_t^{lf} = \mu_t^a - \mu_t^l = 1$, so the currency exposure is limited to the size of the net foreign asset position. Since net foreign asset positions are typically much smaller than gross positions, valuation terms must remain comparatively smaller for emerging countries. On the other hand, valuation effects are also likely to be more destabilizing for borrowing emerging countries ($\mu^a < 0$), because a depreciation of the domestic currency increases the local currency burden of a given net liability.

One incorrect interpretation of these exposure numbers nevertheless captures an important element of the discussion. Specifically, with an exposure of –2.37, a 10 percent depreciation of the dollar would—holding everything else constant—create a positive wealth transfer for the United States of about 5 percent of GDP (–2.37*–0.217*0.1). Given a GDP of about 11.73 trillion U.S. dollars in 2004, this represents the nonnegligible sum of $585 billion! Such a wealth transfer would be of the same order of magnitude as the trade deficit for that year (5.2 percent of GDP, according to the U.S. Bureau of Economic Analysis).

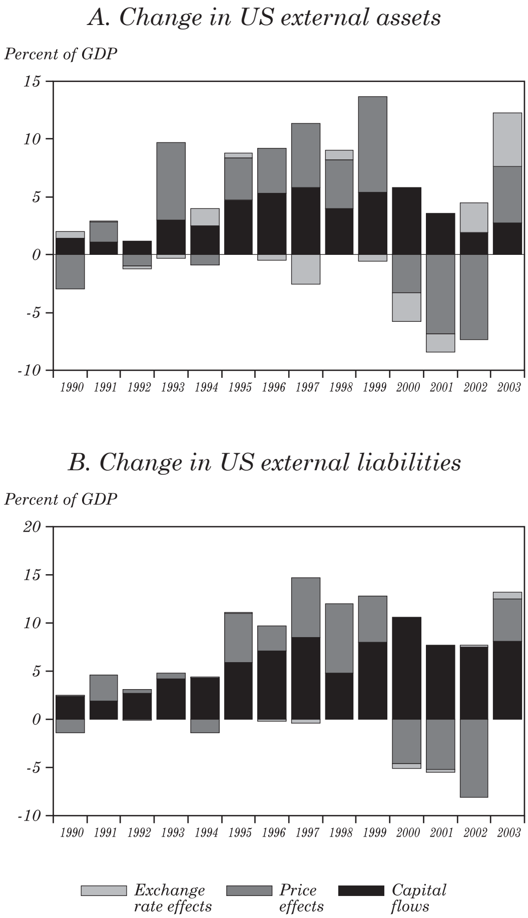
This interpretation is incorrect precisely because everything else is not constant. If a currency depreciation is expected to deliver substantial wealth transfers to the United States, then foreigners will require some compensation in the form of higher expected local returns on dollar-denominated assets or lower expected local returns on foreign-currency-denominated assets. In fact, ex ante local real returns should be expected to move in such a way as to neutralize the expected rate of depreciation. This arbitrage logic is precisely what stands behind the usual interest rate parity condition. Important valuation effects may still arise because the exchange rate differs from its expectation: with substantial leverage, expectation errors will translate into significant valuation effects, but these will not lead to predictable fluctuations in net foreign asset positions and thus cannot contribute to the external adjustment process. Predictable valuation effects that contribute systematically to the adjustment process require significant violations from the usual parity conditions. The evidence discussed so far does not attempt to distinguish between predictable and unpredictable valuation effects, yet the above discussion indicates that this is an essential element of the analysis. I return to this question in more details in section 2, where I survey results for the United States.

1.3 Naive Net Foreign Assets versus Valuation Term

Tille (2003) for the United States and Lane and Milesi-Ferretti (2004) for Australia propose a decomposition of the change in net foreign assets into what they call a flows component (the opposite of the financial account) and price and exchange rate components that sum to the valuation term since 1990.[14] I reproduce their findings in figure 11 for the United States and figure 12 for Australia. As expected, the U.S. exchange rate component is much larger for gross assets than for gross liabilities, reflecting the asymmetry in currency composition discussed above. What is striking is the importance of the capital gains on portfolio and direct investment positions (the price effect). For the United States, the price effect easily dwarfs the exchange rate effect in most years, while for Australia, the two components are similar in size. The price effects on gross assets and gross liabilities are of similar and offsetting size in the United States, whereas the exchange rate effects are of similar and offsetting size in Australia. These two figures clearly illustrate that a full account of the external adjustment process must involve a discussion of the joint determination of trade flows, asset returns, portfolios, and currency values.

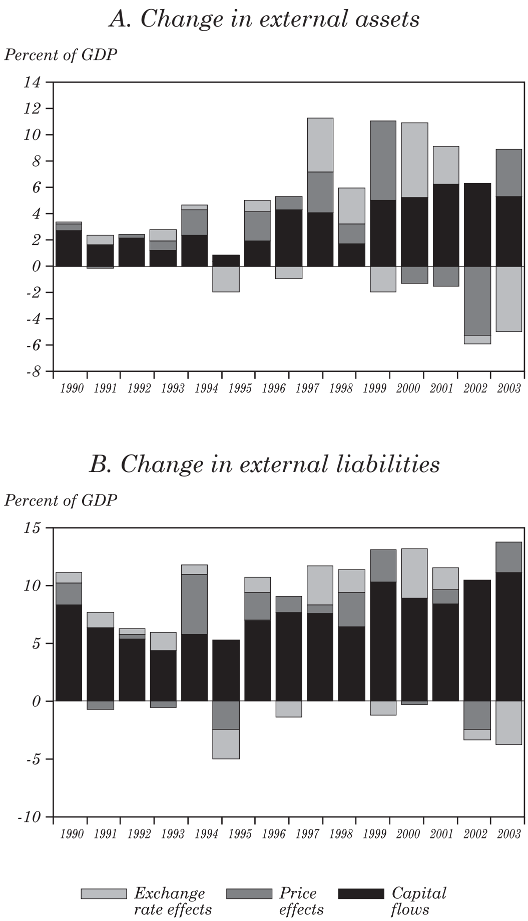
14. The U.S. Bureau of Economic Analysis has published that information for the United States since 2005. It is available at www.bea.gov/international/xls/intinv05_t3.xls.

Figure 11. Change in NA: United States



Source: Tille (2003) and Lane and Milesi-Ferreti (2004).

Figure 12. Change in NA: Australia



Source: Lane and Milesi-Ferreti (2004).

Using equation (3), one can write the change in net foreign assets relative to GDP between year 0 and year t as follows:

$$
\begin{aligned}
na_t - na_0 &= \sum_{s=0}^{t-1}(ca_s - g_{s+1}na_{s+1}) + \sum_{s=0}^{t-1}\left[(R_s - 1)na_s - ni_s\right] \\
&\equiv \sum cay_t + vay_t
\end{aligned}
\tag{9}
$$

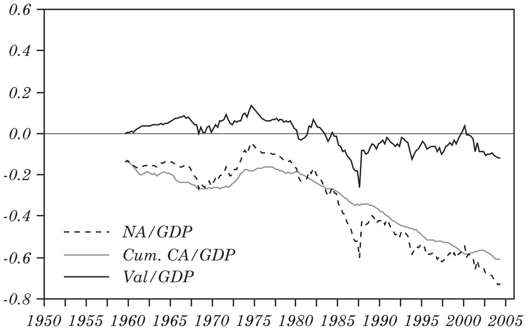
where g_t denotes the growth rate of output between periods $t-1$ and t and, as before, lower case variables represent ratios to GDP. The first sum on the right-hand side corresponds to a naive estimate of the net foreign asset position, one that omits the cumulative valuation effects captured by the second summation term. Gourinchas, Lopez, and Rey (2006) construct detailed estimates of the net foreign asset position for the United States and the United Kingdom. Figure 13 reports their estimate of *na* as well as its decomposition between current account and valuation components for both countries, together with more preliminary data for Canada and Australia. The figure highlights that there is a variety of patterns for the valuation adjustment. In the case of the United States, valuation effects have been positive and relative moderate since the early 1980s, with a sharp acceleration in recent years. As of 2004, they account for 20 percent of GDP. A similar pattern is evident in Canada, which displays increasingly large valuation effects that also reach 20 percent of GDP and that reflect the importance of direct investment assets. The valuation component in both countries is never large enough to offset the naive estimate, except in Canada since 2000.

The United Kingdom exhibits a very significant and growing positive valuation component, in the context of very large gross positions (in excess of 300 percent of GDP), reaching 50 percent of GDP in 2000. This valuation component is so large that it overturns the naive estimates since 1980. Between 1980 and 2000, the cumulated current account deficits fall from 0 to –20 percent of GDP, while the correct net foreign asset position rises from 0 to 20 percent of GDP. Since that time, the valuation component has been reduced by half, pushing the net foreign position into debt in 2002 for the first time since 1977.

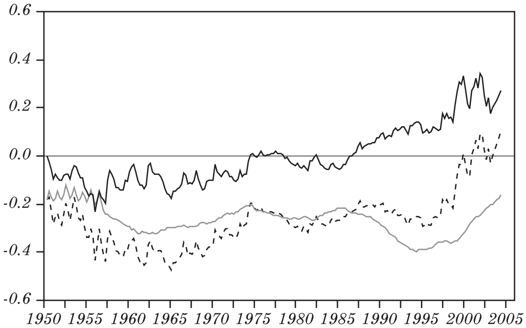
The case of Australia is also interesting. Here, valuation effects have been mostly small relative to cumulated current account deficits, but also negative, contributing to a worsening of the country's already substantial net foreign liability.

Figure 13. Valuation Component for Australia, Canada, the United Kingdom, and the United States

A. Australia



B. Canada



C. United Kingdom

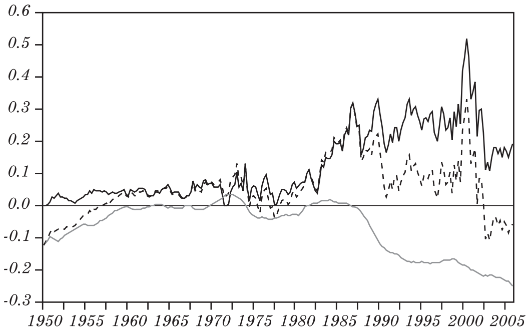
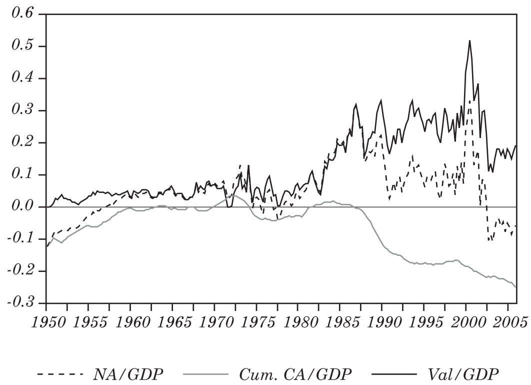


Figure 13. (continued)

D. United States



Source: Gourinchas, Lopez, and Rey (2006).

Emerging economies also exhibit a variety of patterns. Lane and Milesi-Ferretti (2004) provide a decomposition according to equation (9) for a number of emerging countries, between 1992 and 2001. Table 2 reproduces their findings. The importance of these valuation effects is difficult to miss. Consider the case of Indonesia or Thailand. While the naive accumulation of current accounts would point toward a significant improvement in the net foreign asset position (32.9 percent and 11.9 percent of GDP, respectively), the valuation effect more than offset this (–39.0 and –21.9 percent of GDP, respectively). This reflects the impact of these countries' devaluation on their dollarized liabilities. Nevertheless, not all emerging markets experienced negative valuation terms over the period (see the Czech Republic and Mexico).

Table 2. Cumulated Current Account and Valuation Terms
Percent of GDP

Country	Δnay_t	Σcay_t	vay_t
Brazil	–30.6	–17.5	–13.1
Czech Republic	–29.4	–40.0	10.5
Indonesia	–6.1	32.9	–39.0
Mexico	–8.8	–27.7	19.0
Thailand	–10.0	11.9	–21.9
Turkey	–21.3	2.6	–23.9

Source: Lane and Milesi-Ferretti (2004).

In sum, the valuation component of the international investment position is large, sometimes sufficiently so to overturn the naive estimate constructed from cumulated current accounts. This component is also volatile.

2. Predictable Valuation Effects: The Case of the United States

Gourinchas and Rey (2007a) construct detailed estimates of the United States' gross foreign assets and liabilities, disaggregated into four asset classes: direct investment, equities, debt, and other, where the latter category contains mostly official reserves, bank loans, and trade credit. The estimates are compiled from data from the U.S. Bureau of Economic Analysis on the U.S. international investment position, the Federal Reserve's flow-of-funds data, and various surveys on the geographic and currency composition of portfolio and direct investment assets and liabilities.[15] The data are also supplemented with data on equity returns, bond yields, and exchange rates, obtained from the IMF's *International Financial Statistics* and the Global Financial Database. The resulting data allow me to address two important and related questions regarding, first, the composition of gross assets and liabilities and, second, the rates of returns on gross assets, r^a, and gross liabilities, r^l.

Table 3 reports estimates of the share of gross assets and gross liabilities in the different asset classes, relative to GDP, for every decade between 1952 and 2004. Two evolutions are striking. First, the U.S. gross asset position has shifted increasingly toward high-yield risky assets, while its gross liabilities remain dominated by safer lower-yield assets. While equity and direct investment assets represented only 8.75 percent of gross assets in the 1950s [(1.06+0.66)/19.6], the share reached 59.40 percent in 2000 [(26.56+16.04)/71.72]. By contrast, the share of liquid liabilities in total gross liabilities declined from 76.265 [(4.59+0.71)/6.95] to 54.5 percent [(25.07+26.47)/94.6], but it was always in excess of 50 percent. Second, in the 1950s, the U.S. net creditor position was concentrated in other assets (12.61 percent of GDP), while net positions in equities, direct investment,

15. See Gourinchas and Rey (2007a) for a detailed discussion of the data construction. See Hooker and Wilson (1989) for a reconciliation of the flow-of-funds accounts and the international transactions accounts from the U.S. Bureau of Economic Analysis.

and debt assets were mostly balanced (columns 9–12).[16] By 2000, the composition of the net asset position shifted significantly: the U.S. net debtor position is now concentrated in debt instruments (–21.57 percent of GDP). Interestingly, the net position in equity and direct investment remains almost exactly balanced, in part as a result of the decline in equity prices after 2001. Following Despres, Kindleberger, and Salant (1966), Gourinchas and Rey (2007a) argue that the United States is essentially a provider of global liquidity, issuing liquid liabilities and investing in high-yield, high-return assets.[17]

Turning to the second question, Gourinchas and Rey (2007a) decompose the overall excess return on gross assets relative to gross liabilities as follows:

$$\begin{aligned} E(r^a - r^l) &= E\left[\bar{\mu}^o (r^{ao} - r^{lo})\right] + E\left[\bar{\mu}^d (r^{ad} - r^{ld})\right] \\ &\quad + E\left[\bar{\mu}^e (r^{ae} - r^{le})\right] + E\left[\bar{\mu}^f (r^{af} - r^{lf})\right] \\ &\quad + E\left[(\mu^{ad} - \mu^{ld})(\bar{r}^d - \bar{r}^o)\right] + E\left[(\mu^{ae} - \mu^{le})(\bar{r}^e - \bar{r}^o)\right] \\ &\quad + E\left[(\mu^{af} - \mu^{lf})(\bar{r}^f - \bar{r}^o)\right] \end{aligned} \tag{10}$$

where $E[.]$ denotes the expectation operator, μ^{ji} is the share of asset class i ($i \in \{o, d, e, f\}$) in gross assets (j = a) or gross liabilities (j = l), r^{ji} is the corresponding asset return, $\bar{\mu}^i = (\mu^{ai} + \mu^{li})/2$ is the average portfolio share for asset class i, and $\bar{r}^i = (r^{ai} + r^{li})/2$ is the average return on asset class i. The terms on the first line represent the return effect. They denote the average excess return on external assets relative to liabilities within each class of assets. This return effect is zero if the return is the same within each asset class ($r^{ai} = r^{li}$). The terms on the second line represent the composition effect. They quantify the difference in weights between assets and liabilities for equity, foreign direct investment (FDI), and debt. This composition effect is zero if U.S. external assets have the same composition as U.S. external liabilities ($\mu^{ai} = \mu^{li}$). Table 4 shows that the total real return on U.S. assets vastly exceeds the return on its liabilities (by 2.11 percent). Moreover, this excess return mainly reflects a return

16. Gold reserves represented a significant fraction of other gross asset holdings, at 5.24 percent of GDP in the 1950s.

17. See Caballero, Farhi, and Gourinchas (2007) for an analysis of global imbalances that emphasizes this role for the United States.

Table 3. The Composition of Gross Assets and Gross Liabilities
Percent of GDP

	Gross assets				*Gross liabilities*				*Net*			
	Other	*Debt*	*Equity*	*FDI*	*Other*	*Debt*	*Equity*	*FDI*	*Other*	*Debt*	*Equity*	*FDI*
Period	*(1)*	*(2)*	*(3)*	*(4)*	*(5)*	*(6)*	*(7)*	*(8)*	*(9)*	*(10)*	*(11)*	*(12)*
1950	17.20	0.69	0.66	1.06	4.59	0.71	1.36	0.29	12.61	−0.02	−0.70	0.77
1960	11.96	1.20	0.75	4.49	4.17	1.57	1.86	0.91	7.78	−0.36	−1.11	3.58
1970	9.54	1.49	0.61	7.72	4.94	4.74	2.02	1.81	4.60	−3.25	−1.41	5.91
1980	18.87	1.69	1.22	10.84	11.62	7.36	3.23	5.88	7.25	−5.67	−2.01	4.96
1990	19.21	4.53	9.58	20.17	18.21	16.31	7.78	17.10	1.00	−11.78	1.80	3.06
2000	24.21	4.91	16.04	26.56	25.07	26.47	14.47	28.59	−0.86	−21.57	1.57	−2.03

Source: Gourinchas and Rey (2007a).

effect, especially on debt and other assets (1.97 percent over the entire sample, and as high as 4.28 percent in the 1970s).

Table 4 illustrates an important finding: returns measured in common units are not equated. In other words, the arbitrage argument that I evoked above as putting some limits on the role of valuation effects does not appear to be strongly operating. Clearly, U.S. gross assets and gross liabilities are not close substitutes: even within classes, asset returns can be vastly different. Several factors could account for such large average excess returns. First, the asset classes considered are quite broad, so the return effect may, in fact, capture an equity-like premium. For instance, according to the United States was borrowing short and lending long in the Bretton Wood era (Despres, Kindleberger, and Salant, 1966), so the difference in maturities within the debt and loans category could account for the difference in returns. Another hypothesis emphasizes the role of the U.S. dollar as a reserve currency, or the greater liquidity and security of the U.S. financial markets. This would imply that foreigners are willing to hold underperforming dollar-denominated or dollar-area-based assets as long as these assets provide these liquidity services. The excess return obtained by the United States can then be interpreted as an intermediation rent that relaxes the external constraint of the United States. Various names have appeared in the literature for these intermediation rents: exorbitant privilege for some, dark matter for others.[18]

3. Valuation Effects: Some Elements of Theory

As I discussed earlier, valuation effects come in two flavors: unpredictable and predictable. The first variety does not create any particular difficulty for standard models of international finance: while analysts may argue over which model best characterizes international portfolio holdings, most models incorporate something similar to a parity condition in one form or another. Conceptually, perhaps the simplest way to understand unpredictable valuation terms is by reference to a complete market model. In such a setup, one could interpret valuation effects as the record-keeping of future payments on the contingent claims held by domestic and foreign investors, payments that implement full risk sharing. Interpreted in this light, the volatility generated by valuation adjustments could be interpreted

18. See Caballero, Farhi, and Gourinchas (2007); Gourinchas and Rey (2007a); and Hausmann and Sturzenegger (2006).

Table 4. Decomposition of U.S. Total Real Returns into Return and Composition Effects

	Return effect					*Composition effect*				*Total*
	Other	*Debt*	*Equity*	*FDI*	*Total*	*Debt*	*Equity*	*FDI*	*Total*	*ra – rl*
Period	*(1)*	*(2)*	*(3)*	*(4)*	*(1–4)*	*(5)*	*(6)*	*(7)*	*(5–7)*	*(1–7)*
1950	0.37	0.34	0.52	–0.07	1.16	–0.05	–2.14	0.13	–2.06	–0.90
1960	1.00	0.53	–0.04	0.24	1.73	–0.06	–0.64	0.62	–0.07	1.66
1970	2.36	0.16	0.47	1.29	4.28	0.71	–0.42	0.48	0.77	5.05
1980	0.49	0.55	0.79	–0.12	1.71	–0.11	–1.13	1.32	0.08	1.79
1990	0.70	1.24	0.06	–1.36	0.63	–0.16	0.83	1.04	1.71	2.33
2000	0.81	0.42	0.37	0.70	2.30	–0.46	–0.19	0.13	–0.53	1.77
Total	1.00	0.56	0.35	0.06	1.97	0.03	–0.59	0.70	0.14	2.11

Source: Gourinchas and Rey (2007a).

as good volatility insofar as it reduces the volatility of marginal utility of consumption and improves welfare.

By contrast, the predictable valuation effects that are relevant for the United States require large deviations from standard arbitrage conditions. Some limited progress has been made toward modeling predictable valuation effects with a revival of the portfolio balance literature associated with the work of Dale Henderson, Pentti Kouri, or the late Bill Branson.

3.1 Unpredictable Valuation Effect as Efficient Risk Sharing

One puzzling observation is that the increase in valuation effects documented in section 1 is not associated with an increased volatility in consumption. Surely, if wealth becomes more volatile because of valuation effects, then consumption should also become more volatile. There is little direct empirical evidence on this question, yet it seems fairly clear that consumption volatility has not changed much even though valuation effects have become increasingly prevalent.

One possible interpretation is that wealth is not becoming more volatile. This would be the case if, for instance, valuation effects reflect the flow payments associated with greater risk sharing. This hypothesis can be formally investigated with a simple complete market model. In such a model, the current account remains equal to zero after the initial period. Yet net foreign assets can change over time, purely from valuation effects. To see how this is possible, consider the symmetric pooling equilibrium of the Lucas (1982) model. A positive domestic endowment shock generates a dividend payment to foreigners (who are holding claims to half of the domestic tree). This income flow, duly recorded in the net investment income balance, exactly offsets the trade surplus of the home country (which consumes half of the world endowment), leaving the current account equal to zero.

The endowment shock may significantly change the value of the domestic tree relative to the foreign tree. Whether the value of the domestic tree goes up or down depends on the elasticity of intertemporal substitution and the elasticity of substitution between domestic and foreign goods. Under the reasonable assumption that the value of the domestic tree increases following a positive endowment shock, this generates a valuation loss for the domestic economy. This valuation loss exactly offsets the present value of future expected trade surpluses of the home country, evaluated at the equilibrium stochastic discount factor. Since the current account is equal to zero, trade deficits equal net investment income, and the net foreign asset portfolio also records the present value of future net income payments. Net foreign asset positions will thus change over time, but purely as a result of valuation adjustments. The extent of the predictability of asset returns depends on the time-varying risk premium that arises from undiversifiable aggregate risk. This class of models, however, does not typically generate economically significant fluctuations in the risk premium for realistic values of the coefficient of relative risk aversion.

Gourinchas and Rey (2006) explore these insights formally in an endowment model similar to Kollman (2005). The model is simple: it is a complete markets model with two countries and two goods, à la Lucas (1982), where agents have mirror-symmetric preferences for their home good. This consumption home bias implies deviations from purchasing power parity and equilibrium movements in the real exchange rate. In the model, the net foreign asset position represents the value of a tail asset that prices sequences of future trade surpluses using the equilibrium unique stochastic discount factor. It is also possible to characterize gross assets from the portfolio holdings of the Lucas trees that implement the complete market allocation. Gourinchas and Rey (2006) find that there are very small—and economically negligible—predictable valuation effects, no predictability of returns or exchange rates, and very significant unpredictable valuation terms, with net foreign asset positions that can represent many multiples of output.

Such models are not able to match the facts about the United States, but they may still provide an important benchmark for valuation terms and consumption volatility. Models based on improved risk sharing should all predict that the volatility of the relative marginal utility of consumption should decrease over time, as financial globalization and risk sharing increase. Whether this is the case remains an open empirical question.

3.2 Predictable Valuation Effects and Portfolio Balance Models

I now present a stylized and simplified portfolio balance model in which predictable valuation effects can arise in equilibrium. The model is a two-country version of Kouri (1982).[19] Time is continuous.

19. Blanchard, Giavazzi, and Sa (2005) analyze a similar model.

There are two symmetric countries. Each country can invest either in domestic outside assets (D) or in foreign assets (D^*). B represents the net foreign liabilities of the home country measured in domestic currency, $W = D - B$ domestic wealth, and $W^* = D^* + B/e$ foreign wealth. The nominal exchange rate, e, is defined as the domestic price of the foreign currency, while r and r^* denote the instantaneous net returns on domestic and foreign outside assets (each measured in local currency). Assume further that the domestic (respectively, foreign) country wants to invest a fraction α (respectively, α^*) of its wealth in its own asset. α and α^* are a function of the expected excess return on the domestic asset versus the foreign asset: $\mathrm{E}(r^* + \dot{e}/e - r)$ with $\alpha'(.) < 0$ and $\alpha^{*\prime}(.) > 0$.

I consider two possible scenarios. In the first scenario, countries borrow in their own currency and acquire external assets in the foreign currency. This situation is a good characterization for the United States. The second scenario considers a country that can only borrow in the foreign currency. This situation is closer to the experience of many developing and emerging countries who face the problem of original sin.

3.2.1 A stylized model of the U.S. external position: stabilizing and predictable valuation effects

Consider first the case in which the home country is a net debtor ($B > 0$) and gross liabilities (assets) are denominated in domestic (foreign) currency. Formally, B is defined as

$$B = \left(1 - \alpha^*\right) eW^* - \left(1 - \alpha\right) W > 0, \tag{11}$$

with $0 \leq \alpha, \alpha^* \leq 1$. I simplify the analysis further by assuming that domestic nominal interest rates, r and r^*, are constant and equal.

Equilibrium on the market for the domestic asset requires

$$D = \alpha\left[E\left(\frac{\dot{e}}{e}\right)\right]W + \left\{1 - \alpha^*\left[E\left(\frac{\dot{e}}{e}\right)\right]\right\}eW^*. \tag{12}$$

The first term on the right-hand side reflects the domestic demand for the domestic asset; the second term reflects foreign demand for the domestic asset. The second equilibrium condition is the balance-of-payments condition:

$$\dot{B} = r\left\{1-\alpha^*\left[E\left(\frac{\dot{e}}{e}\right)\right]\right\}eW^* - \left(r^* + \frac{\dot{e}}{e}\right)\left\{1-\alpha\left[E\left(\frac{\dot{e}}{e}\right)\right]\right\}W$$
$$-NX\left(e, W, W^*\right). \tag{13}$$

The first term on the right-hand side represents interest payments to foreigners; the second term represents interest payments received from foreigners; The third term is the trade balance, expressed as a function of the nominal exchange rate and domestic and foreign wealth., I assume that changes in wealth directly affect the trade balance. Specifically, I assume that a depreciation of the nominal exchange rate or an increase in foreign wealth improve the trade balance (NX_e, $NX_{w^*} \geq 0$), while an improvement in domestic wealth worsens the trade balance ($NX_w \leq 0$). Substituting the definition of net external debt isolates the role of valuation effects in equation (13), as follows:

$$\dot{B} = rB - NX\,(e, W, W^*) - \frac{\dot{e}}{e}\left\{1-\alpha\left[E\left(\frac{\dot{e}}{e}\right)\right]\right\}W.$$

The first two terms on the right-hand side sum to (the opposite of) the current account. The last term represents the valuation term. Since $r = r^*$, this valuation term arises purely from fluctuations in the value of the currency. When gross liabilities are denominated in domestic currency and gross assets are denominated in foreign currency, a depreciation of the exchange rate reduces the country's external debt proportionately to its gross foreign asset holdings,[20]

$$\left\{1-\alpha\left[E\left(\frac{\dot{e}}{e}\right)\right]\right\}W.$$

Taking D, D^*, r, and r^* as given, equations (12) and (13) form a dynamic system in B and e. Setting $\dot{e} = 0$ in equation (12) yields the first steady-state relationship, which I label the portfolio balance relation (following Blanchard, Giavazzi, and Sa, 2005):

20. The valuation term depends on the realized depreciation of the currency.

$$D\left(1-\alpha_0\right)=\left(1-\alpha_0-\alpha_0^*\right)\bar{B}+\left(1-\alpha_0^*\right)\bar{e}D^*, \tag{14}$$

where $\bar{e}$ and $\bar{B}$ denote the long-run equilibrium values of the currency and external debt, respectively, while $\alpha_0 = \alpha(0)$ and $\alpha^*_0 = \alpha^*(0)$ represent the steady-state portfolio shares. The slope of the relation between the exchange rate and external debt is

$$\frac{d\bar{e}}{d\bar{B}}=\frac{\alpha_0+\alpha_0^*-1}{\left(1-\alpha_0^*\right)D^*}. \tag{15}$$

This slope is positive when $\alpha_0 + \alpha^*_0 > 1$, that is, when there is portfolio home bias. When this condition is satisfied, the domestic demand for the domestic asset (α_0) exceeds the foreign demand for the domestic asset ($1 - \alpha^*_0$). This guarantees that an increase in external debt is associated with a depreciation of the nominal exchange rate. The increase in external debt makes the home country poorer and the foreign country richer. Under equity home bias, the decline in the domestic demand for the home asset exceeds the increase in the foreign demand for the home asset. Hence, there is excess supply of the domestic asset at the initial exchange rate. To restore equilibrium on the asset market, the exchange rate needs to depreciate, making foreigners richer (in domestic currency) and increasing their demand for the domestic asset.

Setting $\dot{B} = 0$ and $\dot{e} = 0$ in equation (13), I obtain the second steady-state condition, which I label the current account balance relation:

$$\begin{aligned} 0 &= r\bar{B}-NX\left(\bar{e},D-\bar{B},D^*+\bar{B}/\bar{e}\right) \\ &= \psi\left(\bar{e},\bar{B}\right) \end{aligned}$$

The model predicts that eventually, trade surpluses must be sufficient to cover interest payments on net foreign debt. The valuation term disappears in the steady state. Thus, while valuation effects influence adjustment dynamics, they do not replace the need for an ultimate adjustment in net exports via expenditure switching or reducing mechanisms. This point is developed in detail in Obstfeld and Rogoff (2004), and is consistent with the results of Gourinchas and Rey (2007b). The slope of the current account balance relation depends on the values of ψ_e and ψ_B. I assume that $\psi_e < 0$ and $\psi_B > 0$.

$\psi_e < 0$ when the expenditure switching effect ($NX_e > 0$) is stronger than the wealth effect ($NX_{w^*}B/e^2 > 0$). Moreover, $\psi_B > 0$ when the impact of the increase in debt on interest payments (r) exceeds the wealth effect on the trade balance ($NX_w - NX_{w^*}/e < 0$).[21]

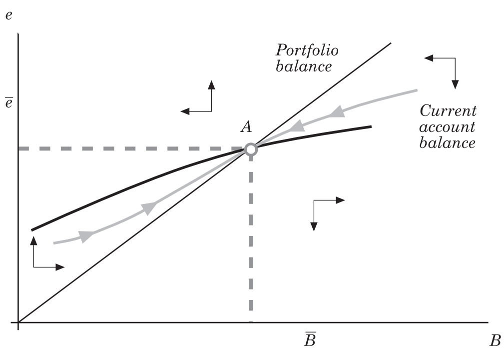
Under these assumptions, the current account balance relation is upward sloping. An increase in external debt increases interest payments and requires a depreciation of the currency that stimulates the trade balance.

To illustrate the model dynamics, figure 14 plots the two relations for the case in which the current account relation is flatter than the portfolio balance relation:

$$\frac{\alpha_0 + \alpha_0^* - 1}{\left(1 - \alpha_0^*\right)D^*} > -\frac{\psi_B}{\psi_e}. \tag{16}$$

In that case, it is easy to check that the dynamic system associated with equations (12) and (13) is saddle-point stable. The intersection of the two curves defines the long-run value of the currency and external debt, while the saddle path is also upward sloping.

Figure 14. Phase Diagram: Assets in Foreign Currency, Liabilities in Domestic Currency



Source: Author's construction.

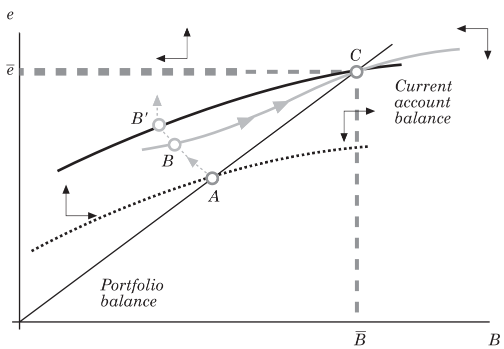
Blanchard, Giavazzi, and Sa (2005) provide an interpretation of condition (16). Consider a movement along the $\dot{e} = 0$ schedule stemming

21. It is easy to analyze the other cases where the wealth effects on debt are powerful enough to change the sign of ψ_e or ψ_B.

from an increase in $\bar{B}$. The currency must depreciate to keep the asset market in equilibrium. The increase in $\bar{B}$ has two effects on the balance of payments. First, it increases interest payments, thereby increasing external debt. Second, the depreciation of the currency improves the trade balance, which reduces external debt. The second effect needs to be stronger for saddle-path stability. This is condition (16).

To explore the response to a decline in the demand for domestic goods, consider now how the economy adjusts to an external shock, such as a permanent decline in the demand for domestic goods (that is, a negative shock to *NX*). The full dynamic adjustment is represented on figure 15. While the portfolio balance relation remains unchanged, the current account balance relation schedule shifts up: lower exports require a depreciation of the exchange rate if external debt is to remain unchanged.

Figure 15. Response to a Negative Demand Shock



Source: Author's construction.

How does the economy adjust to this shock? On impact, the economy jumps from point A to point B, on the new saddle path. Because external assets are denominated in foreign currency, the sudden depreciation of the currency generates a valuation gain that reduces *B*. This valuation gain is proportional to the depreciation, equal to

$$dB = -\left(1 - \alpha_0\right) W \frac{de}{e}.$$

The size of the valuation gain (the horizontal component of the segment [AB]) depends on the gross asset position. A larger gross asset position, $(1 - \alpha_0)W$, implies a larger valuation gain.[22] From point B, the exchange rate depreciates further, to point C, while external debt increases. In the long run, both $\bar{B}$ and $\bar{e}$ increase. Along that path, the exchange rate is expected to depreciate ($\dot{e} > 0$), and the current account, while improving, remains in deficit, that is, foreigners are lending ($\dot{B} > 0$). To understand what is going on, consider what would happen if the currency depreciated sufficiently to maintain the current account balance (point B′). In that case, the depreciation of the currency would stimulate the foreign demand for domestic assets, as foreigners become richer in domestic currency.[23] Equilibrium on the asset market requires that the currency be expected to depreciate further to discourage the demand for domestic assets. This expected depreciation would further stimulate exports and reduce net foreign debt, however, pushing the economy away from the conjectured equilibrium.

What happens instead is that the currency depreciates on impact, but less than needed to stabilize the current account. This depreciation stimulates the demand for domestic assets. What counters this effect is the expectation that the currency will depreciate further in the future. Since the exchange rate does not depreciate all the way to the current account balance relation, the trade balance worsens and the country borrows more.

Foreigners are willing to lend despite the expected currency depreciation for two reasons. First, as net foreign debt increases, the rate of depreciation, $\dot{e}$, decreases and foreign assets become progressively less attractive. Second, as e increases, the share $B/e/W^*$ decreases given B, so foreigners want to rebalance their portfolio by increasing their holdings of domestic assets.

3.2.2 A stylized model of an emerging country's external position: destabilizing and predictable valuation effects

In the previous scenario, valuation effects are stabilizing. Consider now the case of a country forced to borrow in the foreign currency.

22. Since $\bar{B}$ and $\bar{e}$ are determined from the steady-state conditions, one might be tempted to conclude that valuation gains have no impact on the long-run required depreciation or the change in external debt (the move from point A to point C). This would be incorrect since an increase in the cross-border positions coming from either a lower home equity bias (lower α_0 and α^*_0) or greater wealth (a larger D and D^*) would change the steady-state schedules, as well. A decrease in α_0—while still satisfying condition (16)—would reduce $\bar{B}$ and $\bar{e}$.

23. When $0 < \alpha_0$ and $\alpha^*_0 < 1$, $eD^* + B$ increases even though B decreases,

In terms of the model, this is equivalent to assuming that $\alpha^* = 1$ and $\alpha > 1$. The net foreign debt, B, is equal to $(1 - \alpha)W > 0$.

Equilibrium on the domestic asset market takes the following form,

$$D = \alpha\left[E\left(\frac{\dot{e}}{e}\right)\right](D - B), \tag{17}$$

since only domestic agents acquire the domestic asset. The balance-of-payments condition becomes

$$\dot{B} = rB - NX(e, W, W^*) + \frac{\dot{e}}{e}B. \tag{18}$$

The last term represents the valuation term, as before. Two points are worth noting. First, the depreciation of the exchange rate applies to the net position, not the gross. This is simply because net and gross positions coincide in this case. Second, a depreciation of the currency worsens the external positions, because debt is denominated in foreign currency.

For the steady state, the portfolio balance relation takes a simple form here:

$$\bar{B} = \frac{1 - \alpha_0}{\alpha_0} D.$$

The external debt in local currency is a constant fraction of initial assets, regardless of the value of the exchange rate. This implies that the foreign currency debt, $B^* = B/e$, and the exchange rate, e, move precisely in inverse proportions.

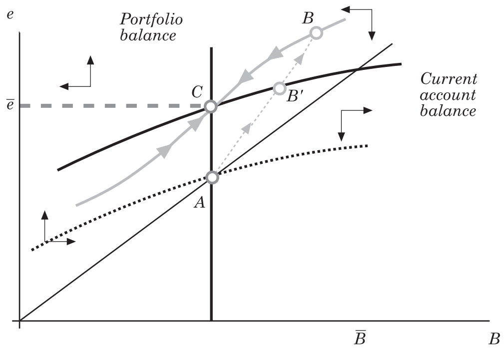
I obtain the current account balance relation by setting $\dot{B} = 0$ and $\dot{e} = 0$ in the balance-of-payments relation (18):

$$\begin{aligned} 0 &= r\bar{B} - NX(\bar{e}, W, W^*) \\ &= \psi(\bar{B}, \bar{e}) \end{aligned}$$

This is the same schedule as before, and I maintain the assumptions that $\psi_B > 0$ and $\psi_e < 0$: an increase in external debt requires a depreciation of the domestic currency.

Figure 16 presents the dynamic analysis. The local dynamics are always saddle-point stable, and the saddle path is upward sloping, as before. Hence, the model with foreign currency debt also features predictable currency and excess returns.

Figure 16. Response to a Negative Demand Shock: Case of Original Sin



Source: Author's construction.

The adjustment to an external shock is profoundly different from the previous case, however. Consider, as before, the case of a permanent decline in the demand for domestic goods. The portfolio balance relation remains vertical and unchanged, since the long-run local currency value of the external debt is unchanged. The current account balance relation schedule shifts up: lower exports require a depreciation of the exchange rate if external debt is to remain unchanged.

How does the economy adjust to this shock? Starting from the initial equilibrium at point A, the exchange rate suddenly depreciates to point B. This depreciation creates valuation losses ($\dot{e}/e\ \bar{B} > 0$) that increase the country's net debt. This necessitates a larger initial depreciation than that required by the current account balance relation. To see why, consider what would happen if the currency depreciated up to point B′, where current account balance is restored. At that point, the increase in external debt reduces domestic demand for the domestic asset. Equilibrium on the asset market thus requires that the domestic currency be expected to appreciate, but this expected appreciation would further increase external debt, requiring still further expected appreciation and pushing the economy away from the conjectured equilibrium.

Instead, the exchange rate needs to overshoot its long-run equilibrium value and then appreciate back. The overshooting of the exchange rate has to be sufficient to trigger an improvement in the trade balance, despite the initial negative shock. In turn, this improvement in the trade balance is what is necessary to reduce the external debt back to $\bar{B}$. As the economy moves from point B to point C, the exchange rate appreciates at a declining rate, while the external position improves. The exchange rate eventually depreciates, while the debt in foreign currency decreases ($B^* = \bar{B}/e$).

For emerging countries with foreign-currency-denominated liabilities, both the exchange rate and the trade balance become more volatile. This is due to the fact that the initial depreciation makes the country poorer, not richer. Following a sudden stop episode, the response of the trade balance and the exchange rate will need to be larger in countries with liabilities denominated in foreign currency and smaller in countries with liabilities denominated in domestic currency. This also implies that the trade balance and valuation component should be negatively correlated, a fact that seems to be borne out by the data presented in table 2.[24]

In contrast to the relatively innocuous valuation effects of the perfect-risk-sharing model, or the stabilizing effects that seem to be at work in the United States, valuation effects can be significantly destabilizing for many emerging countries, given the currency composition of their external balance sheet. It remains to be seen whether and how the increased importance of the valuation terms affects consumption and welfare.

4. Conclusion

This paper has provided a quick panorama of the empirical and theoretical research on the role of valuation effects for the external adjustment. On the empirical side, valuation effects are here to stay. The phenomenal increase in cross-border asset holdings opens the door to massive wealth transfers from relatively small price and currency movements. Short-term movements in a country's external asset position increasingly appear to be driven by the valuation component. The paper also expounded the distinction between predictable and unpredictable valuation effects. The former arise naturally and do not pose any particular theoretical or empirical challenge. For instance,

24. Brazil is the exception.

in a world with perfect risk sharing, valuation effects simply reflect the record keeping of future payments on the contingent claims held by domestic and foreign investors, payments that implement full risk sharing. Interpreted in this light, the volatility generated by valuation adjustments could be interpreted as good volatility, insofar as it reduces the volatility of marginal utility of consumption and improves welfare. However, the empirical evidence on the United States indicates that predictable valuation effects are important, at least in that particular case. The last section of this paper showed how such effects arise in a simple portfolio balance model. The model suggests that valuation effects are perverse for emerging countries with dollarized liabilities and stabilizing for countries like the United States, whose external debt is denominated in dollars. The model also suggests that the valuation terms and the trade balance should be negatively correlated for emerging economies, while their trade balance and exchange rate should be much more volatile than their developed counterpart. On the empirical front, testing these empirical implications should be the obvious first step. On the theoretical front, future research should extend the simple model presented here to a full-fledged international, intertemporal dynamic portfolio model.

APPENDIX
Sample Countries

Table A1. Industrial Countries, 2004

Country	*A/Y*	*L/Y*	μ^a
Australia	0.82	1.46	-1.28
Austria	1.88	2.05	-10.82
Belgium	4.25	3.94	13.75
Canada	0.99	1.12	-7.93
Denmark	1.95	2.08	-15.70
Finland	1.95	2.08	-16.14
France	2.12	2.06	39.80
Germany	1.67	1.59	20.76
Greece	0.67	1.40	-0.91
Iceland	1.49	2.42	-1.60
Ireland	9.30	9.50	-47.16
Italy	1.05	1.24	-5.82
Japan	0.89	0.51	2.34
Netherlands	4.03	4.08	-69.12
New Zealand	0.67	1.59	-0.73
Norway	2.06	1.41	3.18
Portugal	1.76	2.46	-2.53
Spain	1.25	1.75	-2.56
Sweden	2.13	2.23	-22.41
Switzerland	5.71	4.40	4.36
United Kingdom	3.57	3.71	-27.08
United States	0.84	1.07	-3.71

Source: Lane and Milesi-Ferretti (2006) and author's calculations.

Table A2. Emerging Countries, 2004

Country	*A/Y*	*L/Y*	μ^a
Argentina	0.88	1.36	–1.85
Brazil	0.28	0.78	–0.57
Chile	0.81	1.18	–2.19
Colombia	0.36	0.71	–1.03
Mexico	0.20	0.63	–0.46
Venezuela	0.89	0.73	5.33
China	0.55	0.47	6.94
India	0.23	0.34	–2.15
Indonesia	0.24	0.76	–0.46
Korea	0.53	0.57	–13.05
Malaysia	1.11	1.13	–54.37
Philippines	0.39	0.98	–0.67
Taiwan	2.07	0.65	1.46
Thailand	0.45	0.74	–1.54
Czech Republic	0.64	0.99	–1.85
Hungary	0.42	1.39	–0.43
Poland	0.32	0.85	–0.59
Russia	0.67	0.66	140.65
Israel	0.94	1.16	–4.29
South Africa	0.65	0.70	–12.77
Turkey	0.28	0.76	–0.60

Source: Lane and Milesi-Ferretti (2006) and author's calculations.

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Stocks, Flows, and Valuation Effects of Foreign Assets and Liabilities: Do They Matter?

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Globalization has changed the way countries interact along several dimensions. Financial integration and its underpinnings are probably among the most important. Although cross-border capital flows and external debt have been closely monitored, until recently little was known about the stocks of foreign assets and liabilities accumulated by various countries, especially in the developing world. In this respect, Lane and Milesi-Ferretti (2001, 2006) made an important contribution by assembling a comprehensive data set for 145 countries over the period 1970–2004.[1] According to these

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1. Previous contributions include Sinn (1990) and Rider (1994). Rider builds a data set for the period 1970–87, which misses the effect of the significant increase of cross-border capital flows in the last decade. Official data are also scarce. Data on international investment positions have been published by the International Monetary Fund (IMF) in recent years for most industrial countries, but only for a few developing countries. For the latter group, IMF stock data are generally available only for gross external debt and foreign exchange reserves.

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authors, despite several external crises, financial integration has intensified in recent decades among both industrial and developing countries. This has been accompanied by significant changes in the composition of countries' international investment position. For instance, protracted current account deficits have led a number of countries to reduce their net foreign assets considerably. In other cases, including Chile, financial integration has resulted in substantial and simultaneous expansions of gross international liabilities and assets.

Another interesting stylized fact that emerges from this data set is the existence of some persistent differences between the change in the net foreign asset position and the current account balance, which highlights the importance of valuation effects—capital gains and losses—as a source of external wealth. This scenario has motivated an increasing number of studies on the consequences and relevance of the two basic components of changes in the net foreign position, namely, cumulative flows and valuation effects of both assets and liabilities. Valuation effects can be substantial. For instance, the United States saw its ratio of net foreign asset to gross domestic product (GDP) improve by 3 percentage points of GDP between 2003 and 2005, despite having a rather large and persistent current account deficit (roughly 6 percent of GDP each year) that cumulatively should have deteriorated its external position by around 12 percentage points of GDP. The difference is due to valuation effects under the traditional accounting rules. Hausmann and Sturzenegger (2005) propose a different set of accounting rules based on the income generated by the financial position for which the external position of the United States appears fairly stable over the last twenty years.[2]

Finally, international assets and liabilities can take very different forms. Changes in debt contracts, portfolio flows (including bonds and equity), foreign direct investment (FDI), and international reserves (foreign liquid assets) all explain changes in net foreign assets, but they are quite different in nature.

The objective of this paper is to empirically evaluate the role of net foreign assets and their different components in specific key outcomes, namely, the probability of an external crisis, the perceived country creditworthiness, and the real exchange rate. For that purpose, we systematically assess the effects of net foreign assets and their

2. There is ongoing debate on the Hausmann-Sturzenegger approach, which is beyond the scope of this work.

alternative decompositions on external crises, such as current account reversals, sudden stops, and currency crises, on countries' sovereign credit ratings (by both Moody's and Standard and Poor's), and on the long-term equilibrium real exchange rate.

We extend previous contributions and consider detailed information on countries' international investment positions from Lane and Milesi-Ferretti's new data set. The previous work on external crises limits the analysis of foreign assets and liabilities to international reserves, the stock and composition of external debt, and the size and composition of capital flows.[3] To our knowledge, the same is true for empirical research on the determinants of credit ratings and the real exchange rate, perhaps reflecting the dearth of available data. Although research on real exchange rates consistently assesses the role of net foreign assets, it makes no distinction between the different components. Such an analysis would have immense practical value, since these medium-term trends in exchange rates are an essential tool in assessing current and future macroeconomic conditions in industrial and developing countries.

The methodology we follow is straightforward: we augment empirical models used and validated by other authors to study determinants of particular outcomes and assess the contribution of the different stocks that make up net foreign assets, as well as the implicit flows that explain their variation. We analyze a large panel of countries, and we merge the data set compiled by Lane and Milesi-Ferretti with a few others commonly used to study the outcomes we focus on.

To supplement this analysis, we also examine the role of net foreign assets' valuation effects in determining the probability of external crises. This could be the case, for instance, if valuation effects are important for the external adjustment process (Gourinchas and Rey, 2006; Lane and Milesi-Ferretti, 2005) or, more generally, if there is cross-sectional variation in the denomination of international liabilities.[4] We empirically assess this issue by evaluating the impact of net valuation adjustments on each of three alternative definitions of external crisis.

3. Among the variables that have been considered are foreign direct investments versus portfolio flows, long-term versus short-term external debt, fixed-rate versus floating-rate borrowing, the ratio of short-term external debt to international reserves, the ratio of short-term external debt to GDP, and the ratio of debt services to exports.

4. With some countries having only foreign-currency-denominated liabilities, a phenomenon known as original sin (Eichengreen, Haussmann, and Panizza, 2003).

Our paper tackles a number of important questions from a policy perspective. First, it assesses whether the size of net foreign assets (a stock beyond current flows) is an important determinant of crisis and creditworthiness. Second, it evaluates whether gross external assets and liabilities have differentiated roles in determining the likelihood of a crisis, the real exchange rate, and creditworthiness. Since global financial integration entails high levels of external assets and liabilities, a differentiated analysis sheds light on the effects of integration and the underlying mechanism. Third, it estimates the effects of different components of net external assets on different outcomes. For instance, we examine whether FDI is safer—or at least perceived as safer—than, say, portfolio investment, or whether it has a different effect on the exchange rate than other components of net foreign assets. If alternative components of net foreign assets have dissimilar effects on the outcomes we analyze, there could be an argument in favor of facilitating some types of flows or of hoarding international reserves as a counterpart. Finally, it evaluates whether valuation effects are different from the impact of accumulated flows along different dimensions.

The paper is organized as follows. Section 1 analyzes the role of net foreign assets and its components in the likelihood of current account reversals, sudden stops, and currency crises, based on a large panel of countries. Section 2 analyzes the determinants of country credit ratings using ordered probit models including the stock of net foreign assets. Section 3 presents cointegrating models of real exchange rate determination for a large sample of countries, also considering splits of the stock of net foreign assets. Section 4 concludes.

1. Foreign Assets and Liabilities and External Crises

Empirical researchers on external crises (namely, current account reversals, sudden stops, and currency crises) have limited their analysis of foreign assets and liabilities to the stock of international reserves, the stock and composition of external debt, and the size and composition of capital flows. Several papers analyze the effect of these variables on the probability of occurrence of these crises. Frankel and Rose (1996) find that low ratios of FDI flows to external debt increase the probability of currency crashes. Both Radelet and Sachs (1998) and Rodrik and Velasco (1999) find that the ratio of external debt to international reserves is a robust predictor of capital flow reversals, highlighting the importance of liquidity problems as precursors of financial crises. Milesi-Ferretti and Razin (1998) examine current account reversal episodes and find that the ratio of external debt to GDP helps predict these events, while the ratio of FDI flows to GDP and the share of short-term debt to total external debt have an effect that is not statistically significant. Edwards (2005a, 2005b) finds that countries with high current account deficits are more likely to suffer a reversal, while the ratio of international reserves to GDP and the ratio of external debt to GDP have no statistically significant effect. Calvo, Izquierdo, and Mejía (2004) highlight the relevance of balance sheet effects in explaining the probability of a sudden stop of capital inflows; they find that a combination of high current account leverage (that is, the ratio of the current account deficit to the absorption of tradable goods) and high domestic liability dollarization increases the likelihood of a sudden stop.

In this section, we consider standard empirical models used in the external crisis literature, augmenting them with partitions of net foreign asset stocks and flows. We analyze three types of crisis indicators: current account reversals, sudden stops, and exchange rate market pressure indexes. Estimations consider maximum-likelihood panel probit models and yearly observations for the period 1975–2004. The whole sample includes more than a hundred countries.[5] Not every country has data for every year, so our panel estimations are unbalanced. For details on data construction, sources, and the sample of economies included, see the appendix.

1.1. Current Account Reversals

Our basic specification for the probability of current account reversal closely follows Milesi-Ferretti and Razin (1998) and Edwards (2005a, 2005b). We consider current account reversal episodes as periods in which the current account deficit records a reduction of at least 4 percent of GDP over one year and an accumulated reduction of at least 5 percent of GDP in three years. Therefore, our dependent variable ($CAR_{i,t}$) takes a value of one if country *i* experiences a current account reversal in year *t*, and zero otherwise.

The initial set of explanatory variables includes the following: a measure of regional contagion represented by the relative occurrence of sudden stops in the country's region (SSR); the ratio of imports to GDP as a measure of openness (OPEN); and the percentage change in

5. The appendix provides a list of economies included in each group.

the terms of trade (TOT).[6] We consider this set of variables as controls and evaluate the effect of the components of alternative partitions of net foreign assets. Because one of the key flow variables for explaining a current account reversal—identified in Milesi-Ferretti and Razin (1998) and Edwards (2005a)—is the first lag of the current account deficit, our estimates include two-year lags of stock variables (STOCK) and one-year lags of the change in stocks (ΔSTOCK); this also helps us identify the effects of flows versus stocks more easily.[7] We consider maximum-likelihood probit estimations and estimate relationships of the following type:

$$\Pr\left(\mathrm{CAR}_{i,t}=1\right)=\Phi\begin{pmatrix}\beta_1\mathrm{SSR}_{i,t-1}+\beta_2\mathrm{OPEN}_{i,t-1}+\beta_3\mathrm{TOT}_{i,t-1}\\+\alpha_1\mathrm{STOCK}_{i,t-2}+\alpha_2\Delta\mathrm{STOCK}_{i,t-1}\end{pmatrix},$$

To evaluate alternative partitions of the net foreign asset position, we estimate five different specifications. The first one includes the one-year lag of overall NFA position, while the remaining four specifications breakdown this variable into its stock component (two-year lags of NFA position components) and its recent variation (one-year lags of current account deficit and valuation adjustments). We consider four alternative partitions of the NFA position: (i) the overall net foreign asset position; (ii) total gross assets and total gross liabilities; (iii) gross FDI assets, gross portfolio equity assets, gross portfolio debt assets, gross FDI liabilities, gross portfolio equity liabilities, gross portfolio debt liabilities, and international reserves; and (iv) cumulative current account balance and cumulative valuation adjustments.

Table 1 presents the results. Because probit coefficients are not easy to interpret, we report the marginal effects of one-unit changes in regressors on the probability of CAR (expressed in percentage points), evaluated at the mean of the data. The estimated coefficients for our initial set of explanatory variables are in line with findings by Milesi-Ferretti and Razin (1998) and Edwards (2005a, 2005b). As expected, the lagged current account deficit is a very important determinant of the likelihood of a current account reversal. The evidence also

6. We considered a number of other covariates that did not turn out to be statistically relevant. These included per capita GDP, the fiscal deficit, domestic credit growth, the U.S. interest rate, and OECD output growth.

7. Change in stocks is divided into transaction flows (current account deficit) and valuation adjustments.

confirms the importance of regional contagion. In this respect, a higher incidence of sudden stops in a country's region increases the probability of reversal. An increase in the terms of trade also increases the probability of a reversal with a small marginal effect. The effect of openness (imports to GDP) on the probability of a reversal seems positive, but it is not robust to different specifications.

Column 1 shows that a higher stock of net foreign assets (first lag) decreases the probability of a current account reversal. This result changes completely, however, if we consider net foreign assets (second lag) and the current account deficit simultaneously (column 2): having larger net foreign assets seems not to affect the likelihood of a current account reversal once we control for the current account deficit. The result in column 1 thus appears to be driven by the lagged current account deficit implicit in net foreign assets. Recall that, by definition, $\text{NFA}_t = \text{NFA}_{t-1} + \text{CA}_t + \text{VA}_t$, where NFA is net foreign asset stocks at the end of the year and CA and VA are the current account balance and valuation adjustments, respectively. The basic conclusion is that transaction flows, represented by the current account deficit, are the most significant determinant of current account reversals. Its marginal effect on the probability of reversals is much higher than the other explanatory variables.

Despite the significant role of the current account deficit, other components of net foreign assets show up as quite relevant. In particular, the composition of gross assets and gross liabilities seems important (columns 3 and 4). A higher stock of portfolio equity assets and a lower stock of portfolio equity liabilities are statistically significant in reducing the probability of a reversal. Ceteris paribus, countries that accumulate more portfolio equity investment from abroad face a higher probability of current account reversal. Quantitatively, the effect of an increase in the current account deficit by 1 percent of GDP on the probability of a current account reversal is more than three times the effect of a 1 percent of GDP increase on the stock of portfolio equity liabilities.

The analysis by gross components also shows that the stock of FDI liabilities reduces the probability of a current account reversal. Having accumulated FDI flows decreases the likelihood of a current account reversal.

We also find a statistically important role for valuation effects. When we disaggregate the stock of net foreign assets into cumulative financial transactions (cumulative current account balance) and cumulative valuation adjustments, the latter component reduces the

Table 1. Current Account Reversal: Panel Probit, All Countries[a]

Explanatory variable	*(1)*	*(2)*	*(3)*	*(4)*	*(5)*
Openness: imports to GDP (1st lag)	0.106 (0.000)***	0.026 (0.049)**	0.011 (0.430)	0.013 (0.342)	0.022 (0.081)*
Sudden stops in region (1st lag)	0.190 (0.000)***	0.070 (0.000)***	0.041 (0.000)***	0.043 (0.000)***	0.066 (0.000)***
Terms of trade, % change (not lagged)	0.001 (0.001)***	0.001 (0.011)**	0.000 (0.021)**	0.000 (0.020)**	0.000 (0.033)**
NFA to GDP (first lag)	–0.043 (0.000)***				
NFA to GDP		0.003 (0.699)			
Total assets to GDP				–0.007 (0.626)	
Total liabilities to GDP				–0.003 (0.651)	
Portfolio debt assets to GDP			–0.012 (0.430)		
FDI assets to GDP			0.048 (0.270)	0.053 (0.224)	
Portfolio equity assets to GDP			0.173 (0.071)*	0.197 (0.079)*	
Debt liabilities to GDP			0.002 (0.744)		
FDI liabilities to GDP			–0.031 (0.055)*	–0.028 (0.096)*	
Portfolio equity liabilities to GDP			0.106 (0.004)***	0.121 (0.001)***	

Table 1. (continued)

Explanatory variable	*(1)*	*(2)*	*(3)*	*(4)*	*(5)*
International reserves to GDP			0.006		
			(0.827)		
Cumulative current account to GDP					0.011
					(0.132)
Cumulative valuation adjust. to GDP					–0.023
					(0.037)**
Current account deficit to GDP (1st lag)		0.453	0.323	0.337	0.449
		(0.000)***	(0.000)***	(0.000)***	(0.000)***
Valuation adjust. to GDP (1st lag)		0.054	0.046	0.048	0.069
		(0.073)*	(0.054)*	(0.051)*	(0.025)**
No. observations	1342	1254	1199	1199	1254
Pseudo R^2	0.15	0.35	0.38	0.38	0.39
No. crisis	65	60	53	53	60

Source: Authors' calculations.

* Statistically significant at the 10 percent level. ** Statistically significant at the 5 percent level. *** Statistically significant at the 1 percent level.

a. The dependent variable is the current account reversal indicator. Coefficients are marginal effects at the mean. Explanatory variables are two–year lags, unless otherwise mentioned. Robust p values are in parentheses.

probability of reversal (column 5). Unexpectedly, the lagged valuation adjustment (a flow) appears to be very significant, with a positive sign. However, the puzzling marginal effect of this flow component is around one-sixth the effect of the current account deficit.

1.2 Sudden Stops of Capital Inflows

The recent literature on external crises focuses not only on current account reversals as a measure of crisis, but also on sudden stops of capital inflows.[8] A sudden stop episode occurs when the flow of capital coming to a country is reduced significantly in a very short period of time.

Current account reversals and sudden stop episodes do not necessarily coincide. Although the two phenomena are strongly related, a country could certainly suffer a sharp reduction in capital inflows without experiencing a current account reversal. By definition, net capital inflows are equal to the sum of the current account deficit and the net change in international reserves. The latter component may absorb part of the effect of a reduction of capital inflows on the current account balance. In fact, empirical evidence confirms that sudden stops may imply a quite different timing for the onset of a crisis compared to current account reversals: in our data set, only 28 percent (31 percent) of current account reversals (sudden stops) coincide with sudden stops (current account reversals).

This section evaluates the effect of the stock of net foreign assets, and its composition, on the likelihood of sudden stops of capital inflows. As in the previous sections, we estimate a panel probit model using a broad multi-country data set and evaluate the effect of alternative partitions of country's net foreign asset position on the likelihood of a sudden stop. Following Edwards (2005b), we define a sudden stop as a reduction in net capital inflows of at least 5 percent of GDP in one year. The country in question must have received an inflow of capital larger to its region's third quartile during the two years prior to the sudden stop. Since current account reversals and sudden stops are closely related phenomena, our estimations consider the same explanatory variables used in previous section.

Table 2 reports the results. In line with the findings of Calvo, Izquierdo, and Mejía (2004), openness increases the probability of a sudden stop. Evidence confirms the importance of regional contagion:

8. For more on sudden stops, see Calvo (1998) Calvo, Izquierdo, and Talvi (2003), Calvo, Izquierdo, and Mejía (2004), and Edwards (2005a).

having a sudden stop in the country's region increases the probability of a sudden stop. This finding supports Calvo's (1999) view that liquidity shocks to investors stemming from adverse developments in one country may trigger the sale of assets from other countries in the investors' portfolio to restore liquidity.

With regard to foreign assets and liabilities, we find that a higher stock of net foreign assets reduces the likelihood of a sudden stop (column 1). Also, when we break down net foreign assets into one-year-lagged net foreign assets, lagged current account deficit, and valuation adjustment, we observe that net foreign assets is not significant while the current account deficit emerges as the main determinant of sudden stops (column 2). A higher current account deficit increases the likelihood of sudden stops. Also, its marginal effect on the probability of a crisis is the highest of all the explanatory variables.

Although the net foreign asset position is not significant when we include current account deficit, its composition seems to matter (columns 3 and 4). Both FDI assets and liabilities have an impact: countries that accumulate more direct investment abroad (FDI assets) are more prone to sudden stops; while countries that accumulate more foreign direct investment (FDI liabilities) face a smaller chance of crisis. Unexpectedly, a higher stock of international reserves is related to a higher probability of sudden stop. This last result may be due to endogeneity: countries that are more prone to crises are required to hoard larger stocks of international reserves. Finally, both valuation adjustments and cumulative valuation adjustments are statistically insignificant (column 5).

How different are these result from our findings for current account reversals? The current account deficit is the main determinant of both types of crisis. Not only is the marginal effect on the probability of a crisis the highest of the explanatory variables, but it is also very significant. Portfolio equity assets and liabilities are key for current account reversals, with higher marginal effects, while the stocks of FDI assets and portfolio equity assets seem more relevant for sudden stops. Finally, the valuation component of net foreign assets matters only for current account reversals.

1.3. Exchange Rate Market Pressure

Our third measure of external crisis is an indicator of exchange rate market pressure. We again consider a large sample of country experiences, as we empirically evaluate the role of foreign assets

Table 2. Sudden Stops: Panel Probit, All Countries[a]

Explanatory variable	*(1)*	*(2)*	*(3)*	*(4)*	*(5)*
Openness: imports to GDP (1st lag)	0.117 (0.000)***	0.078 (0.000)***	0.028 (0.266)	0.056 (0.013)**	0.079 (0.000)***
Sudden stops in region (1st lag)	0.249 (0.000)***	0.178 (0.000)***	0.139 (0.266)	0.150 (0.013)**	0.177 (0.000)***
Terms of trade, % change (not lagged)	0.000 (0.526)	0.000 (0.449)	0.000 (0.438)	0.000 (0.330)	0.000 (0.450)
NFA to GDP (1st lag)	–0.018 (0.026)**				
NFA to GDP		0.007 (0.479)			
Total assets to GDP				0.002 (0.873)	
Total liabilities to GDP				0.008 (0.468)	
Portfolio debt assets to GDP			–0.018 (0.249)		
FDI assets to GDP			0.227 (0.000)***	0.205 (0.001)***	
Portfolio equity assets to GDP			–0.225 (0.161)	–0.350 (0.043)**	
Debt liabilities to GDP			0.012 (0.219)		
FDI liabilities to GDP			–0.090 (0.010)***	–0.093 (0.028)**	
Portfolio equity liabilities to GDP			0.066 (0.366)	0.114 (0.121)	

Table 2. (continued)

Explanatory variable	*(1)*	*(2)*	*(3)*	*(4)*	*(5)*
International reserves to GDP			0.114 (0.044)**		
Cumulative current account to GDP					0.006 (0.561)
Cumulative valuation adjust. to GDP					0.010 (0.500)
Current account deficit to GDP (1st lag)		0.448 (0.000)***	0.425 (0.000)***	0.452 (0.000)***	0.445 (0.000)***
Valuation adjust. to GDP (1st lag)		−0.047 (0.385)	−0.042 (0.317)	−0.041 (0.375)	−0.048 (0.381)
No. observations	1261	1219	1164	1164	1219
Pseudo R^2	0.15	0.22	0.26	0.25	0.22
No. crisis	54	53	49	49	53

Source: Authors' calculations.
* Statistically significant at the 10 percent level. ** Statistically significant at the 5 percent level. *** Statistically significant at the 1 percent level.
a. The dependent variable is the sudden stop indicator. Coefficients are marginal effects at the mean. Explanatory variables are two–year lags, unless otherwise mentioned. Robust p values are in parentheses.

and liabilities in the likelihood of episodes of significant pressure on the exchange rate market. As in the previous section, we do not attempt to test specific theories on this matter, but rather examine the contribution of foreign assets and liabilities. The valuation effects that emerge from these holdings, usually denominated in different currencies, lead to large capital gains or losses. The basic question is whether foreign assets or liabilities (or both) are relevant in explaining a country's vulnerability to an exchange rate crash.

The exchange rate market pressure (ERMP) measure considered here is the standard index defined by Eichengreen and others (1995), which includes both large exchange rate depreciations and speculative attacks that are successfully warded off by the authorities. The latter include episodes characterized by large and sudden falls in international reserves (or increases in interest rates). Concretely, a speculative attack exists when the ERMP index is above a certain threshold. The index is a weighted average of changes in the real exchange rate (RER) and in international reserves (IRES) for country i in month t:

$$\mathrm{ERMP}_{i,t} = \omega_{\mathrm{RER}}\left(\frac{\mathrm{RER}_{i,t} - \mathrm{RER}_{i,t-1}}{\mathrm{RER}_{i,t-1}}\right) - \omega_{\mathrm{IRES}}\left(\frac{\mathrm{IRES}_{i,t} - \mathrm{IRES}_{i,t-1}}{\mathrm{IRES}_{i,t-1}}\right).$$

The weights ω_{RER} and ω_{IRES} are the relative precision of each variable, defined as the inverse of the variance for each variable for all countries and over the full sample period. We do not consider interest rates in constructing the index because of the lack of comparable data.

The rationale for using this measure to characterize a currency crisis is that it captures the options faced by a government. At a given moment, authorities may tolerate currency depreciation or avoid it through intervention (or by raising the interest rate). We consider that a currency crisis (CR) episode occurs when this index exceeds its mean by more than three standard deviations. The mean and the standard deviation are country specific:

$$\mathrm{CR}_{i,t} = \begin{cases} 1 & \text{if } \mathrm{ERMP}_{i,t} > \overline{\mathrm{ERMP}_i} + 3\mathrm{SD}(\mathrm{ERMP}_i) \\ 0 & \text{otherwise} \end{cases}$$

We assume that there is a well-defined function that relates macroeconomic variables to the probability of a crisis in country *i* in period *t*. The estimation procedure closely follows previous contributions, including Eichengreen and others (1995), Milessi-Ferretti and Razin (1998), Bussiere and Fratzscher (2002), and García and Soto (2005). We estimate a probit model using maximum likelihood and considering several explanatory variables other than foreign assets and liabilities. All these variables are lagged one year, and their inclusion follows the large literature on currency crises. As before, we report marginal effects, that is, the effects of one-unit changes in regressors on the probability of a crash (expressed in percentage points), evaluated at the mean of the data. Although the estimates cannot be interpreted structurally, they allow us to characterize currency crises.

Numerous theoretical models have been used to explain the causes and origins of currency crises.[9] First-generation models (Krugman, 1979; Blanco and Garber, 1986) emphasize the role of inconsistencies between fiscal, monetary, and exchange rate policies. Key variables that emerge from this approach are the exchange rate regime, domestic credit growth, the level of international reserves, and the fiscal balance. Second-generation models, such as Obstfeld (1996), consider that governments face tradeoffs (output-inflation), so their decisions are not state invariant. From the government's standpoint, it may be optimal to abandon a fixed exchange rate regime even if it might have been possible (at some cost) to maintain it. A key variable that emerges is the overvaluation of the real exchange rate. Ceteris paribus, the more overvalued the real exchange rate, the bigger the incentives for the government to abandon a fixed exchange rate regime and, therefore, the higher the probability of having a currency crisis in the coming months.

Third-generation models focus on moral hazard and imperfect information, highlighting the importance of banking problems and overborrowing as determinants of a currency crisis. Diaz-Alejandro (1985) and Velasco (1987) model banking problems as determinants of currency crises, whereby the central bank's financing of the rescue of the financial system could be inconsistent with a managed exchange rate regime. These models suggest that the growth in bank credit may play an important part in currency crises.

9. For a review of the economic literature on currency crises, see Eichengreen and others (1995), Flood and Marion (1998), and Kaminsky (2003).

More recent models highlight the relevance of capital flows as a possible source of instability (Calvo, 1998; Calvo, Izquierdo, and Talvi, 2003). A sudden stop of capital inflows can generate a liquidity crisis and trigger a significant depreciation of the domestic currency. Variables such as foreign interest rates, the amount of external debt, and the composition of foreign assets and liabilities might have an important impact.

Our set of control variables is rather standard and follows previous empirical contributions on the determinants of speculative attacks and currency crises. We follow Frankel and Rose (1996) and Milesi-Ferretti and Razin (1998) in examining seven variables related to domestic macroeconomic conditions and currency crises: the growth rate of bank credit; the ratio of the fiscal balance to GDP; the current account deficit as a percentage of GDP; the real growth rate of GDP; the real growth rate of exports; the degree of overvaluation of the real exchange rate; and the stock of international reserves. We also include foreign variables such as the U.S. interest rate and the real GDP growth rate in member countries of the Organization for Economic Cooperation and Development (OECD); a dummy variable for a fixed exchange rate regime; and a measure of trade openness represented by the ratio of imports to GDP. Our measure of real exchange rate overvaluation is the deviation of the actual value of the real exchange rate from the trend component of a rolling Hodrick-Prescott (HP) filter.

The growth in bank credit is intended to capture the monetary policy stance and overborrowing. Crashes are more likely to occur in countries where the real exchange rate is appreciated relative to its historical average. We take a step forward on this variable and introduce the real exchange rate misalignment estimated from a rolling (real time) HP filter. As suggested by second-generation models, sluggish GDP growth may trigger difficulties in repaying the debt burden, and the government may be reluctant to implement stabilization programs if output is already slowing down (Bussiere and Fratzscher, 2002). Trade openness exposes the country to external shocks, but it may benefit the economy through gained opportunities to share risk with the rest of the world. Export growth can serve as a driving force for economic growth or as a proxy for misalignment. Finally, the U.S. interest rate is a measure of how "easy" foreign borrowing is. The literature includes other variables to explain currency crashes, but there is no clear consensus on their importance and significance. We therefore chose to avoid overparameterizing our benchmark model and took the most parsimonious specification, which we extend with stocks, cumulative flows, and valuation effects of foreign assets and liabilities, distinguishing between net and gross components.

After we remove insignificant variables, our basic model is reduced to five variables: the degree of overvaluation or misalignment of the real exchange rate; the growth rate of bank credit; the growth rate of real GDP; the growth rate of exports; and the U.S. interest rate. This model is extended with alternative disaggregations of the net foreign asset position.

Table 3 reports the results. Real exchange rate misalignment measured by the rolling HP filter of the effective real exchange rate has the expected sign, but it is not always statistically significant.[10] Bank credit is significant for all specifications, suggesting a significant role for financial variables in line with third-generation models of currency crises. While GDP growth is not significant, we report a negative and significant association between crashes and export growth. Finally, an increase in the U.S. interest rate increases the probability of a crisis.

The net foreign asset position (as a ratio to GDP) is negatively related to currency crises (column 1). The previous period's current account deficit—the main component of the change in net foreign assets —appears to have no link to a currency crisis (column 2). This contrasts sharply with the results on current account reversals. Milesi-Ferretti and Razin (1998) also report a statistically insignificant link between these variables when they include a large sample of middle- and low-income economies.

Disaggregating net foreign assets into total gross assets and gross liabilities (columns 3 and 4) shows that gross assets play a significant role. Within gross assets, debt is the only statistically significant component. Interestingly, if we split net foreign assets between cumulative current account and cumulative valuation adjustments (column 5), both turn out to significantly reduce the probability of a currency crash. The marginal contribution of cumulative valuation effects almost dobles the contribution of cumulative current account.

Table 4 presents a summary of the main results, distinguishing among the different components of the stock of net foreign assets and the types of external crises. Our results support the view that assets and liabilities are rather different external holdings. A larger stock of

10. We also performed estimations including the cyclical component of the HP filter and using the whole sample. Although the coefficient turned out to be highly significant under this procedure, we prefer a real-time variable to avoid overfitting currency attacks. An ex post filter is equivalent to using information that will only be available in the future to determine whether domestic currency is presently undervalued. Although this improves the fit of the model, the main results are the same.

Table 3. Exchange Rate Market Pressure: Panel Probit, All Countries[a]

Explanatory variable	*(1)*	*(2)*	*(3)*	*(4)*	*(5)*
RER deviation from HP rolling trend (1st lag)	−0.022 (0.085)*	−0.023 (0.106)	−0.021 (0.075)*	−0.021 (0.088)*	−0.021 (0.139)
Real bank credit growth (1st lag)	0.029 (0.001)***	0.03 (0.001)***	0.032 (0.000)***	0.033 (0.000)***	0.031 (0.001)***
Real GDP growth (1st lag)	−0.071 (0.252)	−0.077 (0.230)	−0.094 (0.115)	−0.089 (0.142)	−0.074 (0.249)
Real export growth (1st lag)	−0.079 (0.060)*	−0.078 (0.068)*	−0.083 (0.042)**	−0.084 (0.044)**	−0.075 (0.079)*
U.S. interest rate (1st lag)	0.004 (0.017)**	0.005 (0.006)***	0.005 (0.003)***	0.005 (0.003)***	0.005 (0.006)***
NFA to GDP (1st lag)	−0.022 (0.060)*				
NFA to GDP		−0.03 (0.005)***			
Total assets to GDP				−0.065 (0.014)**	
Total liabilities to GDP				0.017 (0.334)	
Portfolio debt assets to GDP			−0.082 (0.037)**		
FDI assets to GDP			−0.08 (0.357)	−0.033 (0.705)	
Portfolio equity assets to GDP			0.021 (0.838)	0.091 (0.477)	
Debt liabilities to GDP			0.021 (0.232)		

Table 3. (continued)

Explanatory variable	*(1)*	*(2)*	*(3)*	*(4)*	*(5)*
FDI liabilities to GDP			0.03	0.038	
			(0.398)	(0.394)	
Portfolio equity liabilities to GDP			0.159	0.128	
			(0.168)	(0.292)	
International reserves to GDP			0.002		
			(0.972)		
Cumulative current account to GDP					−0.026
					(0.017)**
Cumulative valuation adjust. to GDP					−0.046
					(0.013)**
Current account deficit to GDP (1st lag)		−0.056	−0.134	−0.127	−0.041
		(0.649)	(0.339)	(0.362)	(0.752)
Valuation adjust. to GDP (1st lag)		−0.009	0.007	0.01	−0.001
		(0.904)	(0.921)	(0.895)	(0.984)
No. observations	1304	1257	1206	1206	1257
Pseudo R^2	0.06	0.06	0.09	0.08	0.06
No. crisis	55	54	53	53	54

Source: Authors' calculations.
* Statistically significant at the 10 percent level. ** Statistically significant at the 5 percent level. *** Statistically significant at the 1 percent level.
a. The dependent variable is the exchange rate market pressure indicator. Coefficients are marginal effects at the mean. Explanatory variables are two–year lags, unless otherwise mentioned. Robust p values are in parentheses.

net foreign assets does not necessarily make crises less likely: both the composition of the overall position of international investments and the amount of financial flows (namely, the current account deficit) are key determinants. Changes in the composition of gross assets towards more portfolio investment and less FDI assets make current account reversals and sudden stops less likely. The opposite happens with the composition of gross liabilities.

Also, the cumulative valuation adjustment component of net foreign assets reduces the probability of a crisis, while the cumulative financial flow (cumulative current account balance) is often irrelevant. In general, financial flows (that is, current account deficits) do not matter for currency crises and are very important for current account reversals and sudden stops.

Table 4. Foreign Assets and Liabilities and External Crises: Main Results

	Effect on crisis probability[a]		
Explanatory variable	*Current account reversals*	*Sudden stops*	*Exchange rate market pressure*
Net foreign assets (NFA)	n.s.	n.s.	(–)
Gross assets			
FDI assets	n.s.	(+)	n.s.
Portfolio equity assets	(–)	(–)	n.s.
Portfolio debt assets	n.s.	n.s.	(–)
International reserves	n.s.	(+)	n.s.
Gross Liabilities			
FDI liabilities	(–)	(–)	n.s.
Portfolio equity liabilities	(+)	n.s.	n.s.
Portfolio debt liabilities	n.s.	n.s.	n.s.
Cumumulative current account	n.s.	n.s.	(–)
Cumulative valuation adjustments	(–)	n.s.	(–)
Δ NFA			
Current account deficit	(+)	(+)	n.s.
Valuation adjustment	(+)	n.s.	n.s.
No. crises	53	49	53

Source: Authors' calculations.
a. Only the sign of statistically significant coefficients are reported (n.s.: not significant).

2. Foreign Assets and Liabilities and Sovereign Credit Ratings

In this section, we identify whether the size and composition of foreign assets and liabilities help explain the sovereign risk ratings awarded by the rating agencies to developing economies. Our approach consists of modeling sovereign ratings within a maximum-likelihood, ordered probit framework. The credit standing of an obligor, at the end of the period, is assumed to be governed by a latent variable consisting of a random error plus an index of macroeconomic variables.[11]

Indices such as the EMBI, assembled on the basis of price movements in emerging-economy secondary bond markets, are related to the borrowing costs of sovereign or private bond issuers. The correlation and possible causality between qualitative ratings of sovereign risk, on the one hand, and indices of the premiums charged in the secondary sovereign bond markets, on the other, are important factors that have a bearing on the interest rates in emerging economies. This is a direct channel of influence exercised by risk ratings on the macroeconomic management of emerging economies.

The principal international official and private credit risk rating agencies (namely, Moody's and Standard and Poor's) regularly carry out sovereign risk rating exercises. The rating agencies dealing with sovereign risk seek to assess the capacity and willingness of a sovereign government to service its debt within the maturity dates and in accordance with the conditions agreed upon with the creditors at the time the loans were contracted. The outcome of this assessment is synthesized in ratings, which essentially are estimates of the probability that a given government will default—meaning not only the suspension of interest payments or nonpayment of the principal at maturity date, but also its swap or "involuntary" restructuring.

Risk ratings are straightforward indicators available in the public domain, and their fairly widespread use to manage risk exposure is a sign that investors consider them to be appropriate indicators of the probability of default. Ratings are indicators of relative risk across countries. A given country with an Aa rating will not necessarily remain creditworthy, but that tends to be the case more frequently over time than for economies with lower risk ratings. Default rates are sensitive to economic factors at the time they are calculated,

11. In this section, we follow Godoy (2006) in defining the benchmark dependent variables and in the sample of economies, which are listed in the appendix.

and they vary considerably in line with world and local economic cycles. Our exercise tries to disentangle the role of asset and liability holdings, controlling for variables usually reported as explanatory of credit ratings.[12]

Variables commonly used in past studies of credit ratings may be classified as liquidity variables, solvency variables, macroeconomic fundamentals, and external variables. Liquidity variables include the debt-service-to-exports ratio, the interest-to-service ratio, and the liquidity-gap ratio, which all capture short-run financing problems. Most empirical results point to the debt-service-to-exports indicator as the most significant (Hu, Kiesel, and Perraudin, 2002). Solvency variables measure a country's medium- to long-term ability to service its debt; they include the reserves-to-imports and debt-to-GDP ratios. The key macroeconomic fundamentals are the inflation rate, investment/GDP, and GDP growth; and external variables include the U.S. Treasury interest rates and commodity prices.

We estimate an ordered probit model for the period 1990–2004 using a sample of fifty-two developing economies. Block and Vaaler (2004) and Hu, Kiesel, and Perraudin (2002) use the same estimation procedure, based on its better forecasting ability relative to linear procedures. We consider sovereign credit ratings of Moody's and Standard and Poor's separately.

The assumption of ordered probit estimation, which is relatively standard for credit ratings, is that for $j + 1$ rating categories and the initial rating of a particular obligor, i, the terminal rating at the end of one period, j, is determined by the realization of a latent variable, R:

$$\begin{cases} j = 0 & \text{if} \quad R \leq 0 \\ j = 1 & \text{if} \quad 0 < R \leq Z_2 \\ \ldots & \\ j = J + 1 & \text{if} \quad Zj \leq R \end{cases}$$

Zs are scalar cut-off points. It is assumed that $R = \beta X + \xi$, where X is a vector of predetermined variables and ξ is assumed to have a standard normal distribution. The probabilities of being in each category are thus as follows: $\text{Prob}(j = 0) = \Phi(-\beta X)$, $\text{Prob}(j = 1) = \Phi(Z_1 - \beta X), \ldots,$ $\text{Prob}(j = J + 1) = 1 - \Phi(Z_j - \beta X)$.

12. See, for example, Cantor and Parker (1996) for cross-section estimation and Hu, Kiesel, and Perraudin (2002) for panel estimation.

Our dataset of credit ratings is collected directly from Bloomberg and is ordered such that AAA (Aaa) corresponds to 20 and D corresponds to 0 under Standard and Poor's (Moody's) classification. Table 5 presents the results of the baseline estimation. The benchmark variables in the baseline model are the ones we might expect to influence credit ratings standing, and they are also included in past empirical studies as determinants of sovereign ratings. Overall, there is a robust selection of liquidity, solvency, and macroeconomic variables, abstracting from external variables which are partially captured in the domestic macroeconomic variables.[13]

As expected and widely reported in previous contributions, we observe a significant role for GDP growth in Standard and Poor's ratings. Remarkably, per capita income, the inflation rate, and the fiscal deficit are significant for most specifications. The debt-service-to-exports ratio is not significant in Moody's ratings, and it has the wrong sign in Standard and Poor's. A larger current account deficit is associated with a better rating. This last result may be explained by the endogeneity of the series, but it may also reflect the fact that developing countries experienced a strong process of financial integration in the 1990s—mainly through larger indebtedness with the rest of the world. This timeline does not bring enough cross-section variability as an explanatory variable, however. Block and Vaaler (2004) report a similar result for a sample of seventeen emerging market economies.

Including different measures of stocks of foreign assets and liabilities yields several interesting results. Our estimates suggest that net foreign assets have a significant effect on one of the rating agencies only (Standard and Poor's; see column 7). Furthermore, the split between gross assets and gross liabilities shows that while Moody's ratings appear not to depend on any of them, Standard and Poor's reacts to both with effects that are broadly similar (columns 4 and 9).

With regard to net and gross components of net foreign assets (columns 3, 5, 8, and 10), the results show that their effect in the aggregate for Standard and Poor's is explained not only by the role of debt, but also by a significant role of FDI liabilities and equity liabilities. Allowing nonresidents to hold large shares of domestic stocks and firms seems to be positively associated with credit ratings. Debt assets, which are associated with lending to the rest of world, are positively associated with Moody's ratings. Similarly, equity

13. We also performed estimations including the real oil price, and results were unaltered. The model is estimated including country and time dummies.

Table 5. Credit Ratings, Stocks: Ordered Probit Estimation, 1990–2004[a]

	Moody's ratings[b]					*Standard & Poor's ratings*[b]				
Explanatory variable	*(1)*	*(2)*	*(3)*	*(4)*	*(5)*	*(6)*	*(7)*	*(8)*	*(9)*	*(10)*
Real GDP growth	0.016 (0.279)	0.016 (0.286)	0.018 (0.249)	0.016 (0.277)	0.018 (0.243)	0.039 (0.015)**	0.036 (0.019)**	0.041 (0.017)**	0.036 (0.022)**	0.045 (0.015)**
Per capita real GDP (PPP)	0.96 (0.007)***	0.936 (0.007)***	0.703 (0.026)**	0.918 (0.008)***	0.691 (0.035)**	7.407 (0.000)***	7.588 (0.000)***	7.362 (0.000)***	7.575 (0.000)***	8.299 (0.000)***
Inflation rate	−0.294 (0.000)***	−0.309 (0.000)***	−0.219 (0.022)**	−0.311 (0.000)***	−0.226 (0.020)**	−0.227 (0.039)**	−0.195 (0.068)*	−0.07 (0.561)	−0.195 (0.070)*	−0.069 (0.574)
Fiscal deficit / GDP	−6.831 (0.007)***	−6.696 (0.008)***	−6.234 (0.021)**	−6.768 (0.008)***	−5.869 (0.030)**	−12.922 (0.000)***	−12.638 (0.000)***	−13.23 (0.000)***	−12.525 (0.000)***	−8.356 (0.018)**
Debt – services / Exports	1.352 (0.169)	0.789 (0.442)	1.499 (0.129)	0.805 (0.433)	1.593 (0.109)	2.188 (0.061)*	2.491 (0.045)**	3.608 (0.002)***	2.419 (0.055)*	4.092 (0.001)***
Current account deficit / GDP	13.318 (0.000)***	13.866 (0.000)***	11.373 (0.000)***	13.829 (0.000)***	11.092 (0.000)***	16.819 (0.000)***	16.087 (0.000)***	14.236 (0.000)***	16.209 (0.000)***	11.141 (0.000)***
NFA / GDP		−0.191 (0.770)					1.936 (0.008)***			
Net FDI /GDP			−5.127 (0.002)***					−5.204 (0.001)***		
Net portfolio equity / GDP			−2.178 (0.342)					1.556 (0.544)		
Net debt /GDP			2.462 (0.001)***					4.391 (0.000)***		
Assets / GDP				−0.43 (0.673)					2.347 (0.022)**	
Liabilities / GDP				0.205 (0.752)					−1.944 (0.009)***	

Table 5. (continued)

	Moody's ratings[b]					*Standard & Poor's ratings*[b]				
Explanatory variable	*(1)*	*(2)*	*(3)*	*(4)*	*(5)*	*(6)*	*(7)*	*(8)*	*(9)*	*(10)*
Reserves / GDP			1.398 (0.601)		1.566 (0.557)			1.457 (0.599)		2.02 (0.467)
FDI assets / GDP					–3.175 (0.479)					–2.885 (0.445)
FDI liabilities / GDP					4.981 (0.003)***					4.512 (0.004)***
Debt assets / GDP					1.623 (0.199)					1.641 (0.313)
Debt liabilities / GDP					–2.42 (0.001)***					–4.683 (0.000)***
Equity assets / GDP					–0.898 (0.719)					10.62 (0.000)***
Equity liabilities / GDP					3.234 (0.239)					9.734 (0.007)***
No. observations	336	328	317	328	317	323	318	313	318	313
Pseudo R^2	0.42	0.42	0.43	0.42	0.43	0.49	0.49	0.51	0.49	0.53

Source: Authors´ calculations.
* Statistically significant at the 10 percent level. ** Statistically significant at the 5 percent level. *** Statistically significant at the 1 percent level.
a. The regressions were estimated with time and country dummies (not presented). All stocks are in first lags. Robust p values are in parentheses.
b. A rating of AAA for Moody's (Aaa for Standard & Poor's) corresponds to 20; a rating of D corresponds to 0.

assets, which are related to the acquisitions of stocks in external financial markets, seem to be quite significant for Standard and Poor's ratings.

Finally, we evaluate the role of changes in gross assets and liabilities, distinguishing aggregate components (table 6). We do not include the current account, to avoid colinearity with the other explanatory variables. As expected, increases in debt liabilities are negatively associated with credit ratings. Again, we observe a significant effect for FDI liabilities in improving credit ratings.

The above exercises confirm that assets and liabilities have an important effect on the credit ratings of emerging market economies. They also highlight the importance of distinguishing among the different components of countries' international investment position. We find support for the view that FDI liabilities play a part in sovereign ratings, in a context in which FDI has usually been associated with a large potential for generating employment, raising productivity, transferring skills and technology, enhancing exports, and contributing to the long-term economic development of the recipient country.

3. Foreign Assets and Liabilities and the Real Exchange Rate

An increasingly dominant view is that over the business cycle, the real exchange rate tends to move toward an underlying equilibrium value determined by real factors, usually defined by some version of purchasing power parity. Examining the path of the equilibrium exchange rate over time can be extremely helpful in allowing economists to determine the degree to which movements in actual exchange rates have deviated from fundamentals and to offer some idea as to the likely rate of return to the underlying equilibrium. This has immense practical value, as such medium-term trends in exchange rates are an essential tool in assessing current and future macroeconomic conditions in industrial and developing countries.

This section extends previous contributions that assess the role of foreign assets in the long-run dynamics of the real exchange rate. In particular, we evaluate whether the alternative components of external assets affect the real exchange rate in the same way, based on a large panel of countries. An empirical assessment is important for policy analysis since it will allow us to judge whether the process of international financial integration may affect the level and dynamics of an economy's currency.

Table 6. Credit Ratings, Change in Stocks: Ordered Probit Estimation, 1990–2004[a]

	Moody's Ratings[b]						*Standard & Poor's Ratings*[b]					
Explanatory variable	*(1)*	*(2)*	*(3)*	*(4)*	*(5)*	*(6)*	*(7)*	*(8)*	*(9)*	*(10)*	*(11)*	*(12)*
Real GDP growth	0.026 (0.076)*	0.021 (0.141)	0.028 (0.065)*	0.031 (0.041)**	0.029 (0.058)*	0.025 (0.091)*	0.048 (0.001)***	0.045 (0.003)***	0.051 (0.001)***	0.045 (0.004)***	0.048 (0.001)***	0.044 (0.006)***
Per capita real GDP (PPP)	0.955 (0.009)***	0.951 (0.006)***	0.935 (0.011)**	0.765 (0.048)**	0.928 (0.011)**	0.721 (0.045)**	7.506 (0.000)***	7.822 (0.000)***	7.763 (0.000)***	8.409 (0.000)***	8.05 (0.000)***	8.47 (0.000)***
Inflation rate	−0.403 (0.000)***	−0.435 (0.000)***	−0.437 (0.000)***	−0.388 (0.000)***	−0.441 (0.000)***	−0.374 (0.000)***	−0.353 (0.002)***	−0.337 (0.003)***	−0.355 (0.002)***	−0.196 (0.087)*	−0.343 (0.002)***	−0.2 (0.101)
Fiscal deficit / GDP	−7.886 (0.002)***	−7.428 (0.003)***	−7.932 (0.002)***	−8.496 (0.001)***	−6.842 (0.018)**	−7.696 (0.007)***	−13.517 (0.000)***	−12.984 (0.000)***	−13.837 (0.000)***	−12.502 (0.000)***	−16.137 (0.000)***	−15.125 (0.000)***
Debt – services / Exports	1.888 (0.055)*	0.998 (0.310)	1.466 (0.144)	2.271 (0.024)**	1.618 (0.100)*	2.035 (0.036)**	2.42 (0.039)**	2.017 (0.100)	2.057 (0.096)*	4.359 (0.000)***	2.249 (0.061)*	3.856 (0.003)***
(ΔFDI assets) / GDP		−3.597 (0.490)				−3.77 (0.510)		3.263 (0.663)				−3.71 (0.610)
(ΔFDI liabilities) / GDP		3.472 (0.033)**				3.634 (0.078)*		1.767 (0.256)				4.037 (0.099)*
(ΔEquity assets) / GDP				0.361 (0.800)		1.683 (0.200)				2.747 (0.093)*		2.684 (0.101)
(ΔEquity liabilities) / GDP				−1.69 (0.057)*		−3.284 (0.000)***				−5.16 (0.000)***		−5.214 (0.000)***
(ΔDebt assets) / GDP			4.655 (0.344)			2.788 (0.619)			12.848 (0.028)**			9.201 (0.154)
(ΔDebt liabilities) / GDP			1.923 (0.376)			0.22 (0.929)			−1.606 (0.619)			0.353 (0.915)
(ΔReserves) / GDP					2.51 (0.273)	2.053 (0.447)					−6.613 (0.001)***	−7.616 (0.005)***
No. observations	336	321	324	328	329	317	323	318	313	318	319	313
Pseudo R^2	0.39	0.39	0.39	0.40	0.39	0.41	0.45	0.45	0.45	0.48	0.46	0.49

Source: Authors´ calculations.

* Statistically significant at the 10 percent level. ** Statistically significant at the 5 percent level. *** Statistically significant at the 1 percent level.

a. The regressions were estimated with time and country dummies (not presented). All stocks are in first lags. Robust p values are in parentheses.

b. A rating of AAA for Moody's (Aaa for Standard & Poor's) corresponds to 20; a rating of D corresponds to 0.

As our starting point, we consider the same basic specification that has been used elsewhere to evaluate the effect of fundamentals on the real exchange rate. In particular, we use the specification and country sample outlined in Aguirre and Calderón (2005). They construct a series of equilibrium real exchange rate measures for a large group of countries to obtain misalignment estimates; they then use standard empirical growth equations to evaluate how misalignment estimates affect growth.

The specification follows the so-called single-equation approach, which relates the real exchange rate to a particular set of fundamentals in a reduced form and has a long tradition in empirical international finance. Edwards (1989), Obstfeld and Rogoff (1995), and Faruqee (1994) provide theoretical underpinnings that motivate the type of fundamentals to be considered. Almost all of the fundamentals have an effect on the real exchange rate from a flow perspective. Higher productivity will appreciate the domestic currency in real terms (appreciate the real exchange rate herein) through the well known Balassa-Samuelson effect. More favorable terms of trade allow the country to spend more, thereby pressuring nontradable goods prices and appreciating the real exchange rate. A larger participation of government spending will appreciate the real exchange rate through a composition effect (which is usually assumed to be relatively nontradables intensive) or just as an aggregate demand effect if there is not perfect capital mobility.

More importantly for the purpose of this paper, the stock of net foreign assets (as a ratio to GDP) should influence the real exchange rate because owning more assets has a counterpart in larger revenues earned (a surplus in factor payments), which in turn can finance a larger sustainable commercial deficit in steady state. This larger commercial deficit is coherent only with a more appreciated real exchange rate. Of all the fundamentals considered, net foreign assets is the only one that is a stock. Its impact, however, stems from its flow effect on the current account.

In principle, if all components of net foreign assets have the same rate of return, they should have the same effect on the equilibrium real exchange rate, for they would produce the same income flow. Nevertheless, expected returns may differ across particular assets and liabilities. More importantly, the different components of net foreign assets can have very different valuation effects, which in turn may depend on the exchange rate. The dynamics of the real exchange rate could also be influenced by the flows associated with the changing stocks. In this case, an increase in a particular asset could end up depreciating the exchange rate, at least temporarily.

Several studies use a specification similar to the one we use here to study the effects of different fundamentals on the real exchange rate. Goldfajn and Valdés (1999) use a very similar approach to calculate misalignments and study the way they are resolved. Valdés and Délano (1999) use the same type of model to explore the quantitative relevance of the Balassa-Samuelson effect. Razin and Collins (1997) consider panel fundamental real exchange rate equations to study the effects of misalignments on growth. Edwards and Savastano (2000) survey other papers that make use of this approach.

The basic specification we consider includes a real exchange rate constructed from the domestic consumer price index (CPI) and the wholesale price index (WPI) of trading partners, while productivity is measured as the relative tradables-to-nontradables labor productivity. Net foreign assets corresponds to the series constructed by Lane and Milessi-Ferreti (2001), updated with capital account information.

The results of the basic specification (column 1 in table 7) are the same as in Aguirre and Calderón (2005). The four fundamentals have the expected sign and are highly significant: higher productivity, improved terms of trade, a larger share of government consumption in GDP, and higher net foreign assets (as a percentage of GDP) are all correlated with a more appreciated domestic currency in real terms. Furthermore, the tests on the stationarity of residuals show that the variables cointegrate (table 8).[14]

When we split the whole sample into industrial and developing countries, the results of the former continue to meet expectations.[15] In the developing countries' subsample, however, productivity is no longer statistically significant, whereas terms-of-trade shocks appear to depreciate the real exchange rate. Cointegration continues to hold.

When we consider alternative decompositions of net foreign assets, the results show that gross assets and gross liabilities have quite similar effects on the real exchange rate in all three cases (with the opposite sign) (column 2). More external assets or less gross liabilities equivalent to one percentage point of GDP appreciate the real exchange rate by approximately 0.1 percent if one considers the full sample and the subsample industrial countries. For developing countries, assets appear to appreciate the real exchange rate by almost 0.15 percent, while liabilities depreciate it by 0.1 percent.

14. Rank cointegration test is available on request.
15. The list of countries included in each group is in the appendix.

Table 7. Long–Run Real Exchange Rate Equations: Panel Cointegration[a]

	All Countries				*Industrial Countries*				*Developing Countries*			
Variable	*(1)*	*(2)*	*(3)*	*(4)*	*(1)*	*(2)*	*(3)*	*(4)*	*(1)*	*(2)*	*(3)*	*(4)*
Productivity	0.160**	0.148**	0.095*	0.0861	0.409***	0.431***	0.393***	0.572***	–0.157	–0.168*	–0.284**	–0.492
	(0.03)	(0.02)	(0.10)	(0.18)	(0.00)	(0.00)	(0.00)	(0.00)	(0.11)	(0.08)	(0.02)	(0.31)
Terms of trade	0.244***	0.244***	0.227***	0.380***	0.428***	0.432***	0.426***	0.431***	–0.109*	–0.111*	–0.139**	–0.089
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.07)	(0.06)	(0.03)	(0.24)
Government consumption / GDP	0.267***	0.267***	0.263***	0.334***	0.442***	0.435***	0.437***	0.260***	0.114***	0.109**	0.141***	0.243***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.04)	(0.00)	(0.00)
NFA / GDP	0.093**				0.088**				0.010*			
	(0.02)				(0.02)				(0.07)			
Assets / GDP		0.103**				0.093**				0.148**		
		(0.02)				(0.02)				(0.02)		
Liabilities / GDP		–0.086***				–0.089**				–0.103*		
		(0.01)				(0.02)				(0.06)		
Net FDI / GDP				–0.067				–0.163**				–0.212
				(0.26)				(0.02)				(0.24)
Net portfolio / GDP				0.237***				0.194***				–0.439
				(0.00)				(0.00)				(0.14)
Net debt / GDP				0.147***				0.006				0.325***
				(0.00)				(0.44)				(0.00)
Reserves / GDP				–0.752***				–0.743				–1.573***
				(0.00)				(0.22)				(0.00)
Cum. current account / GDP			0.177***				0.119**				0.333**	
			(0.00)				(0.03)				(0.02)	
Net valuation (A – L) / GDP			–0.069*				0.065*				–0.220**	
			(0.07)				(0.09)				(0.01)	
No. observations	1815	1815	1815	888	660	660	660	480	924	924	924	312
R^2	0.14	0.15	0.18	0.28	0.37	0.38	0.38	0.40	0.04	0.04	0.13	0.25

Source: Authors' calculations.
* Statistically significant at the 10 percent level. ** Statistically significant at the 5 percent level. *** Statistically significant at the 1 percent level.
a. Panel DOLS estimates for each group of countries, accounting for country and time effects. p values are in parentheses.

Table 8. Long–Run Real Exchange Rate Equations: Residual–Based Cointegration Tests[a]

	All Countries				*Industrial Countries*				*Developing Countries*			
	NFA / GDP	*CCA / GDP*	*Assets / GDP*	*NFDI / GDP*	*NFA / GDP*	*CCA / GDP*	*Assets / GDP*	*NFDI / GDP*	*NFA / GDP*	*CCA / GDP*	*Assets / GDP*	*NFDI / GDP*
		Net val. / GDP	*Liab. / GDP*	*NPort / GDP*		*Net val. / GDP*	*Liab. / GDP*	*NPort / GDP*		*Net val. / GDP*	*Liab. / GDP*	*NPort / GDP*
				NDebt / GDP				*NDebt / GDP*				*NDebt / GDP*
				IR / GDP				*IR / GDP*				*IR / GDP*
Cointegration test												
Homogeneous residual–based cointegration tests (p values) [b]												
DF(rho)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.002)	(0.000)
DF(t_rho)	(0.001)	(0.000)	(0.000)	(0.002)	(0.003)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
ADF	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.002)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
McCoskey and Kao (1998)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.002)
Panel LM	(0.002)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Pedroni (1995)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.002)	(0.000)	(0.002)	(0.000)	(0.000)	(0.000)	(0.000)
TN1(rho)	(0.000)	(0.000)	(0.000)	(0.002)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
TN2(rho)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.002)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Heterogeneous residual–based cointegration tests (p–values) [c]												
Panel–v	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Panel–rho	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Panel–t (nonparametric)	(0.002)	(0.000)	(0.002)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Panel–t (parametric)	(0.000)	(0.000)	(0.000)	(0.000)	(0.002)	(0.000)	(0.000)	(0.002)	(0.000)	(0.000)	(0.000)	(0.000)
Group rho	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.002)	(0.000)
Group–t (nonparametric)	(0.002)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Group–t (parametric)	(0.000)	(0.000)	(0.000)	(0.002)	(0.000)	(0.001)	(0.002)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)

Source: Authors' calculations.
a. Test includes Productivity, Terms of Trade and Government Consumption. Each specification of the test is extended by the variables showed at the beginning of the column.
b. Kao (1999).
c. Pedroni (1999).

Although gross assets and liabilities appear roughly equally important in determining the real exchange rate, different components of net foreign assets have quite different effects (column 3). Considering all countries together, we find that while the cumulative current account has a positive effect on the real exchange rate (as expected in theory), the valuation effect has a negative one, albeit smaller in magnitude. Within the subsamples, the current account result still holds (with a larger effect in developing countries), but the valuation effect has a positive impact in industrial countries and a rather large negative effect in developing countries. Part of this could be the result of a reverse causality problem: in developing countries, real exchange rate depreciation may have a larger adverse consequence for valuation effects (that is, a larger share of their liabilities is denominated in foreign currency).

As for different components by type of flows (column 4), FDI does not have any significant impact on the real exchange rate for the full sample, whereas net portfolio and net debt assets have a strong positive effect. International reserve assets appear to depreciate the real exchange rate. Some of these results do not hold for both subsamples simultaneously. In fact, both net debt and reserve accumulation appear to be quite relevant for developing countries' real exchange rate, which is not the case in industrial economies.[16] Net portfolio significantly appreciates the real exchange rate only in the subsample of industrial countries.

4. Conclusions

Despite several external crises, financial integration has intensified in recent decades in industrial and developing countries. This has been accompanied by significant changes in the composition of countries' international investment position. Large holdings of foreign assets and liabilities, along with increasing relevance of the valuation effects, have characterized the international financial integration of economies.

In this paper, we have empirically assessed the implications of stocks, flows, and valuation adjustments in current account reversals, sudden stops, speculative attacks, and sovereign ratings, as well as in the long-run dynamics of real exchange rates in industrial and

16. The results should be compared with some care, considering that the actual samples change depending on data availability.

developing economies. The paper has tackled a number of policy-oriented questions. First, it assessed whether the size of net foreign assets (a stock beyond current flows) is an important determinant of crises and creditworthiness. Second, it evaluated whether gross external assets and liabilities have differentiated roles in determining the likelihood of crises, the real exchange rate, and creditworthiness. Third, it estimated the effects of different components of net external assets on different outcomes. Finally, it explored the differences and similarities between valuation effects and the impact of accumulated flows in different dimensions.

We found support for the view that assets and liabilities are rather distinctive external holdings with different implications for the occurrence of an external crisis. In general, flows do not influence the likelihood of currency attacks and are quite relevant for current account reversals and sudden stops. A higher stock of net foreign assets reduces the likelihood of currency crises, while its composition is what matters for reversals and sudden stops: more portfolio equity assets and FDI liabilities reduce the likelihood of these crises. Furthermore, cumulative valuation adjustments seem to have a statistically significant impact on current account reversals and currency crises.

In the long-run dynamics of the real exchange rate, gross assets and liabilities appeared to be equally important, but components of external holdings have considerably different effects. While the cumulative current account is associated with real depreciation of the currency in the long run, a valuation effect is strongly linked with real currency appreciations in developing economies.

From an economic policy perspective, our work sheds light on the importance of how economies integrates with the rest of world. The amount of assets and liabilities the economy accumulates is not innocuous. Some assets and liabilities, and the flows associated with them, may trigger important valuation effects that, along with the external holdings, certainly are significant in the mechanism for adjusting to external shocks and in the constraints the economy faces in the international financial markets. Further research on this issue is unquestionably a must for academia and policymakers.

APPENDIX

Data sources and Sample Definition

The data for the estimations on current account reversals correspond to Edwards (2005b). The data set for the estimations on exchange rate market pressure corresponds to García and Soto (2005). These data sets were enlarged with the foreign assets and liabilities of the main components of the international investment position prepared by Lane and Milesi-Ferretti (2006).[17] Valuation adjustments were constructed subtracting from the net foreign asset position (assets and liabilities) the cumulative current account taken from the IMF's International Financial Statistics. All stock and flow series are over current GDP in dollars.

For the credit ratings estimations, we take the year-end sovereign ratings released by Standard and Poor's and Moody's for the period 1990–2005. Ratings were converted into a numeric scale as indicated in table A1.

For the panel real exchange rate, we take the real exchange rate, productivity, government consumption, and terms of trade from Aguirre and Calderón (2005). Foreign assets and liabilities are again taken from Lane and Milesi-Ferretti (2006). Country and fixed effects were removed from the series on foreign assets and liabilities before performing the long-run estimations.

We used a sample of 136 countries for our analysis of current account reversals, currency crises, and sudden stops. The full sample encompasses 33 industrial and 103 developing countries. See table A2 for the complete list.

The real exchange rate panel regressions include 49 countries. The 20 industrial countries in the sample are Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Japan, Netherlands, Norway, New Zealand, Portugal, Spain, Sweden, the United Kingdom, and the United States. The 29 developing countries in the sample are Argentina, Bolivia, Brazil, Chile, Colombia, Côte d'Ivoire, Costa Rica, Dominican Republic, Ecuador, Egypt, Indonesia, India, Jamaica, Jordan, Korea, Mexico, Morocco, Norway, Pakistan, Panama, Peru, Philippines, Syrian Arab Republic, Thailand, Trinidad and Tobago, Tunisia, Turkey, Uruguay, and Venezuela.

17. Available at www.imf.org/external/pubs/ft/wp/2006/data/wp0669.zip.

Table A1. Numeric Conversion of Standard and Poor's and Moody's Ratings

Standard & Poor's	*Moody's*	*Numeric Scale*
AAA	Aaa	20
AA+	Aa1	19
AA	Aa2	18
AA-	Aa3	17
A+	A1	16
A	A2	15
A-	A3	14
BBB+	Baa1	13
BBB	Baa2	12
BBB-	Baa3	11
BB+	Ba1	10
BB	Ba2	9
BB-	Ba3	8
B+	B1	7
B	B2	6
B-	B3	5
CCC+	Caa1	4
CCC	Caa2	3
CCC-	Caa3	2
CC	Ca	1
D	D	0

Source: Authors' construction.

The credit rating regressions are based on the following 52 countries: Argentina, Bolivia, Brazil, Bulgaria, Chile, China, Colombia, Costa Rica, Croatia, Czech Republic, Dominican Republic, Ecuador, Egypt, El Salvador, Estonia, Fiji Islands, Guatemala, Honduras, Hungary, India, Indonesia, Israel, Jordan, Kazakhstan, Korea, Latvia, Lebanon, Lithuania, Malaysia, Mauritius, Mexico, Moldova, Morocco, Oman, Pakistan, Panama, Papua New Guinea, Paraguay, Peru, Philippines, Poland, Romania, Russian Federation, Slovak Republic, South Africa, Thailand, Trinidad and Tobago, Turkey, Ukraine, Uruguay, Venezuela, and Vietnam.

Table A2. List of Countries Used for the Current Account Reversals, Currency Crises, and Sudden Stops

Industrial	*Developing*		
Australia	Albania	Ghana	Oman
Austria	Algeria	Guatemala	Pakistan
Bahrain	Angola	Guinea	Panama
Belgium	Argentina	Haiti	Papua New Guinea
Canada	Armenia	Honduras	Paraguay
Cyprus	Azerbaijan	Hungary	Peru
Denmark	Bangladesh	India	Philippines
Finland	Belarus	Indonesia	Poland
France	Benin	Iran, Islamic Rep.	Romania
Germany	Bolivia	Jamaica	Russian Federation
Greece	Bosnia and Herzegovina	Jordan	Rwanda
Hong Kong, China	Brazil	Kazakhstan	Saudi Arabia
Iceland	Bulgaria	Kenya	Senegal
Ireland	Burkina Faso	Kyrgyz Republic	Slovak Republic
Israel	Cambodia	Laos PDR	South Africa
Italy	Cameroon	Latvia	Sri Lanka
Japan	Chad	Lebanon	Sudan
Kuwait	Chile	Libya	Swaziland
Luxembourg	China	Lithuania	Tajikistan
Malta	Colombia	Macedonia, FYR	Tanzania
Netherlands	Congo, Dem. Rep.	Madagascar	Thailand
New Zealand	Congo, Rep.	Malawi	Togo

Table A2. (continued)

Industrial	*Developing*		
Norway	Costa Rica	Malaysia	Trinidad and Tobago
Portugal	Croatia	Mali	Tunisia
Qatar	Czech Republic	Mauritius	Turkey
Singapore	Dominican Republic	Mexico	Uganda
Slovenia	Ecuador	Moldova	Ukraine
Spain	Egypt, Arab Rep.	Morocco	Uruguay
Sweden	El Salvador	Mozambique	Venezuela, RB
Switzerland	Equatorial Guinea	Myanmar	Vietnam
United Arab Emirates	Estonia	Namibia	Yemen, Rep.
United Kingdom	Ethiopia	Nepal	Zambia
United States	Fiji	Nicaragua	Zimbabwe
	Gabon	Niger	
	Georgia	Nigeria	

Source: Authors' construction.

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Financial Frictions and Business Cycles in Middle-Income Countries

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Empirical analysis reveals three regularities among middle-income countries: consumption is highly procyclical and more volatile than output, investment is highly procyclical and three to four times as volatile as output, and real net exports are countercyclical and about three times as volatile as output. Standard dynamic stochastic general equilibrium (DSGE) small open economy models have failed to match these regularities, as they predict excessive consumption smoothing, low procyclicality and volatility of investment, and procyclical real net exports. Some studies tackle these problems by increasing the persistence of shocks (Aguiar and Gopinath, 2004 and in this volume) or by lowering the intertemporal elasticity of substitution, as when using the preferences introduced by Greenwood, Hercowitz, and Hoffman (1988) (Mendoza, 1995, 2001; Neumeyer and Perri, 2005).

This study approaches the problem by considering market imperfections relevant for middle-income countries; a limited access to the foreign capital market, identified as an external borrowing constraint; and asymmetric financing opportunities across tradable and nontradable firms, identified as a sector-specific labor-financing wedge (Caballero, 2002; Tornell and Westermann, 2003). The key parameters associated with these frictions are deduced to match selected data for Chile between 1986 and 2004, given the lack of data on the economy's net foreign asset position and sectoral financing costs. This exercise narrows the discussion to whether the cyclical properties of the deduced variables make sense according to previous

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studies, or whether they could be representing some other distortions not identified in the model.

I conclude that a model with an external borrowing constraint can capture the procyclical and volatile path of investment and consumption of tradable goods and produce countercyclical real net exports. However, it generates countercyclical employment and a low volatility of nontradables consumption. Introducing a countercyclical sector-specific labor-financing wedge enables the model to capture the cyclical pattern of these other variables, as well. Moreover, the cyclical properties of the key variables associated with both frictions are consistent with previous studies (Caballero, 2002; Tornell and Westermann, 2003).

An external borrowing constraint may arise from problems of enforceability and risk of default. Atkeson and Rios-Rull (1996) and Caballero and Krishnamurthy (2001) identify this friction as collateral constraints, in which part of the export sector's profits or revenues could be seized by external lenders in case of default. Eaton and Gersovitz (1981), Bulow and Rogoff (1989), Atkeson (1991), Kehoe and Levine (1993), Kocherlakota (1996), Alvarez and Jermann (2000), and Jeske (2001) consider exclusion from the external capital market as the punishment for defaulting.

Atkeson (1991) derives an external borrowing constraint in an environment in which foreign lending takes place under moral hazard and risk of repudiation. External lenders cannot observe whether borrowers are investing the borrowed funds efficiently or consuming them, and sovereign borrowers can repudiate their debt at any time. With no moral hazard and risk of repudiation, the optimal contract produces full risk sharing between domestic agents and foreign lenders. With these problems, however, foreign lenders can infer the domestic agents' allocations only after output is realized. The optimal contract reduces risk sharing, transferring part of the output risk to the domestic borrowers and thereby inducing them to invest efficiently and repay their loans.

For practical convenience, the constraint is set as the foreign lenders' requirement for domestic households to self-finance a fraction of their expenditures, $0 < \Psi_t < 1$, with their current income at each date t, as in Mendoza (2001). I then deduce Ψ_t to match the path of the real net exports in Chile between 1986 and 2004. Full risk sharing is equivalent to a sufficiently procyclical Ψ_t, so that domestic agents can borrow more relative to income in bad times than in good to smooth expenditures. Partial risk sharing is equivalent to a less than sufficiently procyclical Ψ_t and less expenditure smoothing. The constraint should always bind to prevent domestic agents from building up savings that would lead them to repudiate their debt.

In the simulations for Chile, the external constraint slackens when the economy receives positive shocks and tightens when it faces negative shocks, but not enough to produce full risk sharing. External financing becomes more (less) expensive during recessions (booms), increasing the procyclicality and volatility of investment and tradable goods consumption. It also reduces the procyclicality of output of export goods, as there is less reallocation of production factors across sectors, and it makes real net exports as countercyclical as in the data. However, this friction makes employment countercyclical and does not increase the volatility of nontradables consumption as much as in the data. A countercyclical labor-financing wedge would help the model match these moments by making labor demand more procyclical and volatile.

The sectoral labor-financing wedge reflects credit constraints at the firm level. They may arise from informational or enforcement problems, which could be very severe for small and medium-sized firms that lack the collateral to secure loans. Holmström and Tirole (1998) derive credit constraints for firms from moral hazard problems, while Bernanke and Gertler (1989) do it from costly state verification problems. Albuquerque and Hopenhayn (2004) and Medina (2004) derive them from enforcement problems. Kiyotaki and Moore (1997) and Caballero and Krishnamurthy (2001) represent them as collateral constraints. Tornell and Westermann (2003), using firm-level data for twenty-seven middle-income countries, find that financing is a more severe obstacle for firms in the nontradables sector, as they are mostly small and medium-sized firms that lack collateral.

Here, I set this friction as a firm's specific labor-financing wedge, which represents the lending spread each firm is charged for the credit needed to pay wages in advance of production. The spread depends on the firm's available collateral, as in Chari, Kehoe, and McGrattan (2003).[1] The wedges are deduced to allow the model to replicate the path of output in the data for each sector. Consistent with previous studies, the resulting wedges are countercyclical, particularly in the nontradables sector, reflecting a lower cost of financing during

1. This specification could be capturing some other distortions in the labor market, such as sticky wages or unions (Chari, Kehoe, and McGrattan, 2003) or labor market regulations (Caballero and others, 2004).

booms when the collateral's value increases and a higher cost during downturns when the opposite valuation effect occurs. The wedge allows the model to generate procyclical employment, as labor demand becomes more procyclical and volatile, and to increase the volatility of nontradables consumption.

Although this study does not endogenize the source of market imperfections, it presents a simulated scenario for a lower incidence of frictions to show what the economy's cyclical properties would have been if it had better access to external and domestic financing. The self-financing requirement is made more procyclical and volatile to achieve a constant borrowing constraint multiplier over time, and the cyclical fluctuations of the sector-specific labor-financing wedge are reduced. The cyclical properties of this economy would be qualitatively similar to the frictionless case; the volatility of consumption and investment would be smaller, and total work hours and the output of exportable goods would be more procyclical and volatile, resulting in procyclical and less volatile real net exports. This scenario would be welfare improving, as households value a smoother path of consumption over time.

The paper is organized as follows. Section 1 presents a discussion of the empirical evidence and related literature. Section 2 presents the model and simulations for the standard friction-less economy. I then derive variations of the base model: section 3 presents the model and simulations for an externally credit constrained economy, section 4 for an economy with asymmetric financing opportunities, and section 5 for an economy that features both frictions. Section 6 concludes.

1. Empirical Evidence and Related Literature

This section compares the moments of middle-income countries and small developed economies to highlight the particular features of middle-income countries. Table 1 presents statistics for output, consumption, investment, real net exports, and the terms of trade for twenty-seven middle-income countries and the average of sixteen small developed economies for annual data between 1980 and 2004. Each variable corresponds to the log deviation from its trend, which was obtained using the Hodrick-Prescott filter with a smoothing parameter of 100. The statistics presented are the first-order autocorrelation and standard deviation of gross domestic product (GDP) and the cross-correlations and standard deviations of consumption, investment, real net exports and terms of trade relative to GDP.

Table 1. Business Cycles Moments, Annual Data: 1980–2004[a]

Country	*(1) Autocorr. Y*	*(2) St. dev. Y*	*(3) Correl. C to Y*	*(4) St. dev. C/ St. dev.Y*	*(5) Autocorr. I*	*(6) Correl. I to Y*	*(7) St. dev. I/ St. dev. Y*	*(8) Correl. NE/Y to Y*	*(9) St. dev. NE/Y*	*(10) Autocorr. TOT*	*(11) St. dev. TOT/ St. dev. Y*
Small developed countries[b]	0.67	2.31	0.79	0.86	0.55	0.83	3.99	–0.45	1.35	0.53	1.70
Middle-income countries[c]											
Argentina	0.55	5.87	0.93	1.22	0.46	0.91	3.27	–0.90	2.17	0.36	1.42
Bolivia	0.82	3.02	0.56	0.88	0.53	0.55	5.59	0.17	2.96	0.24	4.28
Brazil	0.57	3.75	0.91	0.97	0.55	0.91	2.78	–0.41	1.12	0.45	0.55
Chile	0.67	5.70	0.97	1.22	0.51	0.93	3.08	–0.90	2.56	0.33	1.16
Colombia	0.71	2.54	0.86	1.21	0.61	0.71	6.25	–0.56	3.13	0.24	3.18
Costa Rica	0.57	3.53	0.81	1.21	0.41	0.66	4.21	–0.38	3.42	0.48	1.90
Dominican Rep.	0.50	3.32	0.79	1.40	0.42	0.70	3.66	–0.59	3.72	0.32	2.33
Ecuador	0.29	2.97	0.81	1.02	0.22	0.69	5.03	–0.47	3.84	0.37	3.30
El Salvador	0.66	3.05	0.84	1.17	0.36	0.30	3.53	–0.01	2.43	0.21	3.59
Guatemala	0.85	3.07	0.98	0.85	0.44	0.58	4.12	0.00	1.25	0.35	2.35
Honduras	0.40	2.28	–0.05	1.76	0.31	0.53	7.20	0.05	1.97	0.24	2.33
Hong Kong	0.26	2.96	0.71	1.02	0.56	0.54	3.35	–0.14	2.72	0.20	0.39
Indonesia	0.63	4.68	0.64	1.22	0.62	0.94	3.27	–0.48	3.22	0.56	2.85
Korea, Rep. of	0.50	3.21	0.89	1.12	0.47	0.86	3.36	–0.65	2.87	0.83	1.43
Malaysia	0.69	4.71	0.85	1.46	0.65	0.95	4.29	–0.83	6.73	0.23	0.83
Mexico	0.64	4.28	0.93	1.05	0.44	0.84	3.89	–0.64	3.10	0.63	3.17

Table 1. (continued)

Country	*(1) Autocorr. Y*	*(2) St. dev. Y*	*(3) Correl. C to Y*	*(4) St. dev. C/ St. dev.Y*	*(5) Autocorr. I*	*(6) Correl. I to Y*	*(7) St. dev. I/ St. dev. Y*	*(8) Correl. NE/Y to Y*	*(9) St. dev. NE/Y*	*(10) Autocorr. TOT*	*(11) St. dev. TOT/ St. dev. Y*
Panama	0.65	5.51	0.60	1.10	0.40	0.81	5.89	–0.66	3.40	0.50	1.36
Paraguay	0.76	3.95	0.65	1.29	0.72	0.91	3.11	–0.41	3.44	0.32	2.03
Peru	0.62	6.71	0.89	1.07	0.62	0.76	2.48	–0.64	1.60	0.37	1.72
Philipines	0.70	4.35	0.93	0.56	0.57	0.92	4.00	–0.59	2.47	0.48	1.02
Singapur	0.63	4.18	0.66	0.68	0.54	0.84	3.51	–0.43	2.52	0.57	0.27
Sri Lanka	0.58	1.77	0.77	1.35	0.71	0.59	5.48	–0.33	3.25	0.27	4.70
Taiwan	0.58	2.52	0.73	1.10	0.66	0.79	4.36	–0.38	2.58	0.58	0.98
Thailand	0.75	5.38	0.97	0.92	0.64	0.95	3.88	–0.85	4.40	0.31	0.73
Turkey	0.18	3.42	0.89	1.05	–0.17	0.85	3.67	–0.63	2.73	0.45	2.31
Uruguay	0.68	6.06	0.97	1.21	0.72	0.89	3.71	–0.89	3.79	0.58	0.95
Venezuela	0.37	4.58	0.69	1.17	0.11	0.78	5.39	–0.53	4.06	0.32	3.66
Average	0.59	3.98	0.78	1.12	0.48	0.77	4.16	–0.48	3.02	0.40	2.03

Source: IMF, World Economic Outlook; author's Calculations.
a. Data are HP filtered.
b. Simple average of Australia, Austria, Belgium, Canada, Denmark, Finland, Greece, Iceland, Ireland, Netherlands, Norway, New Zealand, Portugal, Spain, Sweden, and Switzerland.
c. Excludes middle-income countries from Africa and the Middle East.

The first distinctive feature is that GDP is almost twice as volatile in the middle-income countries as in the small developed economies, but only slightly less persistent. Second, while investment is as volatile relative to output in both groups of countries, consumption and real net exports are significantly more volatile relative to output in middle-income countries than in small developed economies. Third, all three expenditure items present roughly the same contemporaneous cross-correlation with GDP in the two groups of countries. These findings are robust to different data frequency. Aguiar and Gopinath (2004) present similar evidence at a quarterly frequency for a smaller sample of small developed economies and middle-income countries. They find the same differences in volatility and similarities in correlations with output, except for the ratio of real net exports to GDP, which is more countercyclical in middle-income countries than in small developed economies at quarterly frequency.

One concern with the moments presented in table 1 is whether they are representative of normal business cycles fluctuations in middle-income countries or are biased as a result of crises. Although table 1 does not abstract from periods of crisis, Tornell and Westermann (2002) argue that the typical lending booms that characterize middle-income countries business cycles commonly end in a soft landing with the same moments as in crisis periods, but with less volatility. To avoid this problem, this paper studies the case of Chile between 1986 and 2004, abstracting from its last crisis in 1982.

Earlier studies reproduce the high volatility of consumption and real net exports in middle-income countries by lowering the intertemporal elasticity of substitution, by increasing the shocks' persistence, or by considering frictions in the access to foreign and domestic financing. With regard to the former, Mendoza (1995, 2001) and Neumeyer and Perry (2005), for Mexico and Argentina, respectively, solved the problem by using Greenwood, Hercowitz, and Hoffman's (1988) preferences or by lowering the intertemporal elasticity of substitution. Greenwood, Hercowitz, and Hoffman's (1988) preferences make the labor-leisure decision dependent only on real wages, which makes work hours, consumption, and investment more procyclical and volatile, while real net exports become countercyclical. A lower intertemporal elasticity of substitution produces similar results.

Some empirical studies estimate a lower intertemporal elasticity of substitution for middle-income countries than for small developed economies (Ostry and Reinhart, 1992; Barrionuevo, 1993), but Domeij (2006) shows that such estimates would be biased downward if borrowing constraints are ignored in the estimation. He applies standard econometric methods to artificial data constructed for credit-constrained agents, but ignores the constraints in the estimation. This results in an estimated intertemporal elasticity of substitution 50 percent lower than the true elasticity with which the data were built.

With regard to increasing the shocks' persistence, Aguiar and Gopinath (2004 and in this volume) introduce a permanent shock to the trend growth rate of productivity into an otherwise standard DSGE small open economy model, to replicate the cyclical regularities of Mexico. This model could replicate the high volatility of consumption and real net exports observed in middle-income countries, but it relies largely on the strong persistence of the shock to the trend growth rate of productivity, which creates larger procyclical fluctuations in consumption and investment and larger countercyclical fluctuations in real net exports than do shocks to productivity around a trend.

There is no evidence that foreign or domestic shocks are, in fact, more persistent in middle-income countries than in small developed economies. Although there are no data on total factor productivity across countries, the cyclical properties of output and investment offer clues. More persistent productivity shocks would presumably result in more persistent fluctuations in output and investment, as the marginal productivity of capital varies directly with the shock. However, column 1 in table 1 shows that output is slightly less persistent in the middle-income countries than in the small developed economies, while columns 5 and 6 show that investment is less persistent and procyclical in the middle-income countries. For foreign shocks, columns 10 and 11 show that the terms of trade are less persistent, but more volatile in the middle-income countries, while the foreign interest rate shocks should be as persistent and volatile across groups as long as the risk premium is endogenous.

Finally, with regard to frictions in the access to foreign and domestic financing, Caballero (2000) studies the source of volatility in three Latin American middle-income countries: namely, Argentina, Chile, and Mexico. He finds that these economies are weak in their links with the foreign capital market and in the development of their domestic financial markets. These frictions can account for a large share of the fluctuations and crises in modern Latin America, either directly or by leveraging a variety of shocks. Tornell and Westermann (2002, 2003) provide evidence of asymmetric financing opportunities across tradable and nontradable firms for a sample of twenty-seven middle-income countries. Estimating an ordered probit model, they find that financing was a more severe obstacle for the nontradable firms, as they were mostly small and medium-sized firms that lack the collateral to secure loans.

Caballero and Krishnamurthy (2001) analyze the interaction of these two frictions in a stylized model with two types of collateral constraints: firms in the domestic economy have limited borrowing capacity from foreign investors and from each other. Their interaction produced two suboptimal allocations. First, disintermediation, by which a fire sale of domestic assets causes banks to fail, triggered a reallocation of resources across firms and resulted in wasted international collateral. Second, a dynamic effect results when firms with limited domestic collateral and a binding international collateral constraint do not take adequate precautions against adverse shocks, thereby increasing their severity.

This paper takes Chile as a case study for three reasons. First, it presents roughly the same cyclical moments as other middle-income countries, although with less volatility. Comparing table 2 with columns 1 through 9 in table 1 reveals that the first-order autocorrelation of output is roughly the same in Chile as in other middle-income countries, while the standard deviation of output is about half the average of middle-income countries. Consumption and investment are both a little more procyclical in Chile, but as volatile relative to output, while real net exports are more countercyclical and a little less volatile. Second, Chile is frequently cited in the literature for its disciplined economic policy, which makes it reasonable to abstract from monetary and fiscal policy shocks. This reduces the model to a simple exchange-production economy, similar to that used by Aguiar and Gopinath (2004 and in this volume), Mendoza (1995, 2001), and Neumeyer and Perry (2005). Third, Caballero (2000, 2002) finds an active role of the two financial frictions studied here in Chile's business cycles in the 1990s. With regard to the limited access to the foreign capital market, he shows that in 1999 consumption and the current account deficit fell more than what could be explained by the negative terms-of-trade shock, in part because of the decline in capital inflows. With regard to domestic financing opportunities, he shows that domestic banks reacted to the shock by slowing down private loans, even though domestic deposits were growing fast. They substituted private domestic loans with public debt and external assets, and they allocated a higher fraction of their credit to large firms, reducing the access to credit of small and medium-sized firms. Large firms, most of them in the tradables sector, could substitute their financial needs in the domestic market, while small and medium-sized firms, most of them in the nontradables sector, could not do so.

Table 2. Data Moments[a]

Variable	x	(1) $\rho(x_t, y_t)$	(2) $\rho(x_t, y_{t-1})$	(3) $\sigma(x)$	(4) $\sigma(x)/\sigma(y)$
Aggregate output	y	1.00	0.59	2.29	1.00
Output exportables	y^x	0.84	0.39	1.78	0.78
Output nontradables	y^n	0.98	0.61	2.80	1.22
Aggregate consumption	c	0.95	0.69	2.66	1.16
Consumption importables	c^m	0.25	0.45	4.98	2.17
Consumption nontradables	c^n	0.98	0.61	2.80	1.22
Investment	i	0.80	0.44	8.50	3.71
Investment exportables	i^x	n.a.	n.a.	n.a.	n.a.
Investment nontradables	i^n	n.a.	n.a.	n.a.	n.a.
Real net exports	nx	–0.74	–0.41	—	2.55
Nominal net exports	nnx	—	—	—	—
Work hours	h	0.40	0.12	1.78	0.78
Work hours exportables	h^x	–0.09	–0.30	2.05	0.89
Work hours nontradables	h^n	0.53	0.25	1.96	0.85
Aggregate capital		0.33	0.68	2.88	1.26
Capital exportables	k^x	0.43	0.75	3.06	1.34
Capital nontradables	k^n	0.24	0.60	2.80	1.22

Source: Central Bank of Chile; author's calculations.
n.a. Not available.
a. Data are HP filtered.

This study seeks to evaluate quantitatively, in a DSGE framework, whether considering these two frictions in an otherwise standard small open economy model can replicate the high volatility of consumption and countercyclicality of net exports observed in middle-income countries. The model is calibrated and simulated for shocks to the terms of trade, foreign interest rate, and total factor productivity between 1986 and 2004. I begin with a frictionless version of the model and then incorporate each friction separately into the model to quantify its specific role in the domestic cycles. Finally, a model that features both frictions is simulated.

2. Model 1: Frictionless Small Open Economy

Consider a small open economy that is perfectly integrated with the world in goods, but faces an aggregate upward-sloping supply of external funds:

$$R_t = R_t^* + \eta(\bar{b} - b_t), \tag{1}$$

where R_t is the domestic rate of return, R_t^* is the foreign rate of return, b_t is the net foreign asset position, $\bar{b}$ is the level of foreign assets at which the risk premium is zero, and η is the elasticity of the risk premium to b_t. R_t^* is stochastic according to

$$R_t^* = \exp(\varepsilon_t^R) R^*, \tag{2}$$

where R^* is its unconditional mean and ε_t^R its first-order autoregressive shock:

$$\varepsilon_{t+1}^R = \rho^R \varepsilon_t^R + \upsilon_{t+1}^R, \tag{3}$$

with $E(\upsilon_{t+1}^R) = 0$ and $V(\upsilon_{t+1}^R) = \sigma_R^2$.

This is not exactly a frictionless setup, in which $R_t = R_t^*$ at each date *t,* because when the model is log-linearized around the steady state, it yields a unit root process for consumption, work hours, investment, net exports, and net foreign assets (see Correia, Neves, and Rebelo, 1995). To have a unique steady state, it is necessary to anchor the level of external debt in equilibrium. This can be done by setting an upward-sloping supply of external funds, a cost function of adjusting the external asset portfolio, or an endogenous discount factor. Schmitt-Grohé and Uribe (2003) show that all of these three forms yield the same first and second moments. I chose the first to be consistent with the later specifications, and I kept η small to make the model a good approximation of the frictionless setup.

There are three goods in this economy: an exportable good (*X*), an importable good (*M*), and a nontradable good (*N*). The two production factors are labor (*h*) and capital (*k*). The home economy produces *X* and *N* goods, using *h* and *k* inputs. Capital is sector specific, and labor moves freely across sectors. The law of one price holds for both tradable goods. The external price of M is normalized to one and assumed constant, while the external price of X is stochastic, according to the following process:

$$P_t^X = \exp\left(\varepsilon_t^{P^X}\right) P^{X*}, \tag{4}$$

where P^{X^*} is its unconditional mean and $\varepsilon_t^{P^X}$ the first-order autoregressive shock:

$$\varepsilon_{t+1}^{P^X} = \rho^{P^X} \varepsilon_t^{P^X} + \upsilon_{t+1}^{P^X}, \tag{5}$$

with $E\left(\upsilon_{t+1}^{P^X}\right) = 0$ and $V\left(\upsilon_{t+1}^{P^X}\right) = \sigma_{P^X}^2$.

There are two types of domestic agents: households and firms. Households own the firms, consume the N good, buy the M good for consumption and investment, and supply h and k to the firms. They are the only ones with access to foreign financing. There are two firms, the export firm and the nontradable firm; both use h and k to produce their goods. The economy follows a balanced growth path at a growth rate of $(\gamma - 1)$, and population is constant. In the following, the model is set in stationary form.

2.1 Households

Households maximize their lifetime utility according to equation (6):

$$U = E_0 \left\{ \sum_{t=0}^{\infty} \frac{\beta^{*t} \left[c_t^{\alpha} \left(1 - h_t\right)^{1-\alpha} \right]^{1-\sigma}}{1 - \sigma} \right\}, \tag{6}$$

where $\beta^* = \beta\gamma^{\alpha(1-\sigma)}$, β is the discount factor, h_t the normalized work hours, and c_t a constant elasticity of substitution (CES) aggregation of consumption of importable (c_t^M) and nontradable (c_t^N) goods:

$$c_t = \left[\varpi c_t^{M\,\rho} + (1 - \varpi) c_t^{N\,\rho} \right]^{\frac{1}{\rho}}, \tag{7}$$

where $1/\sigma$ and $1/(1-\rho)$ are the intertemporal elasticity of substitution and the elasticity of substitution between *M* and *N*, respectively. Since the foreign bonds and capital are the only assets in this economy, asset markets are incomplete and the economy's wealth varies with the state of nature. The households flow budget constraint is

$$w_t h_t + q_t^X k_t^X + q_t^N k_t^N + R_t b_t = c_t^M + P_t^N c_t^N + i_t^X + i_t^N + \gamma b_{t+1}, \tag{8}$$

where w_t is the wage rate, P_t^N the relative price of *N* to *M* goods, and k_t^j, i_t^j, and q_t^j are capital, investment, and the rental rate of capital in sector *j*, respectively. Investment is used to replace depreciated capital, accumulate new capital, and cover the capital adjustment costs, according to the following law of motion:

$$\gamma k_{t+1}^j = (1-\delta)k_t^j + i_t^j - \frac{\theta}{2}(i_t^j)^2, \tag{9}$$

for $j = X, N$, where δ is the depreciation rate and θ the coefficient on the quadratic adjustment costs. Households choose the sequence $\{c_t^M, c_t^N, h_i, i_t^X, i_t^N, k_{t+1}^X, k_{t+1}^N, b_{t+1}\}|_{t=0}^{\infty}$, to maximize equation (6), subject to equations (8) and (9). Their first-order conditions are as follows:

$$\alpha\varpi\left[\varpi c_t^{M\,\rho} + (1-\varpi)c_t^{N\,\rho}\right]^{\frac{\alpha}{\rho}(1-\sigma)-1}(1-h_t)^{(1-\alpha)(1-\sigma)} c_t^{M\,(\rho-1)} = \lambda_t; \tag{10}$$

$$\alpha(1-\varpi)\left[\varpi c_t^{M\,\rho} + (1-\varpi)c_t^{N\,\rho}\right]^{\frac{\alpha}{\rho}(1-\sigma)-1}(1-h_t)^{(1-\alpha)(1-\sigma)} c_t^{N\,(\rho-1)} = P_t^N\lambda_t; \tag{11}$$

$$(1-\alpha)\left[\varpi c_t^{M\,\rho} + (1-\varpi)c_t^{N\,\rho}\right]^{\frac{\alpha}{\rho}(1-\sigma)}(1-h_t)^{\alpha(\sigma-1)-\sigma} = \lambda_t w_t; \tag{12}$$

$$\phi_t^X = \lambda_t + \phi_t^X\,\theta\, i_t^X; \tag{13}$$

$$\phi_t^N = \lambda_t + \phi_t^N\,\theta\, i_t^N; \tag{14}$$

$$\gamma\phi_t^X = \beta E_t\left[\lambda_{t+1} q_{t+1}^X + \phi_{t+1}^X(1-\delta)\right]; \tag{15}$$

$$\gamma\phi_t^N = \beta E_t\left[\lambda_{t+1} q_{t+1}^N + \phi_{t+1}^N (1-\delta)\right]; \tag{16}$$

$$\gamma\lambda_t = \beta E_t (\lambda_{t+1} R_{t+1}); \text{ and} \tag{17}$$

$$E_t\left[\lim_{t\to\infty} \beta^t \lambda_t (k_{t+1}^X + k_{t+1}^N + b_{t+1})\right] = 0 ; \tag{18}$$

where λ_t, φ_t^X, and φ_t^N are the Lagrange multipliers on equations (8) and (9), respectively.

2.2 Firms

Both firms have Cobb-Douglas constant-return-to-scale technologies and choose $\{h_t^{fj}, k_t^{fj}\}|_{t=0}^{\infty}$ to maximize profits, with $j = X, N$. The first-order conditions for the nontradable firm are

$$w_t = (1-\alpha_N) P_t^N \exp(\varepsilon_t^N)(k_t^{fN})^{\alpha_N} (h_t^{fN})^{-\alpha_N} \text{ and} \tag{19}$$

$$q_t^N = \alpha_N P_t^N \exp(\varepsilon_t^N)(h_t^{fN})^{(1-\alpha_N)} (k_t^{fN})^{(\alpha_N-1)}; \tag{20}$$

while the first-order conditions for the export firm are

$$w_t = (1-\alpha_X) P_t^X \exp(\varepsilon_t^X)(k_t^{fX})^{\alpha_X} (h_t^{fX})^{-\alpha_X} \text{ and} \tag{21}$$

$$q_t^X = \alpha_X P_t^X \exp(\varepsilon_t^X)(h_t^{fX})^{(1-\alpha_X)} (k_t^{fX})^{(\alpha_X-1)}, \tag{22}$$

where ε_t^j is the productivity shock in each sector $j = X, N$, respectively. The shocks follow a first-order autoregressive process:

$$\varepsilon_{t+1}^j = \rho^j \varepsilon_t^j + v_{t+1}^j, \tag{23}$$

with $E(v_{t+1}^j) = 0$ and $V(v_{t+1}^j) = \sigma_j^2$.

2.3 Competitive Equilibrium

Given b_0, k_0^X, and k_0^N and shocks' processes $(\varepsilon_t^R, \varepsilon_t^{P_X}, \varepsilon_t^X, \varepsilon_t^N)$, a competitive equilibrium corresponds to sequences of allocations $\{c_t^M$, c_t^N, h_t, i_t^X, i_t^N, k_{t+1}^X, k_{t+1}^N, $b_{t+1}\}|_{t=0}^{\infty}$, $\{h_t^{fX}$, h_t^{fN}, k_t^{fX}, $k_t^{fN}\}|_{t=0}^{\infty}$ and prices $\{P_t^X$, P_t^N, q_t^X, q_t^N, w_t, $R_t\}|_{t=0}^{\infty}$ such that:

—Given b_0, k_0^X, k_0^N, prices, and shocks' processes, $\{c_t^M$, c_t^N, h_t, i_t^X, i_t^N, k_{t+1}^X, k_{t+1}^N, $b_{t+1}\}|_{t=0}^{\infty}$ solve the households' problem;

—Given prices and shocks' processes, $\{h_t^{fX}$, $k_t^{fX}\}|_{t=0}^{\infty}$ solve firm X's problem;

—Given prices and shocks' processes, $\{h_t^{fN}$, $k_t^{fN}\}|_{t=0}^{\infty}$ solve firm N's problem;

—Market-clearing conditions are satisfied: $c_t^N = y_t^N$, $k_t^X = k_t^{fX}$, $k_t^N = k_t^{fN}$, and $h_t = h_t^{fX} + h_t^{fN}$; and

—The resource constraint is satisfied:

$$R_t b_t + P_t^X Y_t^X - c_t^M - i_t^X - i_t^N - \gamma b_{t+1} = 0.$$

2.4 Steady State and Calibration

The parameters are calibrated to match Chile's average macroeconomic ratios between 1986 and 2004. Table 3 presents the parameters, together with the ratios in the data and in the model in steady-state. The risk premium elasticity, η, is 0.001 as in Schmitt-Grohé and Uribe (2003), net foreign assets are –19 percent of GDP, and $\bar{b}$ is 8.8 percent of GDP, to yield a spread $R_t - R_t^*$ of 200 basis points. The parameter γ is equal to 1.056, or one plus the average growth of GDP, while β is 0.94 in the steady state according to equation (17).

To calibrate the other parameters, it is necessary to construct the sectoral series of output and hours of work. For output, the sectoral series of GDP from national accounts were allocated as exportable or nontradable goods as in Stockman and Tesar (1995) and Mendoza (1995). The export sector's GDP was defined as the sum of GDP in the mining, agriculture, forestry, fishery, and manufacturing sectors, equivalent to 36 percent of GDP, while the nontradables sector's GDP corresponds to the sum of GDP of the wholesale and retail trade, construction, electricity, gas, and water, financial services, housing, personal services, public administration and transport, storage, and communication sectors, equivalent to 64 percent of

Table 3. Calibration and Macroeconomic Aggregates

Model and parameter	Value	Macroeconomic ratios: Variable	Data	Model
Model 1: Frictionless economy				
Preferences		Aggregate demand		
β	0.943	c/y	0.762	0.696
ρ	–0.350	c^N/y	0.634	0.600
ϖ	0.079	c^M/y	0.128	0.096
σ	1.500	i/y	0.297	0.292
α	0.323	tb/y	–0.059	0.012
		b/y	n.a.	–0.190
Technology		Production		
α_X	0.523	y^N/y	0.634	0.600
α_N	0.435	y^X/y	0.366	0.400
θ	0.028			
δ	0.080			
Supply of external funds		Inputs		
$\bar{b}$	0.088	k/y	n.a.	1.700
η	0.001	k^N/k	n.a.	0.555
		k^X/k	n.a.	0.445
		h	0.267	0.267
Long-term growth		h^N/h	0.670	0.640
γ	1.056	h^X/h	0.330	0.360
Models 2 and 4: Credit constraint				
Ψ	0.833			
μ	3.35E–08			
Φ	0.019			
Models 3 and 4: Labor-financing wedges				
τ^X	0.162	h^N/h	0.670	0.638
τ^N	0.171	h^X/h	0.330	0.362

Source: Central Bank of Chile; National Institute of Statistics.
n.a. Not available.

GDP. A similar aggregation was used to allocate employment across sectors. Employment in the export sector is the sum of employees in the mining, agriculture, hunting and fishery, and manufacturing sectors, equivalent to 33 percent of total employment, while in the nontradables sector it is the sum of employees in the construction, electricity, gas and water, trade, transport and communication, financial services, and social services sectors, equivalent to 67 percent of total employment.

Consumption of the nontradable good is equal to nontradable output, while consumption of importable goods is equal to the rest of total consumption. In steady state, the current account balance has to be equal to zero, whereas it is in deficit in the data, so I had to adjust some ratios in the model to calibrate a consistent steady state. The ratio of exportable GDP to total GDP was increased from 0.37 in the data to 0.40 in the model; the ratio of investment was reduced from 0.30 in the data to 0.29 in the model; and the ratio of importable goods consumption was reduced from 0.13 in the data to 0.10 in the model. As a result, the ratio of real net exports to GDP was increased from –0.06 in the data to 0.01 in the model.

In line with the adjustments in output, the share of employment in the export sector was increased from 0.33 in the data to 0.36 in the model, and the nontradable share was reduced from 0.67 in the data to 0.64 in the model. The prices of X and N relative to M were both set equal to one in steady state. Next, σ and ρ were set as in Mendoza (1995) for the industrialized economies[2], while α, $\bar{w}$, λ, φ^X, and φ^N were calibrated from equations (10) to (14), respectively. The shares α_X and α_N were calibrated to generate the sectoral allocation of labor in the model and an overall capital income share of 0.46, as estimated by Gallego, Schmidt-Hebbel, and Servén (2005) and García and others (2005). Table 3 shows that the calibration is consistent with the macroeconomic ratios in the data, except for the adjustments made to achieve a zero current account balance in steady state.

2.5 Simulations

The model is simulated for exogenous shocks to the terms of trade, foreign real interest rate, and productivity in the export and

2. I chose the benchmark parameters for industrialized economies because the parameters for the developing economies can be biased as a result of more severe credit constraints ignored in the estimation.

nontradables sectors. The foreign real interest rate is defined as the U.S. federal funds rate minus ex post inflation; the terms of trade is the ratio of prices of exports to imports of goods and services. Total factor productivity for each sector corresponds to the Solow residual, for which I used the sectoral series of output described in the previous section, while the aggregate and sectoral series of work hours and capital were constructed.

Total work hours were built using total employment from the National Institute of Statistics and average hours worked per employee from the International Labor Organization (ILO). They were normalized taking the average hours worked times the number of employees, divided by the potential working time of the working-age population. Its sectoral allocation was built assuming that labor is freely mobile across sectors and that both sectors present Cobb-Douglas production functions with constant return to scale, so that its marginal productivity is equal across sectors according to equation (24):

$$\frac{h_t^N}{h_t^X} = \frac{(1-\alpha_N)P_t^N y_t^N}{(1-\alpha_X)P_t^X y_t^X}. \tag{24}$$

The aggregate capital stock (k_t) was estimated using the following law of motion:

$$\gamma k_{t+1} = (1-\delta)k_t + i_t - \frac{\theta}{2} i_t^2, \tag{25}$$

where k_t and i_t are aggregate capital and investment, respectively. For its sectoral allocation, capital was assumed to be sector specific, but investment freely mobile across sectors. I used a three-step procedure. First, the allocation of freely mobile capital was obtained, equating its marginal productivity across sectors (equation 26):

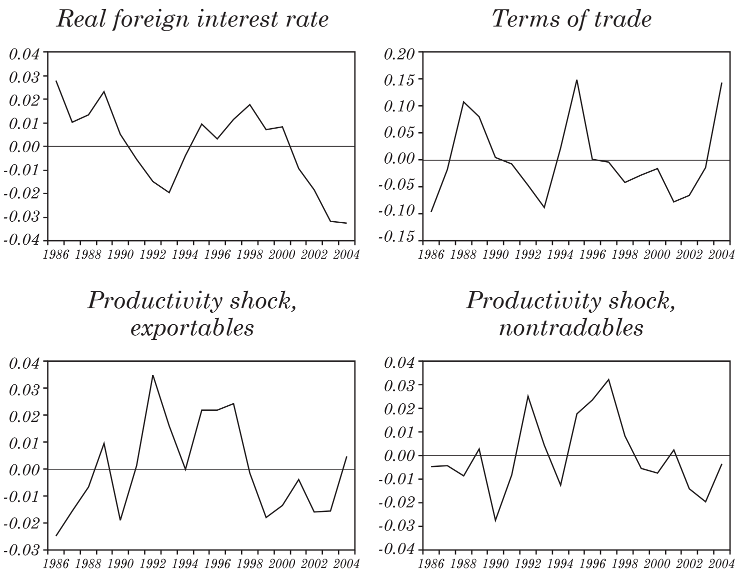
$$\frac{k_t^N}{k_t^X} = \frac{\alpha_N P_t^N y_t^N}{\alpha_X P_t^X y_t^X}. \tag{26}$$

Second, the implicit series of investment were derived from these allocations, considering capital as sector specific. Third, a nonnegativity condition for investment in each sector was verified, with the finding that the freely mobile allocation is consistent with positive investment in both sectors. Then, given that sector-specific capital would only create one-period discrepancies in the sectoral allocation of capital relative to freely mobile capital, I decided to take the latter.[3]

Figure 1, panel A, presents all four shocks in log deviation from their Hodrick-Prescott (HP) trend between 1986 and 2004. Table 4 shows that the autocorrelation of the two productivity shocks and the terms of trade is low, ranging between 0.3 and 0.4. Only the foreign real interest rate is more persistent. The terms-of-trade shocks are the most volatile, about three times as volatile as output, while both productivity shocks and foreign real interest rate are less volatile than output. Finally, the innovations to all four shocks are positively cross-correlated among them, particularly between both productivity shocks and between the terms of trade and the foreign real interest rate.

Figure 1. Chile: Domestic and External Shocks and Financial Frictions

A. Exogenous shocks for models 1, 2, 3, and 4

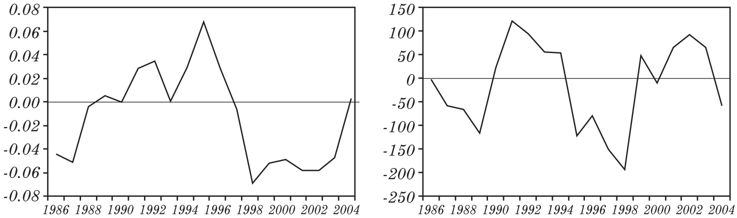


3. This would be optimal if domestic agents could foresee future shocks and invest accordingly.

Figure 1. Chile: (continued)

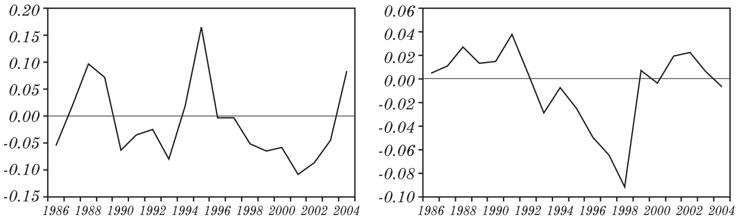
B. Self-financing requirement and external borrowing constraint multiplier for model 2

Self-financing requirement | *Borrowing constraint multiplier*



C. Labor-financing wedges for model 3

Exportable firm's labor-financing wedge | *Nontradable firm's labor-financing wedge*



Source: Author's computations.

The model was log-linearized, so the variables represent log deviations from their steady-state values. Table 5 presents the data moments in columns 1–4 and model 1's simulated moments in columns 5–8. Model 1 predicts excessive consumption smoothing of importable and nontradable goods, a lower volatility and procyclicality of investment, and procyclical, instead of countercyclical, real net exports.

Consumption smoothing results in a less procyclical and less volatile nontradable output, but in a more procyclical and more volatile exportables output. In response to the terms-of-trade shocks (the main drivers of the domestic cycles), work hours are reallocated from the nontradables sector to the export sector for positive shocks and vice versa for negative shocks. Thus, hours of work in the export sector are highly procyclical, contrasting with the highly countercyclical employment in the nontradables sector. At the same time, aggregate work hours become more volatile and procyclical.

Table 4. Shock Processes in Model 1

Shock	*Statistic*	ρ	*St. dev shock/ St. dev GDP*	*Cross correlation of innovations with*			
				P^X	r^*	z^X	z^N
Terms of trade	P^X	0.287	3.16	1.000	0.456	0.202	0.140
Foreign interest rate	r^*	0.774	0.76	0.456	1.000	0.242	0.274
Productivity exportables	z^X	0.409	0.71	0.202	0.242	1.000	0.985
Productivity nontradables	z^N	0.357	0.68	0.140	0.274	0.985	1.000

Source: Author's calculations.

Table 5. Data Moments and Simulations for Model 1: Frictionless Economy

		HP-filtered data				*Model 1*			
		(1)	*(2)*	*(3)*	*(4)*	*(5)*	*(6)*	*(7)*	*(8)*
Variable	x	$\rho(x_t, y_t)$	$\rho(x_t, y_{t-1})$	$\sigma(x)$	$\sigma(x)/\sigma(y)$	$\rho(x_t, y_t)$	$\rho(x_t, y_{t-1})$	$\sigma(x)$	$\sigma(x)/\sigma(y)$
Aggregate output	y	1.00	0.59	2.29	1.00	1.00	0.31	2.28	1.00
Output exportables	y^x	0.84	0.39	1.78	0.78	0.92	0.17	5.35	2.35
Output nontradables	y^n	0.98	0.61	2.80	1.22	0.35	0.40	1.51	0.66
Aggregate consumption	c	0.95	0.69	2.66	1.16	0.45	0.38	1.31	0.58
Consumption importables	c^m	0.25	0.45	4.98	2.17	0.38	0.01	2.64	1.16
Consumption nontradables	c^n	0.98	0.61	2.80	1.22	0.35	0.40	1.51	0.66
Investment	i	0.80	0.44	8.50	3.71	0.02	–0.40	3.37	1.48
Investment exportables	i^x	n.a.	n.a.	n.a.	n.a.	–0.11	–0.53	3.84	1.69
Investment nontradables	i^n	n.a.	n.a.	n.a.	n.a.	0.13	–0.25	3.14	1.38
Real net exports	nx	–0.74	–0.41	—	2.55	0.83	0.30	—	2.20
Nominal net exports	nnx	—	—	—	—	0.78	0.13	—	4.57
Work hours	h	0.40	0.12	1.78	0.78	0.68	0.09	2.84	1.25
Work hours exportables	h^x	–0.09	–0.30	2.05	0.89	0.77	0.08	9.77	4.29
Work hours nontradables	h^n	0.53	0.25	1.96	0.85	–0.63	–0.04	1.94	0.85
Aggregate capital		0.33	0.68	2.88	1.26	0.23	0.11	0.54	0.24
Capital exportables	k^x	0.43	0.75	3.06	1.34	0.34	0.11	0.58	0.25
Capital nontradables	k^n	0.24	0.60	2.80	1.22	0.13	0.11	0.54	0.24

Source: Central Bank of Chile; author's calculations.
n.a. Not available.
a. Data are HP filtered.

Figure 2. Data and Model 1 Simulations

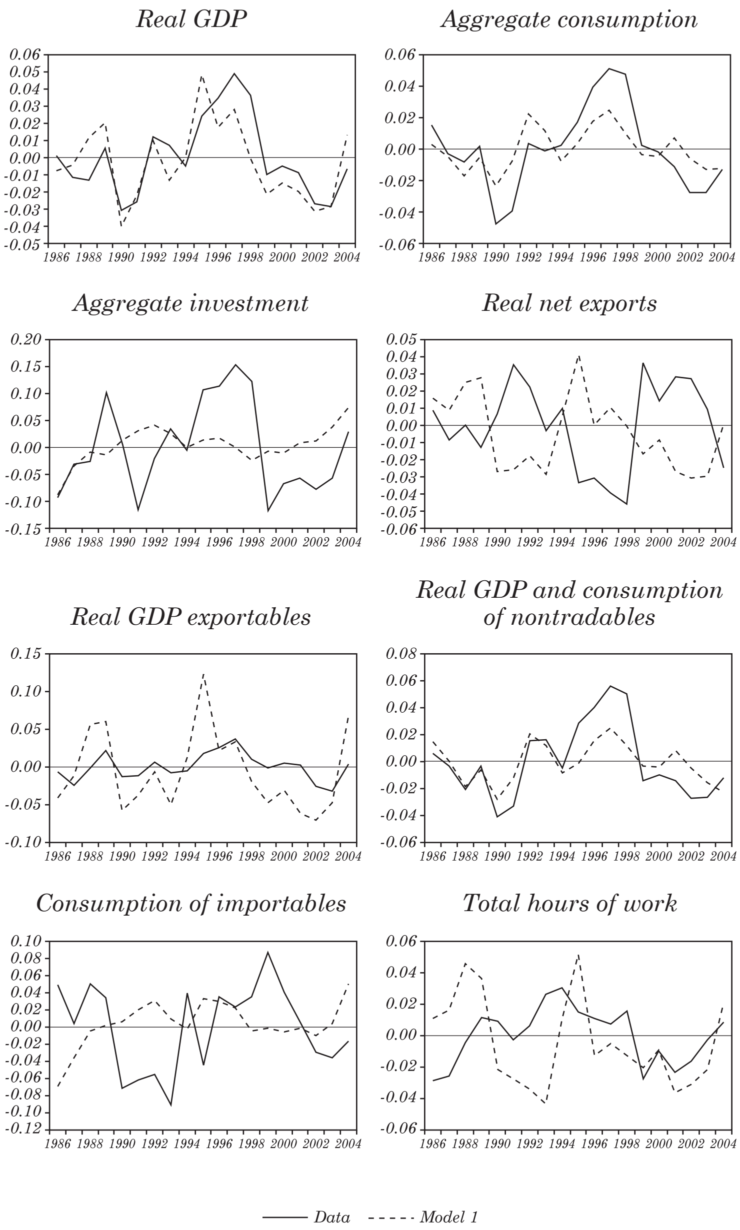
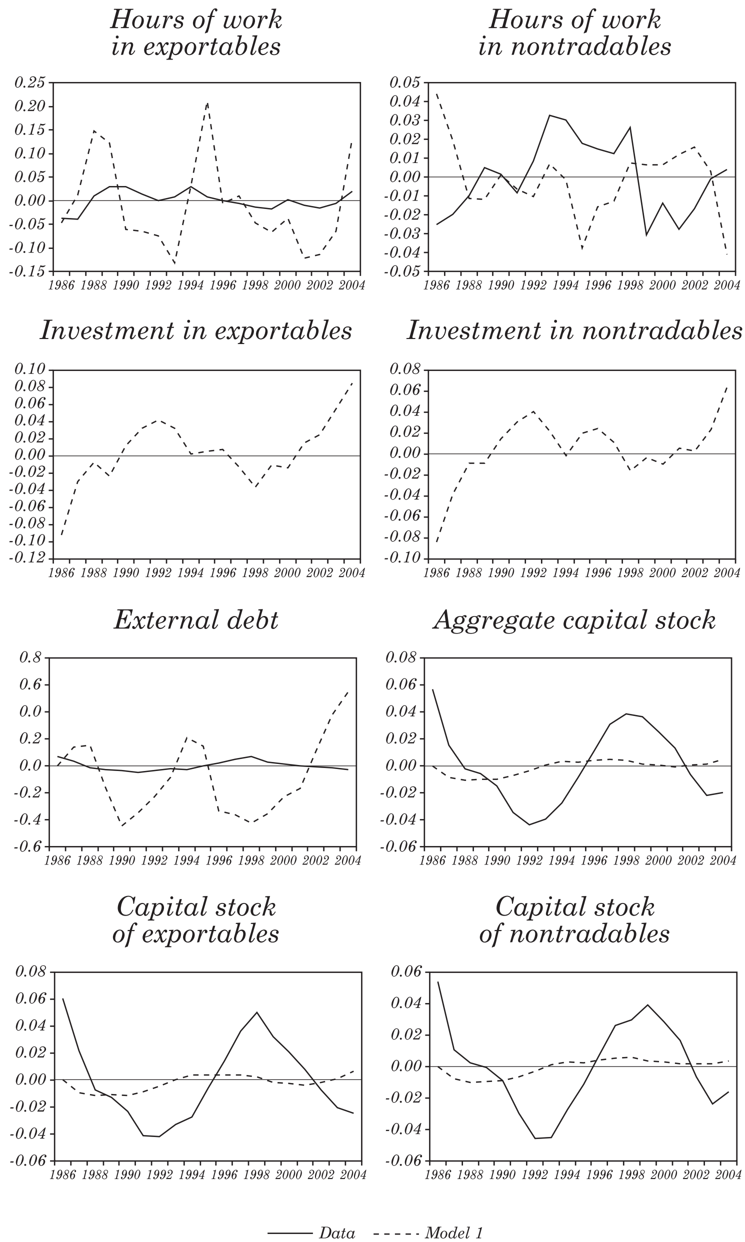


Figure 2. (continued)



Source: Central Bank of Chile; author's computations.

Figure 2 presents the data series and model 1 simulations for the same sample. Model 1 predicts a smaller fall in aggregate and nontradables consumption in 1990–91 and 2001–03, and a lower expansion in 1994–98, resulting in the lower procyclicality and volatility relative to the data. For investment, the model also predicts a lower expansion in 1989 and in 1995–98, together with a smaller fall in 1991–92 and 1999–2004. Aggregate and export sector work hours move similarly to the terms of trade. Labor supply is highly procyclical and volatile. Together with the procyclical reallocations of labor from the nontradables to the export sector, this results in highly volatile and procyclical output and employment in the export sector and—when added to the smooth path of consumption and investment—procyclical, rather than countercyclical, real net exports.

Figure 3 presents the real exchange rate, defined as the price of exportable over nontradable goods, and the spread between the domestic and foreign interest rates in the data and in the different models. It shows that model 1 is unable to replicate the real depreciation between 1988 and 1992 and since 2002, as well as the decline in the foreign lending spread after 2000. Thus, a frictionless model with standard preferences and a normal intertemporal elasticity of substitution cannot generate the regularities observed in middle-income countries, as it predicts excessive consumption smoothing and procyclical real net exports. The next section explores whether adding an external borrowing constraint to this setup can solve these problems.

3. Model 2: Borrowing-Constrained Economy

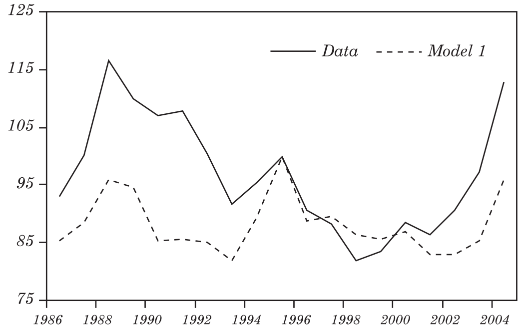
Consider a small open economy that is perfectly integrated with the world in goods, but faces individual specific external borrowing constraints identified as the external lenders' requirement that domestic households finance at least a fraction Ψ_t of their expenditures with their current income at date t (Mendoza, 2001):

$$w_t h_t + q_t^X k_t^X + q_t^N k_t^N \geq \Psi_t \left(c_t^M + P_t^N c_t^N + i_t^X + i_t^N - R_t b_t\right), \tag{27}$$

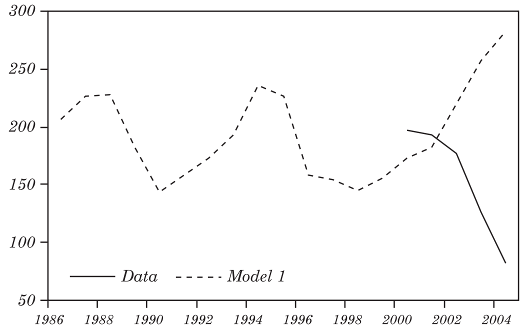
where the left-hand side is the households' current income and the right-hand side the minimum fraction of expenditures to be self-financed. When equations (27) and (8) are combined and equilibrium conditions imposed, this constraint can re-expressed as

Figure 3. Real Exchange Rates and Foreign Lending Spreads[a]

A. Real Exchange Rate



B. Foreign Lending Spread



Source: J.P. Morgan's EMBI Global; author's computations.
a.Real exchange rate is measured as the ratio between the price of exportable goods and the price of nontradable goods. Foreign lending spread corresponds to the differential between the domestic interest rate and the foreign interest rate.

$$b_{t+1} \geq -\frac{1-\Psi_t}{\gamma\Psi_t}\left(P_t^X Y_t^X + P_t^N Y_t^N\right). \tag{28}$$

This constraint can replicate an optimal contract as in Atkeson (1991), in which foreign lending occurs under moral hazard and risk of repudiation. External lenders cannot observe whether borrowers are investing the loans efficiently or consuming them, and sovereign borrowers can repudiate their debt at any time. When there are no informational problems, domestic agents and external lenders share risk fully, but with these problems, the optimal contract reduces risk sharing, transferring part of the output risk to the domestic borrowers to induce them to invest efficiently and repay their loans. Furthermore, the external borrowing constraint should always bind to avoid saving accumulation and debt repudiation.

In this setup, full risk sharing is equivalent to a sufficiently procyclical Ψ_t, which allows domestic agents to borrow more relative to income in bad times than in good, smoothing expenditures over time. Less risk sharing is consistent with a less procyclical Ψ_t and less expenditure smoothing. I assume that the constraint always binds and deduce Ψ_t at each date t to allow the model to replicate the real net exports in the data as a proxy for the household's net repayment to the foreign lenders.[4] Then, Ψ_t and the borrowing constraint multiplier are analyzed according to previous studies.

The rest of the model is the same. There are three types of agents: domestic households, domestic firms, and foreign lenders. Foreign lenders set the borrowing constraint on the domestic households. Domestic households own firms, consume the nontradable good, buy the importable good for consumption and investment, and supply labor and capital to the firms. There are two firms—the export firm and the nontradable firm—that demand capital and labor to produce their goods. The economy follows a balanced growth path, and population is assumed to be constant. In the following subsections, the model is set in stationary form.

3.1 Households

Households choose the sequence $\{c_t^M,\ c_t^N,\ l_t,\ i_t,\ k_{t+1},\ b_{t+1}\}|_{t=0}^{\infty}$ to maximize their lifetime utility (equation 6), subject to equations (8), (9), and (27). Their first-order conditions are as follows:

$$\alpha\varpi\left[\varpi c_t^{M\rho}+(1-\varpi)c_t^{N\rho}\right]^{\frac{\alpha}{\rho}(1-\sigma)-1}(1-h_t)^{(1-\alpha)(1-\sigma)}c_t^{M(\rho-1)}=(\lambda_t+\mu_t\Psi_t); \quad (29)$$

$$\alpha(1-\varpi)\left[\varpi c_t^{M\rho}+(1-\varpi)c_t^{N\rho}\right]^{\frac{\alpha}{\rho}(1-\sigma)-1}(1-h_t)^{(1-\alpha)(1-\sigma)}c_t^{N(\rho-1)}$$
$$=P_t^N(\lambda_t+\mu_t\Psi_t); \quad (30)$$

4. This avoids private agents building up savings that would make the constraint nonbinding again.

$$(1-\alpha)\left[\varpi c_t^{M\rho}+(1-\varpi)c_t^{N\rho}\right]^{\frac{\alpha}{\rho}(1-\sigma)}(1-h_t)^{\alpha(\sigma-1)-\sigma}=(\lambda_t+\mu_t)w_t\,; \tag{31}$$

$$\phi_t^X=(\lambda_t+\mu_t\Psi_t)+\phi_t^X\;\theta\,i_t^X\,; \tag{32}$$

$$\phi_t^N=(\lambda_t+\mu_t\Psi_t)+\phi_t^N\;\theta\,i_t^N\,; \tag{33}$$

$$\gamma\phi_t^X=\beta E_t\left[(\lambda_{t+1}+\mu_{t+1})q_{t+1}^X+\phi_{t+1}^X(1-\delta)\right]; \tag{34}$$

$$\gamma\phi_t^N=\beta E_t\left[(\lambda_{t+1}+\mu_{t+1})q_{t+1}^N+\phi_{t+1}^N(1-\delta)\right]; \tag{35}$$

$$\gamma\lambda_t=\beta E_t\left[(\lambda_{t+1}+\mu_{t+1}\Psi_{t+1})R_{t+1}\right];\text{ and} \tag{36}$$

$$E_t\left[\lim_{t\to\infty}\beta^t\lambda_t\,(k_{t+1}^X+k_{t+1}^N+b_{t+1})\right]=0\,; \tag{37}$$

where λ_t, φ_t^X, φ_t^N, and μ_t are the Lagrange multipliers on equations (8), (9), and (27), respectively.

3.2 Firms

Firms solve the problem in model 1. Thus, their first-order conditions are equations (19) and (20) for the nontradable firm and equations (21) and (22) for the export firm.

3.3 Competitive Equilibrium

Given b_0, k_0^X, and k_0^N and shocks' processes ($\varepsilon_t^R, \varepsilon_t^{P_X}, \varepsilon_t^X, \varepsilon_t^N, \Psi_t$), a competitive equilibrium corresponds to sequences of allocations $\{c_t^M$, $c_t^N, h_t, i_t^X, i_t^N, k_{t+1}^X, k_{t+1}^N, b_{t+1}\}|_{t=0}^{\infty}$, $\{h_t^{fX}, h_t^{fN}, k_t^{fX}, k_t^{fN}\}|_{t=0}^{\infty}$ and prices $\{P_t^X$, $P_t^N, q_t^X, q_t^N, w_t, R_t\}|_{t=0}^{\infty}$ such that:

—Given b_0, k_0^X, k_0^N, prices, and shocks' processes, $\{c_t^M, c_t^N, h_t, i_t^X$, $i_t^N, k_{t+1}^X, k_{t+1}^N, b_{t+1}\}|_{t=0}^{\infty}$ solve the households' problem;

—Given prices and shocks' processes, $\{h_t^{fX}, k_t^{fX}\}|_{t=0}^{\infty}$ solve firm X's problem;

—Given prices and shocks' processes, $\{h_t^{fN}, k_t^{fN}\}|_{t=0}^{\infty}$ solve firm N's problem;

—Market-clearing conditions are satisfied: $c_t^N = y_t^N$, $k_t^X = k_t^{fX}$, $k_t^N = k_t^{fN}$, and $h_t = h_t^{fX} + h_t^{fN}$; and

—The resource constraint is satisfied: $R_t b_t + P_t^X Y_t^X - c_t^M - i_t^X - i_t^N - \gamma b_{t+1} = 0$.

3.4 External Lenders

External lenders are risk neutral and face a complete asset market. They maximize the profit function (38) subject to the domestic households' borrowing constraint (equation 27):

$$\Pi^* = E_0 \left\{ \sum_{t=0}^{\infty} Q_t \; \gamma^t \left[R_t b_t - (1+\Phi)\gamma b_{t+1} \right] \right\}, \tag{38}$$

with $Q_t = \left(\prod_{s=0}^{t} R_s^* \right)^{-1}$, where Φ is the marginal cost of extending new loans. Their first-order conditions are:

$$Q_t (1+\Phi) = Q_{t+1} R_{t+1} (1 - \mu_{t+1} \Psi_{t+1}), \tag{39}$$

which yields the following endogenous upward-sloping supply of funds:

$$R_t - R_t^* = R_t^* \Phi + R_t \mu_t \Psi_t. \tag{40}$$

This supply of funds depends not only on net foreign assets as in model 1, but also on current expenditures and income, all of which are reflected in the multiplier, μ_t. As before, this functional form allows the model to have a unique steady state.

3.5 Steady State and Calibration

The calibrated parameters and the implied macroeconomic ratios from the model are the same as in model 1, as μ is small. The only difference is that the parameters associated with the previous upward supply of funds (η and $\bar{b}$ in equation 1) are now replaced by the coefficients associated with the endogenous upward supply of funds (Φ, Ψ, and μ in equation 40), which are presented in table 3.

3.6 Simulations

The value of Ψ_t is deduced and introduced as a shock, together with the shocks in model 1, to make model 2 replicate Chile's real net exports between 1986 and 2004. Table 6, shows that Ψ_t is highly persistent and more volatile than output. Its innovations are positively correlated with all shocks, but this correlation is higher with the terms of trade than with productivity, which is consistent with a high (low) risk sharing between households and foreign lenders when shocks are observable (unobservable). Figure 1, panel B, shows that Ψ_t was increasing in 1986–95, decreasing in 1996–98, stable until 2003, and increasing again in 2004. The multiplier, μ_t, shows a more binding constraint in 1990–91 and after 1998, when facing negative shocks to productivity and the terms of trade, and a less binding constraint when facing positive shocks (1992–98). This indicates that this constraint may have contributed to the boom in 1995–98 and to the bust in 1999–2003.

Table 7 shows that model 2 captures the volatilities of exportable and nontradable output, consumption of importable goods, and aggregate investment better than model 1. It also reduces the volatility of export sector's work hours, but increases that of the aggregate and nontradables sector's hours. Figure 4 shows that model 2 reproduces investment, consumption of importable goods, and output of exportable goods better than model 1. Investment is more procyclical and more volatile since Ψ_t is highly persistent and highly correlated to the terms of trade. The less binding constraint in 1992–98 produced larger and longer-lasting increases in investment, while the tighter constraint in 1999–2003 produced larger and longer-lasting reductions in investment.

Table 6. Shock Processes in Model 2

Shock	*Statistic*	ρ	*St. dev. shock/ St. dev. GDP*	*Cross correlation of innovations with*				
				P^X	r^*	z^X	z^N	Ψ
Terms of trade	P^X	0.287	3.16	1.000	0.456	0.202	0.140	0.754
Foreign interest rate	r^*	0.774	0.76	0.456	1.000	0.242	0.274	0.157
Productivity exportables	z^X	0.409	0.71	0.202	0.242	1.000	0.985	0.306
Productivity nontradables	z^N	0.357	0.68	0.140	0.274	0.985	1.000	0.192
Self-financing requirement	Ψ	0.709	1.75	0.754	0.157	0.306	0.192	1.000

Source: Author's calculations.

Table 7. Data Moments and Simulations for Model 2: Credit Constraint

		HP-filtered data				*Model 2*			
Variable	x	(1) $\rho(x_t, y_t)$	(2) $\rho(x_t, y_{t-1})$	(3) $\sigma(y)$	(4) $\sigma(x)/\sigma(y)$	(5) $\rho(x_t, y_t)$	(6) $\rho(x_t, y_{t-1})$	(7) $\sigma(y)$	(8) $\sigma(x)/\sigma(y)$
Aggregate output	y	1.00	0.59	2.29	1.00	1.00	0.02	1.26	1.00
Output exportables	y^x	0.84	0.39	1.78	0.78	0.57	–0.41	2.99	2.37
Output nontradables	y^n	0.98	0.61	2.80	1.22	0.51	0.41	1.91	1.51
Aggregate consumption	c	0.95	0.69	2.66	1.16	0.54	0.39	1.42	1.12
Consumption importables	c^m	0.25	0.45	4.98	2.17	–0.12	–0.18	4.82	3.82
Consumption nontradables	c^n	0.98	0.61	2.80	1.22	0.51	0.41	1.91	1.51
Investment	i	0.80	0.44	8.50	3.71	–0.29	–0.16	7.42	5.88
Investment exportables	i^x	n.a.	n.a.	n.a.	n.a.	–0.35	–0.16	8.67	6.87
Investment nontradables	i^n	n.a.	n.a.	n.a.	n.a.	–0.23	–0.16	6.54	5.18
Real net exports	nx	–0.74	–0.41	—	2.55	0.53	–0.01	—	2.55
Nominal net exports	nnx	—	—	—	—	0.34	–0.50	—	2.88
Work hours	h	0.40	0.12	1.78	0.78	0.34	–0.18	2.95	2.34
Work hours exportables	h^x	–0.09	–0.30	2.05	0.89	0.29	–0.50	6.23	4.94
Work hours nontradables	h^n	0.53	0.25	1.96	0.85	0.16	0.27	3.40	2.69
Aggregate capital		0.33	0.68	2.88	1.26	0.16	–0.06	1.06	0.84
Capital exportables	k^x	0.43	0.75	3.06	1.34	0.16	–0.10	1.26	0.99
Capital nontradables	k^n	0.24	0.60	2.80	1.22	0.16	–0.01	0.92	0.73
Borrowing constraint multiplier	μ	n.a.	n.a.	n.a.	n.a.	0.46	0.00	460	365

Source: Central Bank of Chile; author's calculations.
n.a. Not available.
a. Data are HP filtered.

Figure 4. Data and Model 1 and Model 2 Simulations

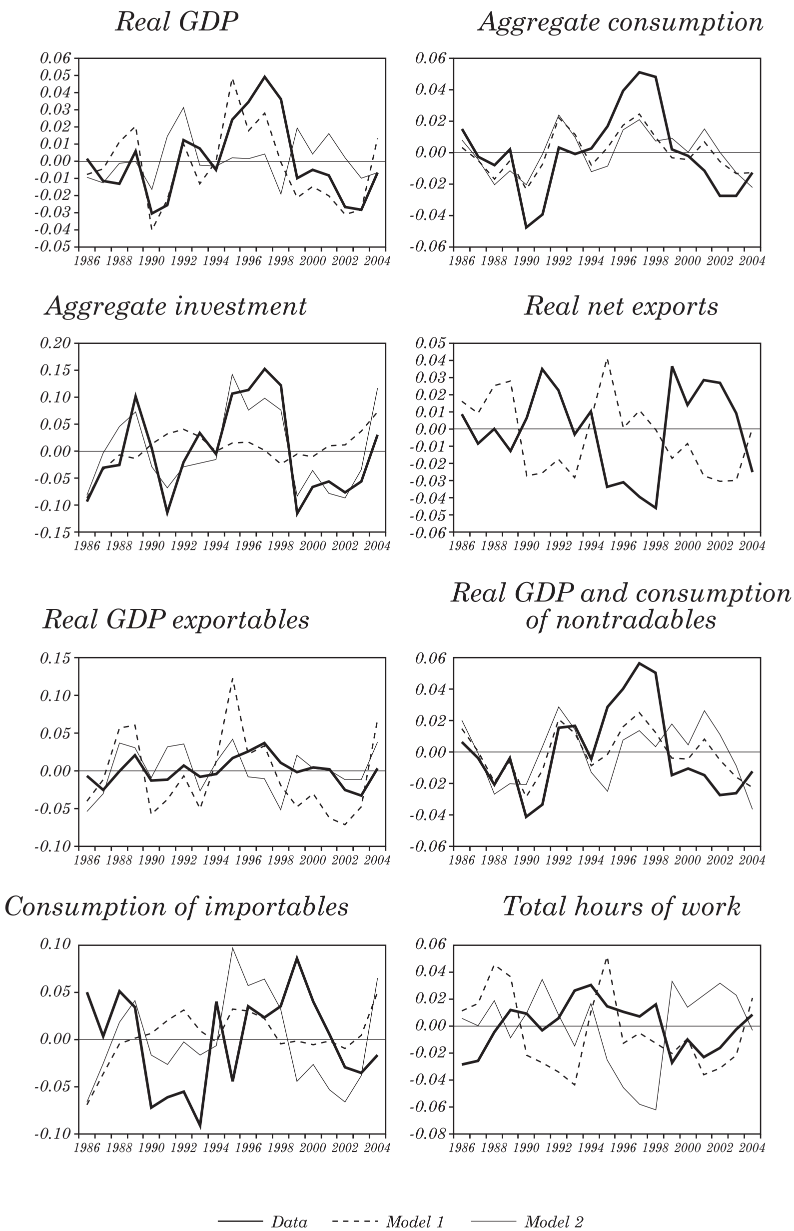
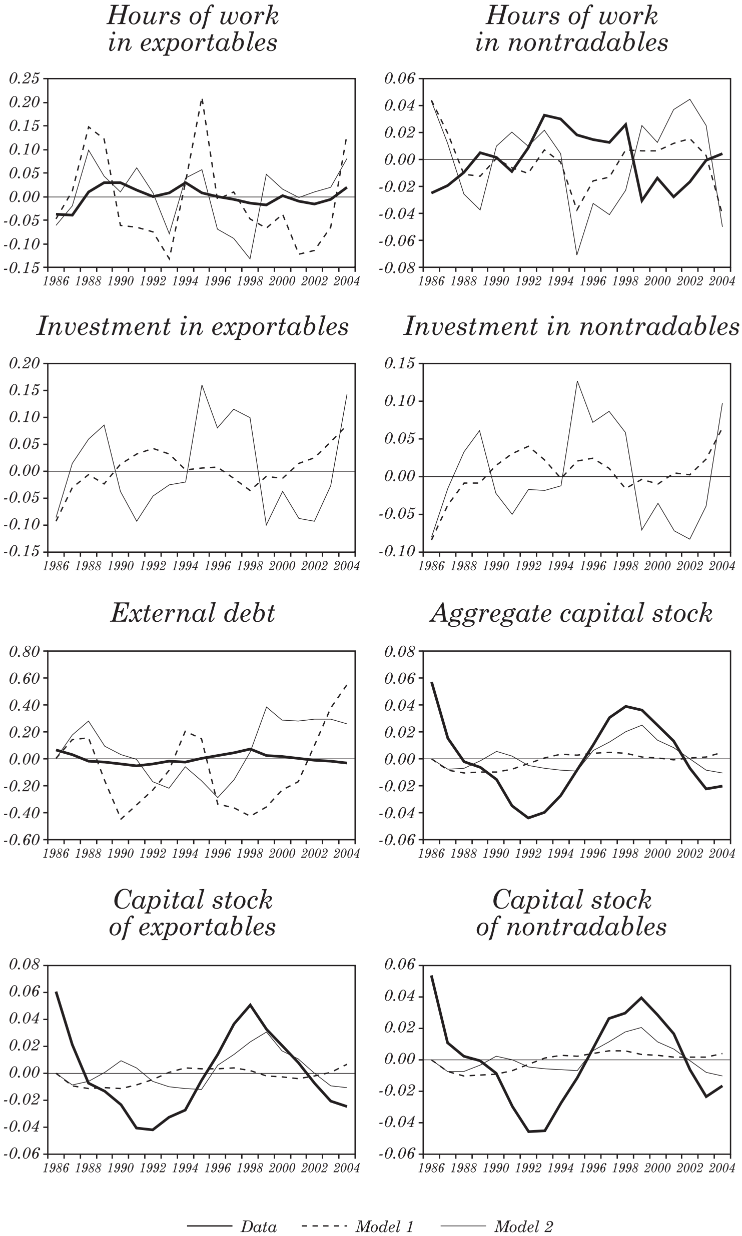


Figure 4. (continued)

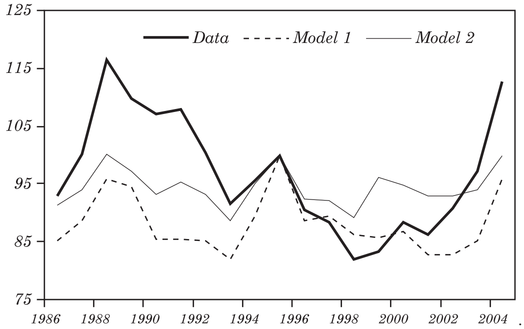


Source: Central Bank of Chile; author's computations.

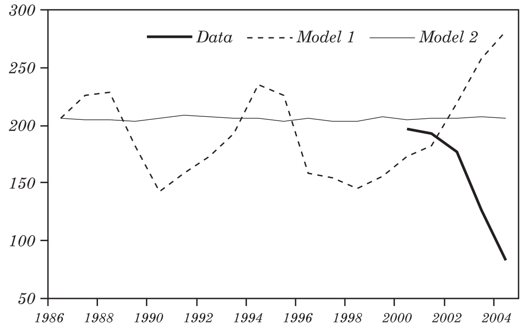
FigHouseholds react to positive shocks and a less binding constraint by increasing consumption and reducing their labor effort. The importable goods are obtained abroad, while nontradables are produced domestically, generating a reallocation of labor from the exportable to the nontradables sector. The lower overall labor effort further reduces employment in the export sector and lowers the increase in employment in the nontradables sector. Thus, the demand for tradable goods increases, but their production falls, generating countercyclical real net exports. Figure 5 shows that model 2 replicates the real exchange rate better than model 1, and it predicts a flat foreign lending spread, as μt is small.

Figure 5. Real Exchange Rate and Foreign Lending Spread[a]

A. Real Exchange Rate



B. Foreign Lending Spread



Source: J.P. Morgan's EMBI Global; author's computations.

a.Real exchange rate is measured as the ratio between the price of exportable goods and the price of nontradable goods. Foreign lending spread corresponds to the differential between the domestic interest rate and the foreign interest rate.

Work hours, however, are countercyclical instead of procyclical, and the volatility of nontradables consumption is still low compared to the data. In figure 4, work hours are higher in periods of negative shocks and a tighter constraint (1990–91 and 1999–2003) than in periods of positive shocks and a less binding constraint (1992–98). Since the countercyclical fluctuations in labor supply drive the cyclical path of work hours, the next section explores whether countercyclical labor-financing wedges can produce sufficiently procyclical fluctuations in the labor demand to solve this problem.

4. Model 3: Asymmetric Financing Costs

Consider a small economy that is perfectly open to the world in goods, but faces the same upward-sloping supply of external funds as in model 1 (equation 1). Domestic households own firms, consume the N good, buy the M good for consumption and investment, and supply h and k to the firms. The export and nontradable firms demand k and h to produce their goods. They face a specific labor-financing wedge that can capture sector-specific labor market distortions such as labor-financing frictions, sticky wages, or unions (Chari, Kehoe, and McGrattan, 2003) or labor market regulations (Caballero and others, 2004).

The appendix shows that this model is similar to a model in which firms need to borrow from domestic banks to pay workers in advance of production, such that they face a credit-in-advance constraint. The cost of credit depends on each firm's specific availability of collateral. This is motivated by the evidence found by Tornell and Westermann (2002, 2003) about asymmetric financing opportunities across tradable and nontradable firms for a sample of middle-income countries, and by Caballero (2002) for Chile. Given the lack of data on sectoral financing costs, I deduced the sectoral labor-financing wedge to make the model replicate output of both sectors in the data between 1986 and 2004. The economy follows a balanced growth path, and population is constant. In the following discussion, the model is set in stationary form.

4.1 Households

Households solve the same problem as in the friction-less economy setup. Their first-order conditions are thus given by equations (10)–(18).

4.2 Firms

Each firm's labor-financing wedge is set as augmenting the cost of labor by a fraction, τ_t^j, with $j = X, N$. Their total cost of production is given by equation (41):

$$q_t^j k_t^{fj} + w_t h_t^{fj}\left(1+\tau_t^j\right), \tag{41}$$

for $j = X$, N. The costs associated with the wedges are rebated to the households as a lump sum transfer, such that the resource constraint remains unchanged with respect to the previous specifications. The firms' static problem is to choose the allocation $\{h_t^{fj}, k_t^{fj}\}$ to maximize profits. The first-order conditions for the nontradable firm are

$$w_t\left(1+\tau_t^N\right) = \left(1-\alpha_N\right) P_t^N \exp\left(\varepsilon_t^N\right)\left(k_t^{fN}\right)^{\alpha_N}\left(h_t^{fN}\right)^{-\alpha_N} \text{ and} \tag{42}$$

$$q_t^N = \alpha_N P_t^N \exp\left(\varepsilon_t^N\right)\left(h_t^{fN}\right)^{(1-\alpha_N)}\left(k_t^{fN}\right)^{(\alpha_N-1)}; \tag{43}$$

while for the export firm, they are

$$w_t\left(1+\tau_t^X\right) = \left(1-\alpha_X\right) P_t^X \exp\left(\varepsilon_t^X\right)\left(k_t^{fX}\right)^{\alpha_X}\left(h_t^{fX}\right)^{-\alpha_X} \text{ and} \tag{44}$$

$$q_t^X = \alpha_X P_t^X \exp\left(\varepsilon_t^X\right)\left(h_t^{fX}\right)^{(1-\alpha_X)}\left(k_t^{fX}\right)^{(\alpha_X-1)}. \tag{45}$$

4.3 Competitive Equilibrium

Given b_0, k_0^X, and k_0^N and shocks' processes $(\varepsilon_t^R, \varepsilon_t^{P_X}, \varepsilon_t^X, \varepsilon_t^N, \tau_t^X, \tau_t^N)$, a competitive equilibrium corresponds to sequences of allocations $\{c_t^M$, c_t^N, h_t, i_t^X, i_t^N, k_{t+1}^X, k_{t+1}^N, $b_{t+1}\}|_{t=0}^{\infty}$, $\{h_t^{fX}$, h_t^{fN}, k_t^{fX}, $k_t^{fN}\}|_{t=0}^{\infty}$ and prices $\{P_t^X$, P_t^N, q_t^X, q_t^N, w_t, $R_t\}|_{t=0}^{\infty}$ such that:

—Given b_0, k_0^X, k_0^N, prices, and shocks' processes, $\{c_t^M$, c_t^N, h_t, i_t^X, i_t^N, k_{t+1}^X, k_{t+1}^N, $b_{t+1}\}|_{t=0}^{\infty}$ solve the households' problem;

—Given prices and shocks' processes, $\{h_t^{fX}, k_t^{fX}\}|_{t=0}^{\infty}$ solve firm X's problem;

—Given prices and shocks' processes, $\{h_t^{fN}, k_t^{fN}\}|_{t=0}^{\infty}$ solve firm N's problem;

—Market-clearing conditions are satisfied: $c_t^N = y_t^N$, $k_t^X = k_t^{fX}$, $k_t^N = k_t^{fN}$, and $h_t = h_t^{fX} + h_t^{fN}$; and

—The resource constraint is satisfied:
$R_t b_t + P_t^X Y_t^X - c_t^M - i_t^X - i_t^N - \gamma b_{t+1} = 0$.

4.4 Steady State and Calibration

Both wedges, τ_t^X and τ_t^N, in table 3 are set to ensure that they are always greater than or equal to zero in the simulations. The nontradable wedge is about one percentage point above the export wedge. This specification only marginally changes the relative allocation of labor across sectors in steady state, while the other parameters and macroeconomic ratios remain as in models 1 and 2.

4.5 Simulations

Both wedges are deduced and introduced as shocks to make the model replicate the path of output of exportable and nontradable goods in the data. The model is simulated for these shocks and for the four shocks in model 1. Table 8 shows that the nontradable wedge is more persistent and less volatile than the export wedge. Its innovations are negatively correlated with both productivity shocks and uncorrelated with the terms of trade, while the innovations to the export wedge are highly correlated with the terms of trade and less correlated with productivity.

Figure 1, panel C, shows that the nontradable wedge decreased continuously between 1991 and 1998 and increased suddenly in 1999. It then remained high until 2004, mirroring the path of nontradable output, consistent with a lower cost of domestic credit during booms than during recessions. The export wedge mimics the path of the terms of trade in the data, probably reducing the reallocation of labor across sectors rather than measuring changes in domestic financing costs.

Table 9 presents the simulated moments for model 3, which replicates the output moments in both sectors in the data by

Table 8. Shock Processes in Model 3

				Cross correlation of innovations with					
Shock	*Statistic*	ρ	*St. dev. shock/ St. dev. GDP*	P^X	r^*	z^X	z^N	τ^X	τ^N
Terms of trade	P^X	0.287	3.16	1.000	0.456	0.202	0.140	0.935	0.070
Foreign interest rate	r^*	0.774	0.76	0.456	1.000	0.242	0.274	0.509	–0.323
Productivity exportables	z^X	0.409	0.71	0.202	0.242	1.000	0.985	0.399	–0.407
Productivity nontradables	z^N	0.357	0.68	0.140	0.274	0.985	1.000	0.342	–0.435
Labor wedge exportables	τ^X	0.337	3.14	0.935	0.509	0.399	0.342	1.000	–0.024
Labor wedge nontradables	τ^N	0.584	1.45	0.070	–0.323	–0.407	–0.435	–0.024	1.000

Source: Author's calculations.

Table 9. Data Moments and Simulations for Model 3: Labor Wedges

		HP-filtered data				*Model 3*			
		(1)	*(2)*	*(3)*	*(4)*	*(1)*	*(2)*	*(3*	*(4)*
Variable	x	$\rho(x_t, y_t)$	$\rho(x_t, y_{t-1})$	$\sigma(x)$	$\sigma(x)/\sigma(y)$	$\rho(x_t, y_t)$	$\rho(x_t, y_{t-1})$	$\sigma(x)$	$\sigma(x)/\sigma(y)$
Aggregate output	y	1.00	0.59	2.29	1.00	1.00	0.58	2.29	1.00
Output exportables	y^x	0.84	0.39	1.78	0.78	0.86	0.40	1.78	0.78
Output nontradables	y^n	0.98	0.61	2.80	1.22	0.98	0.62	2.80	1.22
Aggregate consumption	c	0.95	0.69	2.66	1.16	0.97	0.58	2.45	1.07
Consumption importables	c^m	0.25	0.45	4.98	2.17	0.08	–0.24	2.64	1.15
Consumption nontradables	c^n	0.98	0.61	2.80	1.22	0.98	0.62	2.80	1.22
Investment	i	0.80	0.44	8.50	3.71	–0.20	–0.50	3.61	1.57
Investment exportables	i^x	n.a.	n.a.	n.a.	n.a.	–0.19	–0.50	4.00	1.74
Investment nontradables	i^n	n.a.	n.a.	n.a.	n.a.	–0.20	–0.49	3.36	1.47
Real net exports	nx	–0.74	–0.41	—	2.55	0.51	0.56	—	1.51
Nominal net exports	nnx	—	—	—	—	0.32	–0.02	—	3.23
Work hours	h	0.40	0.12	1.78	0.78	0.69	0.82	2.22	0.97
Work hours exportables	h^x	–0.09	–0.30	2.05	0.89	0.07	0.31	2.65	1.16
Work hours nontradables	h^n	0.53	0.25	1.96	0.85	0.78	0.80	2.93	1.28
Aggregate capital		0.33	0.68	2.88	1.26	0.38	0.26	0.62	0.27
Capital exportables	k^x	0.43	0.75	3.06	1.34	0.43	0.30	0.67	0.29
Capital nontradables	k^n	0.24	0.60	2.80	1.22	0.33	0.23	0.58	0.25

Source: Central Bank of Chile; author's calculations.
n.a. Not available.
a. Data are HP filtered.

construction. Relative to model 2, model 3 better reproduces the volatility and procyclicality of consumption and total and sectoral work hours, but not the procyclicality and volatility of investment and consumption of importable goods or the countercyclicality of real net exports. Figure 6 shows that model 3 better replicates aggregate consumption, as it replicates the nontradable part by construction. Also, since the wedges generate a procyclical labor demand, it better replicates total and nontradable work hours, in particular their increase between 1994 and 1998 and their fall between 1999 and 2003. It does not, however, capture the path of hours in the export sector.

Figure 7 shows that model 3 does not replicate the real exchange rate or the foreign lending spread. The main drawback, however, is that real net exports are procyclical instead of countercyclical, since investment and consumption of importable goods are not sufficiently procyclical and volatile. Thus, the two frictions complement each other: the external borrowing constraint creates countercyclical real net exports, while the labor-financing wedge creates a procyclical and volatile nontradables consumption and employment. The next section considers the two frictions together.

5. Model 4: External Borrowing Constraint and Asymmetric Financing Costs

Consider a small open economy that is perfectly integrated with the world in goods, but has limited access to the external capital market. Foreign lenders set individual borrowing constraints on domestic households according to equation (27). Households own firms, consume the N good, buy the M good for consumption and investment, and supply h and k to the firms. The export and nontradable firms demand k and h to produce their goods. They face a specific labor-financing wedge that captures different sources of labor market distortions.

As in models 2 and 3, the self-financing requirement and the labor-financing wedge are deduced to make the model replicate the paths of real net exports and of export and nontradable output in the data, respectively. Their moments and the moments of the other variables are then compared to those of models 2 and 3. The economy follows a balanced growth path, and population is constant. In the following discussion, the model is set in stationary form.

Figure 6. Data and Model 1 and Model 3 Simulations

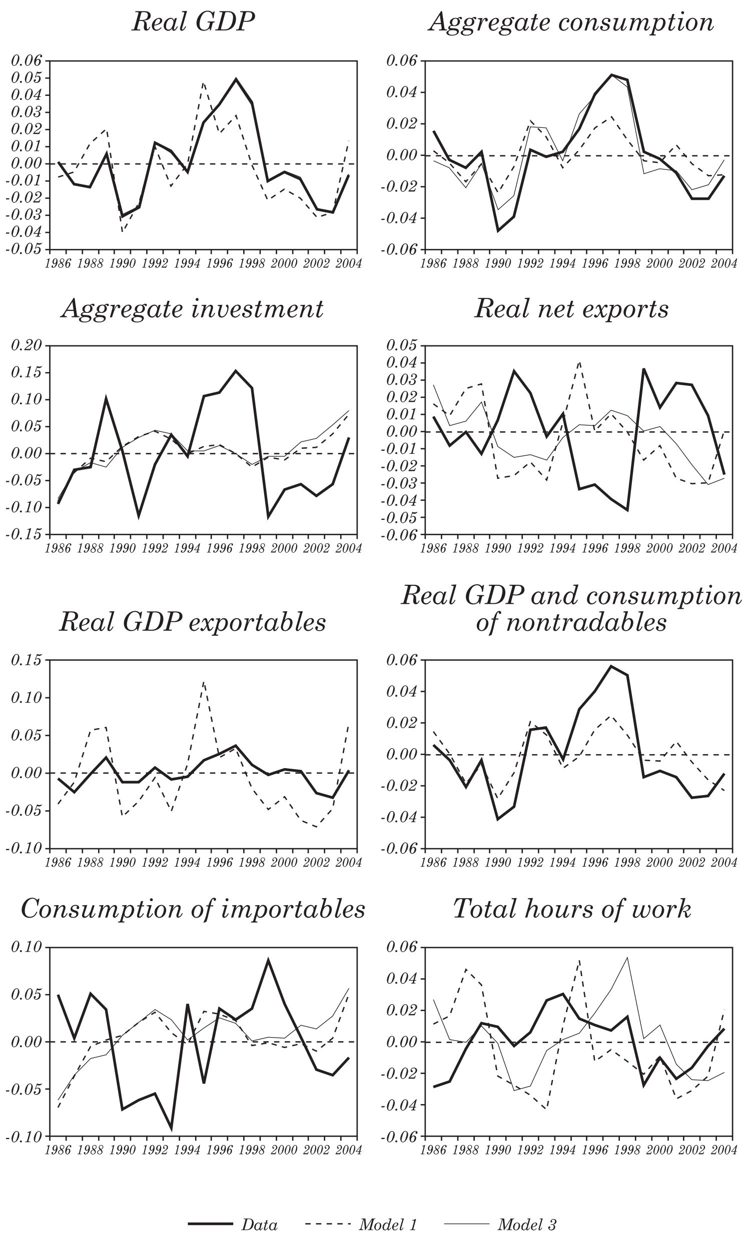
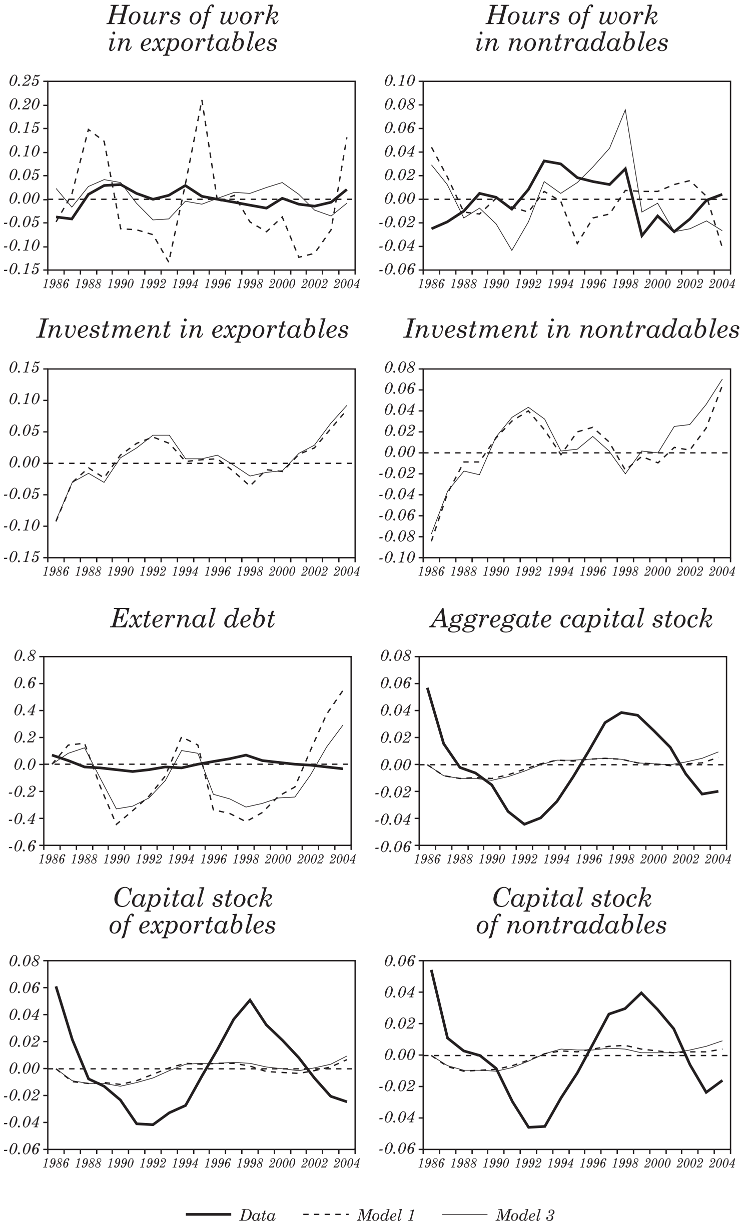
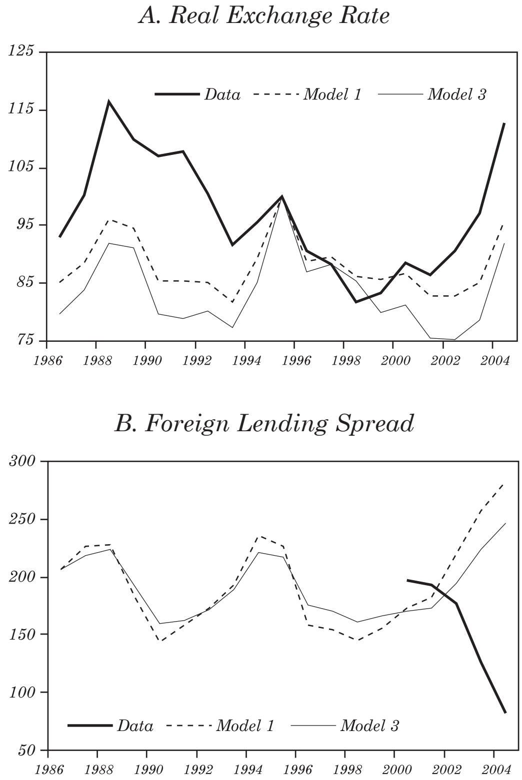


Figure 6. (continued)



Source: Central Bank of Chile; author's computations.

Figure 7. Real Exchange Rate and Foreign Lending Spread[a]



Source: J.P. Morgan's EMBI Global; author's computations.
a.Real exchange rate is measured as the ratio between the price of exportable goods and the price of nontradable goods. Foreign lending spread corresponds to the differential between the domestic interest rate and the foreign interest rate.

5.1 Households

Households solve the same problem as in model 2, so their first-order conditions are given by equations (29)–(37).

5.2 Firms

Both firms solve the same problem as in model 3. Their first-order conditions are thus given by equations (42) and (43) for the nontradable firm and by equations (44) and (45) for the export firm.

5.3 Competitive Equilibrium

Given b_0, k_0^X, and k_0^N and shocks' processes ($\varepsilon_t^R, \varepsilon_t^{P_X}, \varepsilon_t^X, \varepsilon_t^N, \Psi_t, \tau_t^X, \tau_t^N$), a competitive equilibrium corresponds to sequences of allocations $\{c_t^M, c_t^N, h_t, i_t^X, i_t^N, k_{t+1}^X, k_{t+1}^N, b_{t+1}\}|_{t=0}^{\infty}$, $\{h_t^{fX}, h_t^{fN}, k_t^{fX}, k_t^{fN}\}|_{t=0}^{\infty}$ and prices $\{P_t^X, P_t^N, q_t^X, q_t^N, w_t, R_t\}|_{t=0}^{\infty}$ such that:

—Given b_0, k_0^X, k_0^N, prices, and shocks' processes, $\{c_t^M, c_t^N, h_t, i_t^X, i_t^N, k_{t+1}^X, k_{t+1}^N, b_{t+1}\}|_{t=0}^{\infty}$ solve the households' problem;

—Given prices and shocks' processes, $\{h_t^{fX}, k_t^{fX}\}|_{t=0}^{\infty}$ solve firm X's problem;

—Given prices and shocks' processes, $\{h_t^{fN}, k_t^{fN}\}|_{t=0}^{\infty}$ solve firm N's problem;

—Market-clearing conditions are satisfied: $c_t^N = y_t^N$, $k_t^X = k_t^{fX}$, $k_t^N = k_t^{fN}$, and $h_t = h_t^{fX} + h_t^{fN}$; and

—The resource constraint is satisfied:

$$R_t b_t + P_t^X Y_t^X - c_t^M - i_t^X - i_t^N - \gamma b_{t+1} = 0.$$

5.4 Steady State and Calibration

The self-financing requirement is set as in model 2 and the labor wedges are set as in model 3, with the nontradable wedge about one percentage point above the export wedge. The other parameters and macroeconomic ratios remain as in model 1 (see table 3).

5.5 Simulations

As before, Ψ_t, τ_t^X and τ_t^N are deduced and introduced as shocks to make the model replicate the real net exports and sectoral output in the data between 1986 and 2004. The model is simulated for these shocks and the ones in model 1. Table 10 shows that the new Ψ_t presents roughly the same moments as in model 2, while the new wedges are slightly less persistent, but more volatile than in model 3, particularly the nontradable wedge. The innovations to both wedges are highly correlated, suggesting that the export wedge is no longer reducing the reallocation of labor across sectors, as the external borrowing constraint does it.

As in model 3, the innovations to the nontradable wedge are negatively correlated to productivity in both sectors, but now they

Table 10. Shock Processes in Model 4

				Cross correlation of innovations with						
Shock	*Statistic*	ρ	*St. dev. shock/ St. dev. GDP*	P^X	r^*	z^X	z^N	Ψ	τ^X	τ^N
Terms of trade	P^X	0.287	3.16	1.000	0.456	0.202	0.140	0.756	0.418	–0.257
Foreign interest rate	r^*	0.774	0.76	0.456	1.000	0.242	0.274	0.175	–0.255	–0.523
Productivity exportables	z^X	0.409	0.71	0.202	0.242	1.000	0.985	0.340	–0.152	–0.508
Productivity nontradables	z^N	0.357	0.68	0.140	0.274	0.985	1.000	0.222	–0.232	–0.518
Self-financing requirement	Ψ	0.735	1.67	0.756	0.175	0.340	0.222	1.000	0.655	0.064
Labor wedge exportables	τ^X	0.257	3.30	0.418	–0.255	–0.152	–0.232	0.655	1.000	0.693
Labor wedge nontradables	τ^N	0.531	3.43	–0.257	–0.523	–0.508	–0.518	0.067	0.693	1.000

Source: Author's calculations.

are also negatively correlated to the terms of trade and roughly uncorrelated to Ψ_t. The innovations to the export wedge are no longer as correlated with the terms of trade, but rather correlate more strongly with Ψ_t. The lower (but still high) correlation with P_t^X shows that although the external credit constraint reduces the incentive for labor reallocation across sectors, the wedge is still playing some role in the process. There could also be a spurious correlation, as the innovations to Ψ_t and P_t^X are highly cross-correlated.

Figure 8, panel A, shows that the labor-financing wedge does not change how the external borrowing constraint affects households, since the self-financing requirement and borrowing constraint multiplier follow a path similar to model 2. Although the new nontradable wedge is more volatile than in model 3, it presents roughly the same path as before: it falls continuously between 1991 and 1998, rises suddenly in 1999, and remains high until 2004 (see panel B). The new export wedge, however, is more similar to the nontradable wedge, suggesting that it is more representative of the cost of domestic financing than in model 3.

The two frictions seem to be related because both wedges follow a similar path to the external borrowing constraint multiplier, with a cross-correlation of 0.7. According to the appendix, a high correlation between τ_t^j and μ_t suggests that firm *j*'s cost of financing will vary not only with the domestic interest rate, but also with additional direct changes in its specific lending spread.

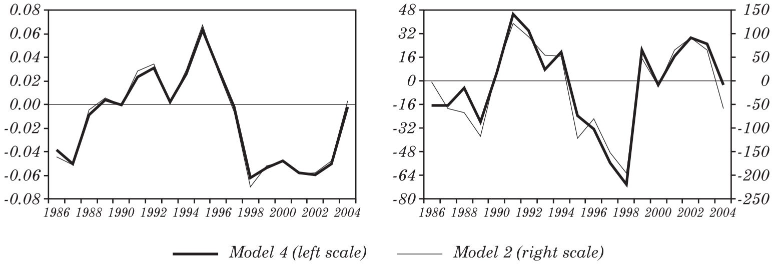
Table 11 presents the moments for model 4, which match those of the real net exports and sectoral output in the data by construction. Relative to models 2 and 3, model 4 better reproduces the volatility and procyclicality of aggregate consumption and investment and the countercyclicality and volatility of real net exports. However, although it better replicates the volatility and correlation with output of hours of work in the export and nontradables sectors, it does so at the cost of overestimating the volatility and procyclicality of total work hours.

Figure 9 shows that model 4 replicates aggregate consumption better than model 2, as it replicates consumption of nontradable goods in the data by construction. It also better replicates the path of investment and consumption of importable goods, which is required to generate countercyclical real net exports. With regard to total work hours, model 4 underestimates employment in 1991, when the borrowing constraint multiplier and wedges were highest, and overestimates employment in 1997 and 1998, when both were

Figure 8. Chile: Self-Financing Requirement and Labor-Financing Wedges

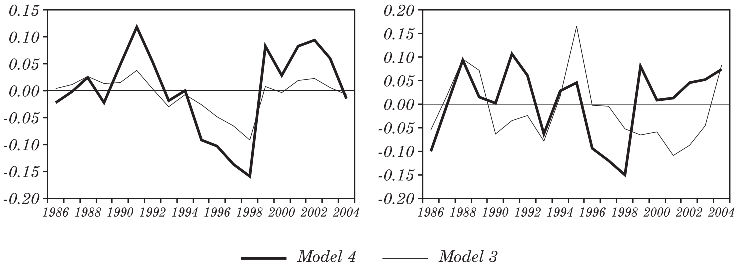
A. Self-financing requirement and extenal borrowing constraint multiplier for models 2 and 4

Self-financing requirement *Borrowing constraint multiplier*



B. Labor-financing wedges for models 3 and 4

Nontradable firm's labor-financing wedge *Exportable firm's labor-financing wedge*



C. Self-financing requirement and extenal borrowing constraint multiplier for model 4 and reduced-friction model

Self-financing requirement *Borrowing constraint multiplier*

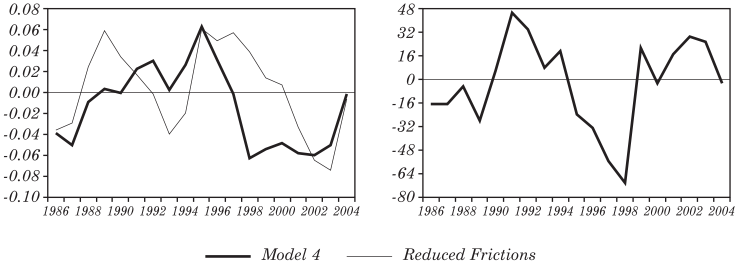
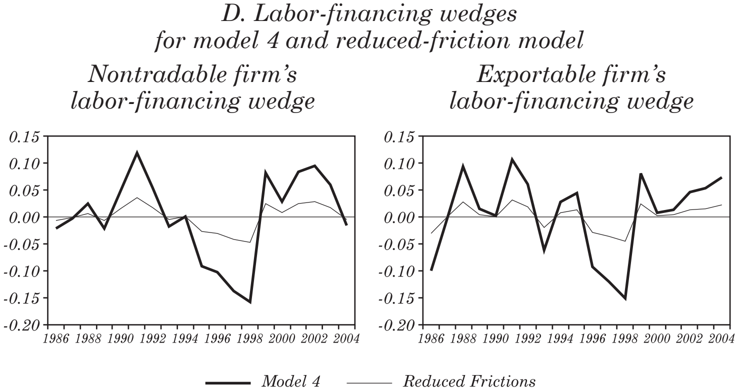


Figure 8. (continued)



Source: Author's calculations.

lowest. Since the procyclical labor demand generated by the labor-financing wedge more than offset the countercyclical labor supply generated by the external borrowing constraint, employment becomes more procyclical and volatile than in the data, particularly in the nontradables sector.

Finally, figure 10 shows that model 4 does a better job of replicating the paths of the real exchange rate and the external lending spread than the previous specifications. In particular, model 4 better captures the real appreciation between 1995 and 2000, as well as the real depreciation thereafter, although not before 1995. The fall in the foreign lending spread, however, is much smaller than in the data because the borrowing constraint multiplier, μ_t, is very small in steady state.

This exercise suggests that an adequate characterization of Chile's business cycles since the mid-1980s—and probably of the business cycles of most middle-income countries—should consider the two frictions introduced in model 4, namely, limited access to the external capital market and asymmetric financing opportunities across tradables and nontradables sectors. The former can explain the high procyclicality and volatility of investment and importable goods consumption, as well as the countercyclicality of the real net exports. The latter can explain the high procyclicality and volatility of work hours and nontradable goods consumption, which results in a better characterization of aggregate consumption when combined with the more procyclical and volatile consumption of importable goods.

Table 11. Data Moments and Simulations for Models 4: Credit Constraint and Labor Wedge

		HP-filtered data				*Model 4*			
		(1)	*(2)*	*(3)*	*(4)*	*(1)*	*(2)*	*(3*	*(4)*
Variable	x	$\rho(x_t, y_t)$	$\rho(x_t, y_{t-1})$	$\sigma(x)$	$\sigma(x)/\sigma(y)$	$\rho(x_t, y_t)$	$\rho(x_t, y_{t-1})$	$\sigma(y)$	$\sigma(x)/\sigma(y)$
Aggregate output	y	1.00	0.59	2.29	1.00	1.00	0.58	2.29	1.00
Output exportables	y^x	0.84	0.39	1.78	0.78	0.86	0.40	1.78	0.78
Output nontradables	y^n	0.98	0.61	2.80	1.22	0.98	0.62	2.80	1.22
Aggregate consumption	c	0.95	0.69	2.66	1.16	0.98	0.60	3.06	1.34
Consumption importables	c^m	0.25	0.45	4.98	2.17	0.86	0.47	5.52	2.41
Consumption nontradables	c^n	0.98	0.61	2.80	1.22	0.98	0.62	2.80	1.22
Investment	i	0.80	0.44	8.50	3.71	0.81	0.44	8.50	3.71
Investment exportables	i^x	n.a.	n.a.	n.a.	n.a.	0.80	0.43	10.87	4.75
Investment nontradables	i^n	n.a.	n.a.	n.a.	n.a.	0.82	0.44	6.78	2.96
Real net exports	nx	–0.74	–0.41	—	2.55	–0.74	–0.42	—	2.55
Nominal net exports	nnx	—	—	—	—	–0.58	–0.67	—	2.88
Work hours	h	0.40	0.12	1.78	0.78	0.76	0.59	2.23	0.97
Work hours exportables	h^x	–0.09	–0.30	2.05	0.89	0.23	0.02	2.07	0.91
Work hours nontradables	h^n	0.53	0.25	1.96	0.85	0.79	0.66	3.03	1.33
Aggregate capital		0.33	0.68	2.88	1.26	0.04	0.54	1.34	0.58
Capital exportables	k^x	0.43	0.75	3.06	1.34	0.02	0.52	1.75	0.77
Capital nontradables	k^n	0.24	0.60	2.80	1.22	0.07	0.56	1.01	0.44
Borrowing constraint multiplier	μ	n.a.	n.a.	n.a.	n.a.	–0.76	0.00	55.87	24.40

Source: Central Bank of Chile; author's calculations.
n.a. Not available.
a. Data are HP filtered.

Figure 9. Data and Model 2 and Model 4 Simulations

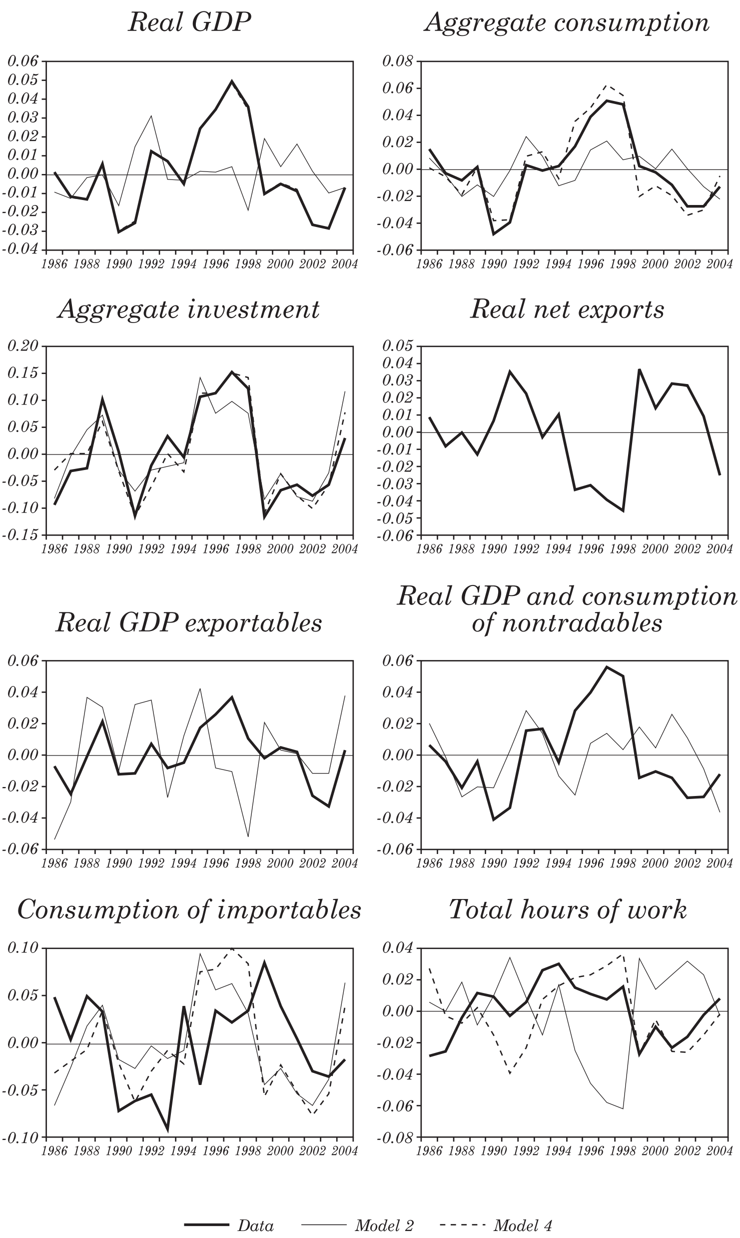
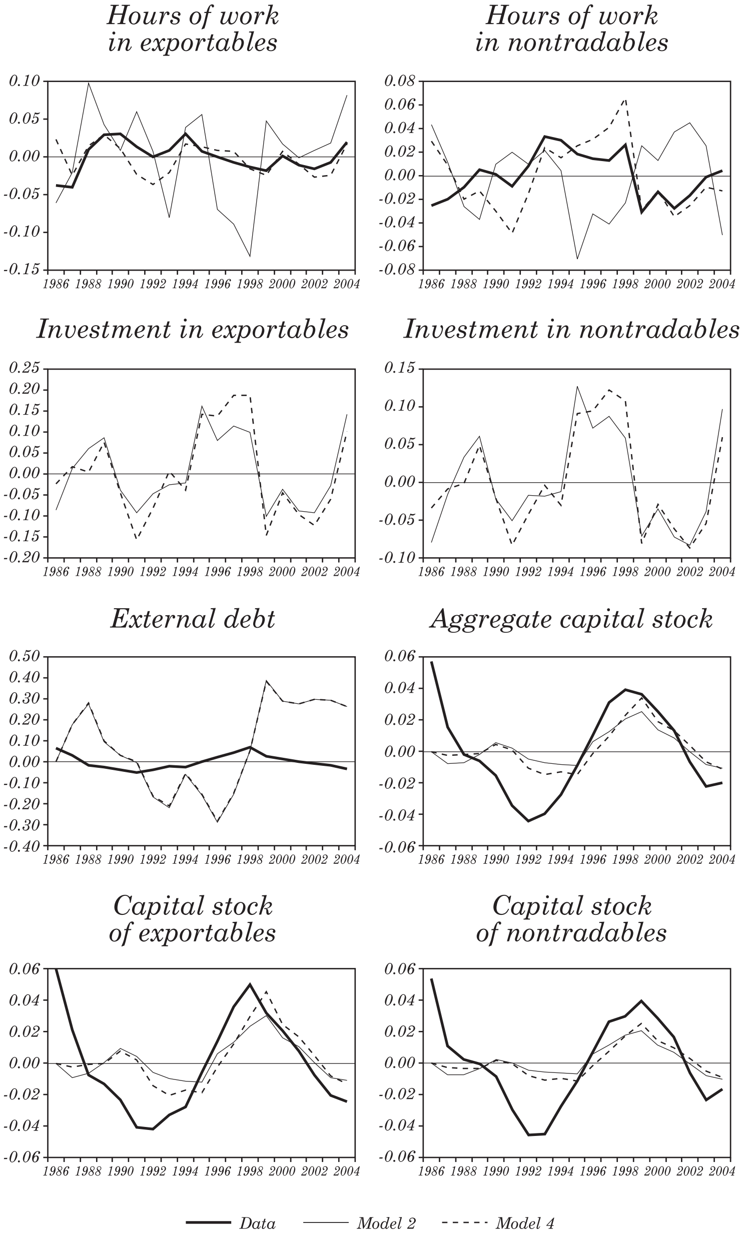


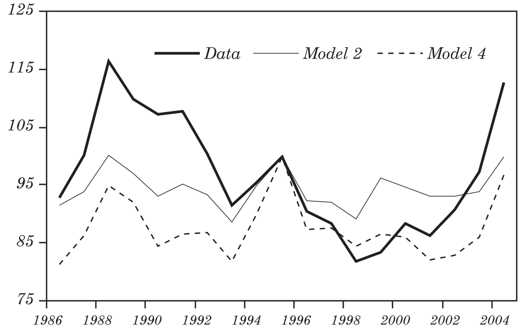
Figure 9. (continued)



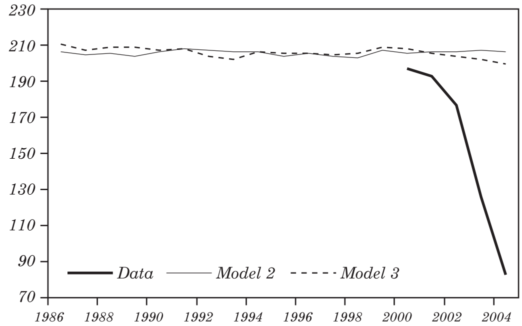
Source: Central Bank of Chile; author's computations.

Figure 10. Real Exchange Rate and Foreign Lending Spread[a]

A. Real Exchange Rate



B. Foreign Lending Spread



Source: J.P. Morgan's EMBI Global; author's computations.

a.Real exchange rate is measured as the ratio between the price of exportable goods and the price of nontradable goods. Foreign lending spread corresponds to the differential between the domestic interest rate and the foreign interest rate.

5.6 Lower Incidence of Frictions

This study does not endogenize the source of the market imperfections to draw policy implications, but rather presents a simulated scenario for a lower incidence of frictions to see what would have been the cyclical properties of an economy with better access to foreign and domestic financing. The self-financing requirement is made more procyclical and volatile to get a constant borrowing constraint multiplier over time, and the standard deviations of the sector-specific labor-financing wedges are reduced to 30 percent of its value in the data. Figure 8, panel C, shows that Ψ_t should have been higher than in model 4 between 1996 and 2001, but lower in 2002 and 2003.

Table 12 presents the autocorrelations, standard deviations, and cross-correlations of innovations in this new set of shocks. It shows that to obtain a higher degree of risk sharing between domestic households and foreign lenders, Ψ_t has to be less persistent, but more volatile, and it should be more correlated to the terms of trade and productivity in both sectors. Figure 11 and table 13 show that with a lower incidence of frictions, the cyclical properties of the economy would be qualitatively similar to the frictionless case. The volatility of consumption and investment would have been smaller, and total work hours and exportable goods output would have been more procyclical and more volatile, resulting in more procyclical and less volatile real net exports. This scenario would have been welfare improving, as households value consumption smoothing.

Table 12. Shock Processes in Reduced-Frictions Model

Shock	*Statistic*	ρ	*St. dev. shock/ St. dev. GDP*	*Cross correlation of innovations with*						
				P^X	r^*	z^X	z^N	Ψ	τ^X	τ^N
Terms of trade	P^X	0.287	3.16	1.000	0.456	0.202	0.140	0.756	0.418	−0.257
Foreign interest rate	r^*	0.774	0.76	0.456	1.000	0.242	0.274	0.175	−0.254	−0.523
Productivity exportables	z^X	0.409	0.71	0.202	0.242	1.000	0.985	0.439	−0.152	−0.507
Productivity nontradables	z^N	0.357	0.68	0.140	0.274	0.985	1.000	0.427	−0.232	−0.518
Self-financing requirement	Ψ	0.639	1.82	0.835	0.725	0.439	0.427	1.000	0.043	−0.471
Labor wedge exportables	τ^X	0.257	0.99	0.418	−0.254	−0.152	−0.232	0.043	1.000	0.693
Labor wedge nontradables	τ^N	0.530	1.03	−0.257	−0.523	−0.504	−0.518	−0.471	0.693	1.000

Source: Author's computations.

Table 13. Data Moments and Simulations for Reduced-Frictions Model

		HP-filtered data				*Reduced-Frictions Model*			
Variable	x	*(1)* $\rho(x_t, y_t)$	*(2)* $\rho(x_t, y_{t-1})$	*(3)* $\sigma(x)$	*(4)* $\sigma(x)/\sigma(y)$	*(1)* $\rho(x_t, y_t)$	*(2)* $\rho(x_t, y_{t-1})$	*(3* $\sigma(y)$	*(4)* $\sigma(x)/\sigma(y)$
Aggregate output	y	1.00	0.59	2.29	1.00	1.00	0.45	2.40	1.00
Output exportables	y^x	0.84	0.39	1.78	0.78	0.89	0.24	4.27	1.78
Output nontradables	y^n	0.98	0.61	2.80	1.22	0.75	0.56	1.97	0.82
Aggregate consumption	c	0.95	0.69	2.66	1.16	0.84	0.57	1.84	0.77
Consumption importables	c^m	0.25	0.45	4.98	2.17	0.67	0.29	2.86	1.19
Consumption nontradables	c^n	0.98	0.61	2.80	1.22	0.75	0.56	1.97	0.82
Investment	i	0.80	0.44	8.50	3.71	0.43	–0.08	3.01	1.26
Investment exportables	i^x	n.a.	n.a.	n.a.	n.a.	0.33	–0.24	3.24	1.35
Investment nontradables	i^n	n.a.	n.a.	n.a.	n.a.	0.49	0.06	2.95	1.23
Real net exports	nx	–0.74	–0.41	—	2.55	0.75	0.33	—	1.23
Nominal net exports	nnx	—	—	—	—	–0.59	0.04	—	3.51
Work hours	h	0.40	0.12	1.78	0.78	0.74	0.38	2.59	1.98
Work hours exportables	h^x	–0.09	–0.30	2.05	0.89	0.69	0.15	7.22	3.01
Work hours nontradables	h^n	0.53	0.25	1.96	0.85	0.11	0.57	1.90	0.79
Aggregate capital		0.33	0.68	2.88	1.26	0.29	0.48	0.46	0.19
Capital exportables	k^x	0.43	0.75	3.06	1.34	0.40	0.54	0.47	0.19
Capital nontradables	k^n	0.24	0.60	2.80	1.22	0.07	0.56	1.01	0.44
Borrowing constraint multiplier	μ	n.a.	n.a.	n.a.	n.a.	–0.36	–0.36	0.00	0.00

Source: Central Bank of Chile; author's calculations.
n.a. Not available.
a. Data are HP filtered.

Figure 11. Data, Model 4, and Reduced-Frictions Model

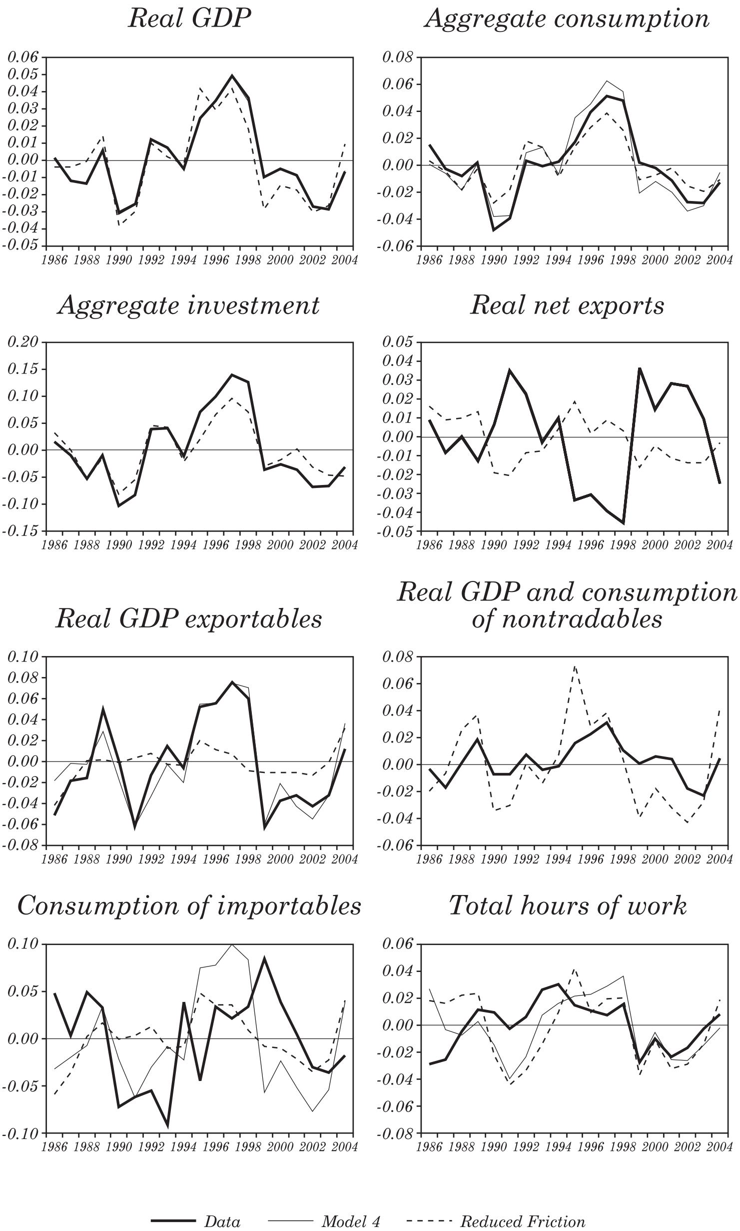
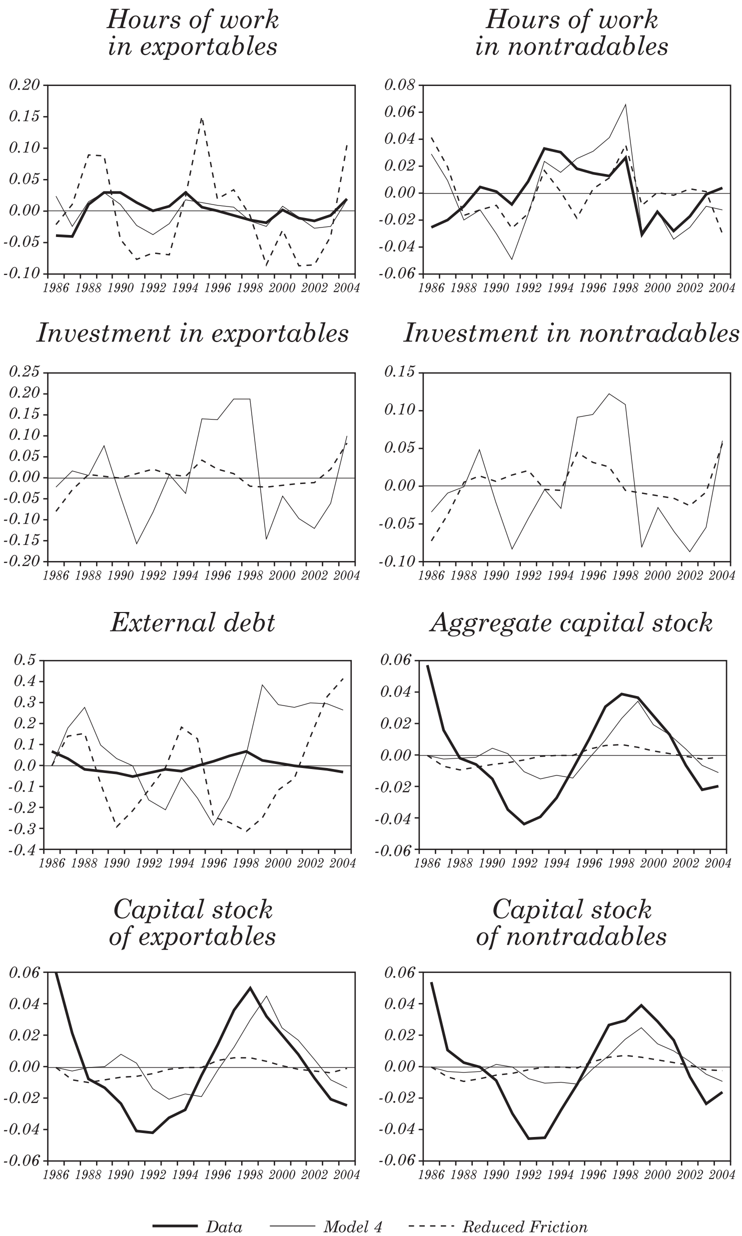


Figure 11. (continued)



Source: Central Bank of Chile; author's computations.

6. Conclusions

Business cycles in middle-income countries are characterized by highly procyclical and volatile consumption and by countercyclical and volatile real net exports. Standard DSGE small open economy models have failed to reproduce these features, because they predict excessive consumption smoothing and procyclical real net exports. Earlier studies approach the problem either by increasing the persistence of shocks or by lowering the intertemporal elasticity of substitution.

This study shows that the problem can be solved without changing preferences or the shocks' persistence, but rather by considering two market frictions that are relevant for middle-income countries: imperfect access to the foreign capital market and asymmetric financing opportunities across tradable and nontradable firms. The former, identified as an external borrowing constraint, generates more procyclical and volatile investment and consumption of importable goods, reduces the excessive reallocation of labor between the export and nontradables sectors, lowers the volatility of exportable output, and produces countercyclical and volatile real net exports. However, it predicts countercyclical rather than procyclical labor supply and employment, and it does not increase enough the volatility of nontradable goods consumption.

The asymmetric financing opportunities across sectors, identified as sector-specific labor-financing wedges, create procyclical fluctuations in labor demand, which increases the procyclicality and volatility of employment, nontradable goods output, and aggregate consumption. It does not increase the procyclicality and volatility of investment and importable goods consumption, nor does it produce countercyclical real net exports. The two frictions thus seem to complement each other, as they help the model to reproduce different features of the data. The exercise considering both frictions together suggests that an adequate characterization of Chile's business cycles since the mid-1980s, and probably the cycles of most middle-income countries, should consider the role played by these two frictions in the origin and amplification of the domestic cycles.

Finally, although this study does not endogenize the source of the market imperfections to draw policy implications, it presents a simulated scenario for a lower incidence of frictions to see the cyclical properties of an economy with better access to foreign and domestic financing. This exercise shows that the self-financing requirement has to be more procyclical, and more correlated to the terms of trade and productivity, to produce a higher degree of risk sharing between domestic households and foreign lenders. The cyclical properties of this economy would be qualitatively similar to a frictionless economy; the volatility of consumption and investment would be smaller; and employment and exportable goods output would be more procyclical and volatile, resulting in procyclical and less volatile real net exports. This would improve welfare since households value consumption smoothing.

Appendix

Labor-Financing Wedges Based on Collateral Constraints

Consider a small economy that is perfectly open to the world in goods, but faces household-specific external borrowing constraints defined as the requirement to self-finance a fraction of their expenditures, Ψ_t, with their current income at date t (equation 27). There are four types of agents: foreign lenders, domestic households, domestic firms, and domestic banks. Foreign lenders set the borrowing constraints on the households. Households own the firms and banks, consume the N good, buy the M good for consumption and investment, and supply h and k to the firms. They supply funds to the domestic banks within the period at the rate of return R_t, and demand funds from the firms within the period at the same rate.

Both the export and the nontradable firms demand h and k for production. They pay wages before production is realized, thus facing a credit-in-advance constraint. The timing is as follows. Firm j get credit from the banks at the beginning of each period at a rate of return, R_t^{lj}, but it pays wages only at the end of the period, just before production is materialized. It can thus lend its loan to the households within the period at the rate of return, R_t, which results in a net cost of the loan of $R_t^{lj} - R_t \geq 0$.

Banks receive deposits from households within the period at the rate of return, R_t, and lend to the firms subject to collateral constraints. The collateral is the fraction of the firm's output they can seize, which results in a lending rate of $R_t^{lj} \geq R_t$ with $j = X, N$. All the lending costs are rebated to the households in a lump sum, so that the resource constraint does not change. The economy follows a balanced growth path, and population is constant. In the following discussion, the model is set in stationary form.

Households

The households' problem is the same as in model 2, so their first-order conditions are given by equations (29)–(37).

Firms

Both firms get credit from banks at the beginning of each period and repay it at the end of the period. They lend their loans within the period to the households at the rate of return R_t. As $R_t^{lj} \geq R_t$, their optimal decision is to hold just the necessary credit to pay wages in each period, satisfying the credit-in-advance constraint in equality:

$$z_t^{fj} = w_t h_t^{fj} \tag{46}$$

for $j = X, N$, where z_t^j is the credit received by firm j. The firm's total cost of production is given by:

$$w_t h_t^{fj}\left(1 + R_t^{lj} - R_t\right) + q_t^j k_t^{fj} \tag{47}$$

for $j = X, N$. Firm j chooses h_t^{fj}, k_t^{fj} to maximize profits. Its first-order conditions are as follows:

$$w_t\left(1 + R_t^{lj} - R_t\right) = \left(1 - \alpha_j\right) P_t^j \exp\left(\varepsilon_t^j\right)\left(k_t^{fj}\right)^{\alpha_j}\left(h_t^{fj}\right)^{-\alpha_j} \text{ and} \tag{48}$$

$$q_t^j = \alpha_j P_t^j \exp\left(\varepsilon_t^j\right)\left(h_t^{fj}\right)^{(1-\alpha_j)}\left(k_t^{fj}\right)^{(\alpha_j - 1)}, \tag{49}$$

for $j = X, N$.

Banks

The banking industry is perfectly competitive. Banks take deposits from households and lend them to the firms, subject to collateral constraints. The collateral is a fraction, Ω_t^j, of firm j's output that banks can seize at the end of each period. They thus face the following constraint when allocating loans:

$$\Omega_t^j Y_t^j \geq z_t^j, \tag{50}$$

for $j = X, N$. The banks' problem is to choose the allocation $\{z_t^X, z_t^N\}$ in each period to maximize profits. Their first-order conditions are

$$R_t^{lX} - R_t = \eta_t^X \text{ and} \tag{51}$$

$$R_t^{lN} - R_t = \eta_t^N, \tag{52}$$

where η_t^X and η_t^N are the Lagrange multipliers on equation (50) for X and N, respectively.

Competitive Equilibrium

Given initial values of b_0, k_0^X, and k_0^N, and shocks' processes ($\varepsilon_t^R, \varepsilon_t^{P_X}, \varepsilon_t^X, \varepsilon_t^N, \Psi_t, \Omega_t^X, \Omega_t^N$), a competitive equilibrium corresponds to sequences of allocations $\{c_t^M, c_t^N, h_t, i_t^X, i_t^N, k_{t+1}^X, k_{t+1}^N, b_{t+1}, z_t^X, z_t^N\}|_{t=0}^{\infty}$, $\{h_t^{fX}, k_t^{fX}, z_t^{fX}, k_t^{fN}, h_t^{fN}, z_t^{fN}\}|_{t=0}^{\infty}$ and prices $\{P_t^X, P_t^N, q_t^X, q_t^N, w_t, R_t, R_t^{lX}, R_t^{lN}\}|_{t=0}^{\infty}$ such that:

—Given b_0, k_0^X, k_0^N, prices, and shocks' processes, $\{c_t^M, c_t^N, h_t, i_t^X, i_t^N, k_{t+1}^X, k_{t+1}^N, b_{t+1}\}|_{t=0}^{\infty}$ solve the households' problem;

—Given prices and shocks' processes, $\{h_t^{fX}, k_t^{fX}, z_t^{fX}\}|_{t=0}^{\infty}$ solve firm X's problem;

—Given prices and shocks' processes, $\{h_t^{fN}, k_t^{fN}, z_t^{fN}\}|_{t=0}^{\infty}$ solve firm N's problem;

—Given prices and shocks' processes, $\{z_t^X, z_t^N\}|_{t=0}^{\infty}$ solve bank's problem;

—Market-clearing conditions are satisfied: $c_t^N = y_t^N$, $k_t^X = k_t^{fX}$, $k_t^N = k_t^{fN}$, $h_t = h_t^{fX} + h_t^{fN}$, $z_t^X = z_t^{fX}$, and $z_t^N = z_t^{fN}$; and

—The resource constraint is satisfied:

$$R_t b_t + P_t^X Y_t^X - c_t^M - i_t^X - i_t^N - \gamma b_{t+1} = 0.$$

Equivalence to Labor Financing Wedges

The reduced form of this model is the same as for model 4, with $\tau_t^j = \eta_t^j = R_t^{lX} - R_t$. Thus, the sector-specific labor-financing wedges deduced in models 3 and 4 can be interpreted as the spread over the domestic interest rate that each firm pays on its credit from the domestic banks.

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Emerging Market Fluctuations: The Role of Interest Rates and Productivity Shocks

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Business cycles in emerging markets are characterized by high levels of volatility in income, investment, and net exports. Consumption is more volatile than income, and net exports are highly countercyclical (see Aguiar and Gopinath, 2007). Furthermore, the interest rates faced by these economies are highly volatile and negatively correlated with income, as described in Neumeyer and Perri (2005). In this paper, we adopt a standard stochastic business cycle model of a small open economy and allow the economy to be driven by productivity shocks that have permanent and transitory components, as well as by shocks to the interest rate process. We then estimate the role of the different processes in explaining the business cycle behavior of emerging markets.

In Aguiar and Gopinath (2007), we examine an economy driven exclusively by shocks to productivity. Productivity shocks in this context may be viewed as manifestations of deeper frictions in the economy, such as changes in monetary, fiscal, and trade policies. For instance, Restuccia and Schmitz (2004) provide evidence of a 50 percent drop in productivity in the petroleum industry in Venezuela within five years of its nationalization in 1975. Similarly, Schmitz and Teixeira (2004) document almost a doubling of productivity in the Brazilian iron ore industry following its privatization in 1991. We view such dramatic changes in productivity following reforms and the undoing of reforms as characteristic of emerging markets. Several emerging markets also experience terms-of-trade shocks that display

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a high degree of persistence. In this set-up, we provide a methodology for identifying the role of transitory versus trend shocks in explaining business cycles. The procedure relies on using the intuition behind the permanent income hypothesis.

In Aguiar and Gopinath (2007), we adopt the standard small open economy assumption and model the interest rate as an exogenous international risk-free rate, which we hold constant. The economy always repays its debt, and there is never any default. In Aguiar and Gopinath (2006), we explicitly allow for default in an Eaton and Gersovitz (1981) set-up. That paper specifies an endowment economy driven by trend and stationary shocks. We show that incorporating trend shocks is important in generating empirically plausible rates of default, as well as simultaneously matching key correlations between the interest rate, output, and the current account.

In this paper, we extend Aguiar and Gopinath (2007) to allow for a stochastic interest rate process. We consider three specifications. The first models the case of exogenous interest rate shocks that are independent of the productivity shocks. In the second specification, the interest rate responds to transitory productivity shocks in addition to independent shocks. In the third case, the interest rate also responds to trend productivity shocks. We assume a reduced-form specification for all these processes and provide intuition for the nature of the process.

We estimate the interest rate process from the Euler equations and do not use observed interest rates. This mirrors our treatment of productivity shocks, for which we do not use the Solow residual series to directly identify the underlying productivity process. We do this for two reasons. First, the observed rates are not risk-free rates given the probability of default. The promised rate observed in the data therefore may not be the relevant real rate governing behavior.[1] Second, agents may be constrained in their access to financial markets. In that case, an implicit Lagrange multiplier, rather than the observed market rate, governs the consumption/investment decision. Our estimation will pick up fluctuations in this multiplier. This approach is different from the work of Neumeyer and Perri (2005), who take the observed interest rate process and feed it into the economy. This assumes that the Euler equation with repayment is always satisfied at the observed interest rates.

We show that the model with interest rate shocks that are orthogonal to productivity shocks does poorly in matching the

1. For explicit models of default, see Aguiar and Gopinath (2006); Arellano (2006).

features of the data for emerging market countries. Movements in the interest rate affect consumption and investment by setting the price for intertemporal substitution. An increase in the interest rate reduces consumption relative to the future, as it increases the incentive to save. It also reduces investment in physical capital, since the return from the bond is higher. Because interest rate shocks are orthogonal to productivity shocks in this exercise, the induced correlations between consumption and income, and investment and income are low, which is contrary to the data. The response of output, on impact, to a rise in the interest rate will be small, as productivity has not changed and capital takes time to adjust. Moreover, when consumption and leisure are inseparable, labor supply rises in response to a drop in consumption, which generates an increase in output; this is counterfactual, given that periods of high interest rates have been associated with large declines in output. Interest rate shocks that are not associated with movements in productivity will clearly perform poorly in matching the facts for emerging markets. This point is similar in spirit to the work of Neumeyer and Perri (2005) and Chari, Kehoe, and McGrattan (2005).

We next allow the interest rate to respond to productivity shocks, including both transitory and trend shocks. The data suggest that a high level of productivity should be associated with a lower interest rate. A positive shock to productivity raises consumption, and the increase is amplified by the contemporaneous decline in interest rates. This increases the relative volatility of consumption for a given income process. Investment also increases following the rise in productivity and the decline in interest rates. This implies that net exports decrease, inducing a negative correlation between net exports and income. The precise moments of the stationary distribution will depend on the persistence in the income and interest rate processes. For reasons explained below, the model performs better when the interest rate primarily responds to the transitory income shock.

Finally, we use generalized method of moments (GMM) and data from Mexico to estimate the parameters of a model that allows for both exogenous interest rate shocks and productivity shocks and for the interest rate shock to respond to the transitory income shock. In the benchmark case, in which the model allows only for productivity shocks, the random walk component of the Solow residual is estimated at 1.02. In Aguiar and Gopinath (2007), we estimate a far lower random walk component for Canada, at 0.5. When we allow for the richer specification with interest rate shocks, we estimate the random walk component to be essentially the same, at 1.01. This supports the conclusions in Aguiar and Gopinath (2007) that emerging markets are subject to more volatile trend shocks than developed markets. We also find evidence of a small negative covariance between productivity shocks and the implied interest rate.

The differences in the Solow residual processes between developed and emerging markets may well be a manifestation of deeper frictions in the economy. Chari, Kehoe, and McGrattan (2007), for instance, show that many frictions, including financial frictions, can be represented in reduced form as Solow residuals. From the perspective of private agents in our economy, these shocks appear as exogenous shifts in productivity. Our analysis provides support for models with frictions that are reflected in the persistence of Solow residuals, rather than frictions that distort the response of investment and consumption to underlying productivity. Guajardo (in this volume), for instance, finds that his model with financial frictions fits the data best when procyclical exogenous labor financing wedges affect hiring decisions. That is, financing working capital requirements is easier in booms than in recessions. These financing wedges behave like productivity shocks. Our analysis shows that interest rate shocks that only affect the Euler equation add little to matching the facts in the data for emerging markets. One could clearly argue that interest rate movements can interact with underlying financial frictions to generate shocks that look like productivity shocks. Our analysis is completely consistent with such a model.

We also present evidence that Chile has features similar to other emerging markets documented in Aguiar and Gopinath (2007).[2] The correlation between Hodrick-Prescott-filtered net exports as a ratio of gross domestic product (GDP) and the HP-filtered log of GDP is –0.82 for Chile. Quarterly series on private consumption are not available before 1996. For the ten years from 1996—2006, the volatility of the HP-filtered log GDP is 1.63, compared with a volatility of 1.89 for the HP-filtered log of private consumption. This is similar to other emerging markets, in which consumption volatility generally exceeds the volatility of income and net exports are highly countercyclical.

The next section describes the stochastic growth model. Section 2 then outlines the identification strategy and provides intuition through impulse responses to various shocks. Section 3 presents the results from a GMM estimation of the model.

2. We thank David Rappoport for providing us with this data.

1. Stochastic Growth Model

The model here is based on Aguiar and Gopinath (2007) and augmented to include a stochastic interest rate process. Technology is characterized by a Cobb-Douglas production function that uses capital, K_t, and labor, L_t, as inputs

$$Y_t = e^{z_t} K_t^{\alpha} (\Gamma_t L_t)^{1-\alpha}, \tag{1}$$

where $\alpha \in (0, 1)$ represents labor's share of output. The parameters z_t and Γ_t represent productivity processes. The two productivity processes are characterized by different stochastic properties. Specifically, z_t follows an AR(1) process,

$$z_t = \rho_z z_{t-1} + \varepsilon_t^z, \tag{2}$$

with $|\rho_z| < 1$, and ε_t^z represents independent and identically distributed (i.i.d.) draws from a normal distribution with zero mean and standard deviation σ_z.

The parameter Γ_t represents the cumulative product of so-called growth shocks. In particular,

$$\Gamma_t = e^{g_t} \Gamma_{t-1} = \prod_{s=0}^{t} e^{g_s} \text{ and}$$

$$g_t = (1 - \rho_g)\mu_g + \rho_g g_{t-1} + \varepsilon_t^g,$$

where $|\rho_z| < 1$, and ε_t^g represents i.i.d. draws from a normal distribution with zero mean and standard deviation σ_g. The term μ_g represents the long-run mean growth rate of productivity. We loosely refer to the realizations of g as growth shocks, as they constitute the stochastic trend of productivity. We use separate notation for shocks to the level of productivity (z_t) and the growth of productivity (g_t) to simplify exposition and calibration.

Given that a realization of g permanently influences Γ, output is nonstationary with a stochastic trend. For any variable x, we introduce a hat to denote its detrended counterpart:

$$\hat{x}_t \equiv \frac{x_t}{\Gamma_{t-1}}.$$

We normalize by trend productivity through period $t-1$. This ensures that if xt is in the agent's information set as of time $t-1$, then so is $\hat{x}_t$. The solution to the model is invariant to the choice of normalization.

Period utility is Cobb-Douglas:

$$u_t = \frac{\left[C_t^{\gamma}(1-L_t)^{1-\gamma}\right]^{1-\sigma}}{1-\sigma}, \tag{3}$$

where $0 < \gamma < 1$. If β is the subjective intertemporal discount factor, a well-behaved steady state of the deterministic linearized model requires

$$\beta(1+r^*) = \mu_g^{1-\gamma(1-\sigma)}.$$

The equilibrium is characterized by maximizing the present discounted value of utility subject to the production function (equation 1) and the per-period resource constraint:

$$C_t + K_{t+1} = Y_t + (1-\delta)K_t - \frac{\phi}{2}\left(\frac{K_{t+1}}{K_t} - e^{\mu_g}\right)^2 K_t - B_t + q_t B_{t+1}. \tag{4}$$

Capital depreciates at the rate δ, and changes to the capital stock entail a quadratic adjustment cost of $(\phi/2)[(K_{t+1}/K_t) - e^{\mu_g}]^2 K_t$. We assume that international financial transactions are restricted to one-period, risk-free bonds. The level of debt due in period t is denoted B_t, and q_t is the time t price of debt due in period $t+1$.

We focus on fluctuations in the price of debt, q_t. We assume that the interest rate is potentially driven by an exogenous process, r_t, as well as the domestic total factor productivity (TFP) shocks. Specifically, the price of debt, q, is given by the following expression:

$$\frac{1}{q_t} = 1 + r^* + e^{\left[r_t + a_z z_t + a_g(g_t - \mu_g)\right]} + \psi\left[e^{(B_{t+1}/\Gamma_t) - b} - 1\right], \tag{5}$$

where

$$r_t = \rho_r r_{t-1} + \varepsilon_t^r. \tag{6}$$

The world interest rate is held constant at r^*. The country-specific shock to the interest rate is given by ε_t^r, which is orthogonal to z and g. The induced process, r_t, has an autocorrelation coefficient of ρ_r and a long-run mean of zero. The parameters a_z and a_g capture the sensitivity of the interest rate to the transitory productivity shock and the trend productivity shock, respectively. Correlation between the interest rate and productivity does not imply a direction of causation between the two, however. Aguiar and Gopinath (2006) describe a model in which exogenous domestic productivity shocks drive an endogenous interest rate, while Neumeyer and Perri (2005) present a model in which exogenous (foreign) interest rate shocks drive domestic TFP. The variable b represents the steady-state level of debt, and $\psi > 0$ governs the elasticity of the interest rate to changes in indebtedness. This sensitivity to the level of outstanding debt takes the form used in Schmitt-Grohé and Uribe (2003).[3] When choosing the optimal amount of debt, the representative agent does not internalize the fact that he or she faces an upward-sloping supply of loans.

In normalized form, the representative agent's problem can be stated recursively:

$$V\left(\hat{K},\hat{B},z,g,r\right)=\max_{\left\{\hat{C},L,\hat{K}',\hat{B}'\right\}}\left\{\begin{array}{l}\dfrac{\left[\hat{C}_t^{\gamma}\left(1-L_t\right)^{1-\gamma}\right]^{1-\sigma}}{1-\sigma}\\ +\beta e^{g_{\gamma}(1-\sigma)}EV\left(\hat{K}',\hat{B}',z',g',r'\right)\end{array}\right\}, \tag{7}$$

such that

$$\hat{C}+e^{g}\hat{K}'=\hat{Y}+(1-\delta)\hat{K}-\frac{\phi}{2}\left(e^{g}\frac{\hat{K}'}{\hat{K}}-e^{\mu_g}\right)^2\hat{K}-\hat{B}+e^{g}q\hat{B}'. \tag{8}$$

The evolution of the capital stock is given by

$$e^{g}\hat{K}'=(1-\delta)\hat{K}+\hat{X}-\frac{\phi}{2}\left(\frac{\hat{K}'}{\hat{K}}e^{g}-e^{\mu_g}\right)^2\hat{K}. \tag{9}$$

3. This adjustment is typically motivated by the need to make assets stationary in the linearized model. An alternative is to recognize that we are linearly approximating a nonlinear economy for which a stationary distribution exists (for example, as a result of borrowing constraints and a world equilibrium interest rate that is lower than the discount rate, as in Aiyagari, 1994). Quantitatively, since the elasticity of the interest rate to changes in indebtedness is set close to 0 (0.001 to be exact), there is a negligible difference between the two approaches in terms of the HP-filtered or first-differenced moments of the model.

Given an initial capital stock, $\hat{K}_0$, and debt level, $\hat{B}_0$, the behavior of the economy is characterized by the first-order conditions of the problem (equation 7), the technology and budget constraints (equations 1 and 8, respectively), and the transversality conditions.

We solve the normalized model numerically by log-linearizing the first-order conditions and resource constraints around the deterministic steady state. Given a solution to the normalized equations, we can recover the path of the nonnormalized equilibrium by multiplying through by Γ_{t-1}. We also compute the theoretical moments of the model from the coefficients of the linearized solution.

2. Identification

The primary goal of this paper is to assess the relative importance of interest rate shocks, transitory productivity shocks, and permanent shocks to productivity in explaining the behavior of emerging markets. In Aguiar and Gopinath (2007), we describe the methodology of exploiting decisions by informed, optimizing agents for identifying the underlying shock process. This paper extends that methodology to accommodate a richer process for the interest rate.

The methodology we employ selects parameters of the model to match key moments of the data. Below, we discuss which moments are particularly useful in identifying the parameters of interest. We do not use market interest rates on sovereign debt, however, because those interest rates represent the price of a defaultable bond. This is a different asset than that modeled above. To see this, consider the Euler equation for bonds from the above model:

$$\frac{\beta}{q} E \frac{u_c'}{u_c} = 1 . \tag{10}$$

While consumption is stochastic, the interest rate paid (conditional on information at the time of borrowing) is deterministic. In a model with defaultable debt, the consumer pays the interest rate conditional on no default and pays zero (or some fraction) if default occurs. Therefore, the observed market interest rate cannot be used directly in a simple Euler equation, but must be combined with a full specification of the states in which default occurs and the payments to be made conditional on default.

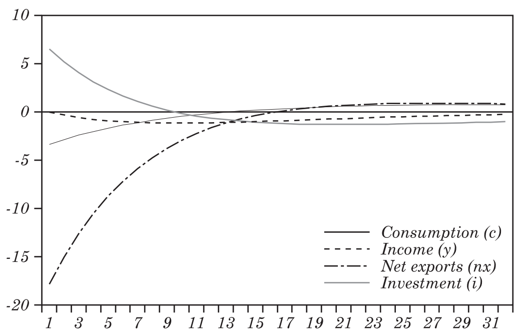
Our interest rate process, q, can be viewed as a wedge in the Euler equations for consumption and investment. Our estimation will then back out the parameters governing the stochastic process of this wedge, similar to the exercise of Chari, Kehoe, and McGrattan (2007). It also captures unobserved frictions (to a linear approximation) such as additional borrowing costs or constraints beyond the market interest rate.

2.1 Interest Rate Shocks Orthogonal to Productivity Shocks

We begin with an exploration of uncorrelated interest rate shocks—that is, shocks to the interest rate that are orthogonal to total factor productivity. Changes in the interest rate induce changes in consumption and investment for a given path of income owing to intertemporal substitution. This will raise the relative volatility of consumption and investment. Such shocks therefore have the potential to explain the relatively high volatility of consumption in emerging markets. However, introducing shocks that move consumption and investment independently of income reduces the covariance of consumption and investment with income. This generates counterfactual implications for the cyclicality of net exports.

Figure 1 plots the impulse responses of consumption, investment, net exports, and income to a one percent shock to ε^r. We set $\rho_r = 0.9$. As expected, an increase in the interest rate leads to a drop in consumption, with an initial decline of roughly 3 percent. Investment declines even more dramatically. Output remains steady, declining slightly over time as a result of the lagged declines in investment. This leads to a jump in net exports.

Figure 1. Impulse Response to Interest Rate Shock[a]



Source: Authors' computations.

a. Impulse response of consumption, investment, net exports, and income to a one percent shock to ε^r; we set $\rho_r = 0.9$.

To explore how orthogonal interest rate shocks affect key moments of the simulated model, we set $a_z = a_g = 0$, but set $\sigma_r \equiv$ standard deviation $(\varepsilon^r) > 0$. To be precise, we consider models with various values of σ_r, ranging from zero to one percent. For each environment, we compute key moments of the simulated economy and plot them in figure 2. We fix all other parameters. We also set $\gamma = 1$, so that labor supply is fixed. All moments refer to HP-filtered variables. Panel A of figure 2 illustrates how the relative (to income) variance of consumption, investment, and net exports increases as we increase σ_r. This corresponds to the above intuition. Panel B shows that net exports become more procyclical as σr increases. This takes us further from the data. At the same time, consumption and investment become less correlated with income, because a positive interest rate shock lowers consumption and investment. Since TFP has not changed, this reduces the correlation with income. When consumption and leisure are inseparable, the decreased consumption is associated with higher labor and therefore higher income, inducing a negative correlation between consumption and income. In this set-up, a crisis associated with a large increase in interest rates will reduce consumption but raise output, which is completely counterfactual.

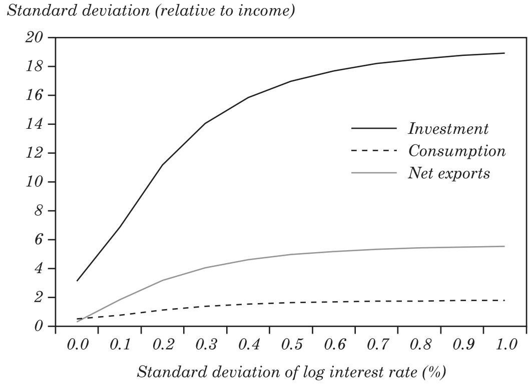
Exogenous interest rate shocks clearly do poorly in explaining the behavior of emerging markets. Such a model is unable to generate the large countercyclicality in the current accounts and the much larger responsiveness of consumption relative to income. This argument is in line with the results in Neumeyer and Perri (2005) and Chari, Kehoe, and McGrattan (2005). A model in which the interest rate process does not affect productivity has little hope of matching moments of the business cycle.

2.2 Interest Rates that Covary with Productivity Shocks

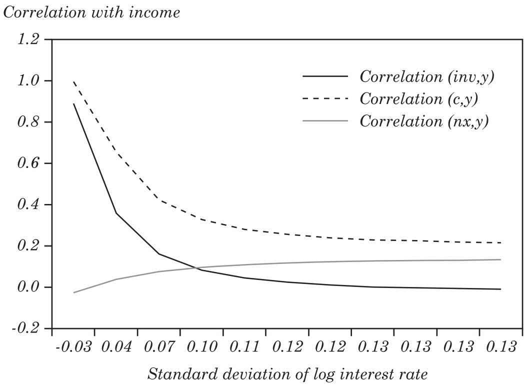
The previous section confirms that we need to interact the interest rate shock with the productivity shock. Since we have two productivity processes, we can link the interest rate and productivity along two dimensions. We begin by setting $a_g = 0$ and considering the link between transitory productivity shocks and the interest rate. We then set $a_z = 0$ and assume the interest rate responds only to the permanent shock, g.

Figure 2. Business Cycle Moments and σ_r[a]

A. Standard deviation of investment, consumption, and net exports



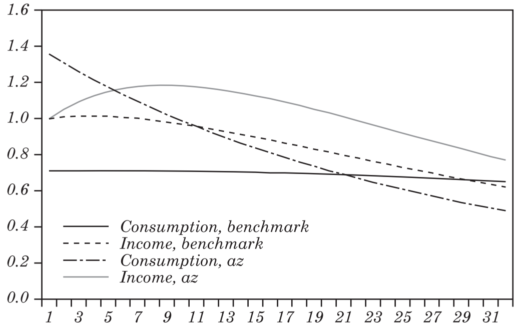
B. Cyclicality of investment, consumption, and net exports



Source: Authors' computations.
a. Panel A shows the standard deviation of (HP-filtered, log) consumption, investment, and net exports relative to income as a function of σ_r. Panel B shows the correlation of (HP-filtered, log) consumption, investment, and net exports with income as a function of σ_r.

Figure 3 plots the impulse response functions of consumption and income to a shock to ε^z when $a_z = 0$ and when $a_z = -0.1$. The latter case generates a fall in the interest rate when productivity increases. This could be an implication of an Eaton-Gersovitz model of default, in which default occurs during low income realizations (see Aguiar and Gopinath, 2006; Arellano, 2006). With persistent shocks, a high shock today implies, on average, high shocks tomorrow and a correspondingly low probability of default, resulting in a negative relationship between productivity and the interest rate.

Figure 3. Impulse Response to *z* Shock[a]



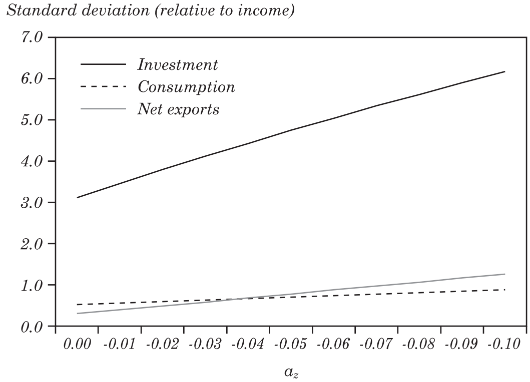
Source: Authors' computations.
a. Impulse response of consumption, investment, net exports, and income to a one percent shock to ε^z. Benchmark model sets $a_z = 0$; *az* model sets $a_z = -0.1$.

For the benchmark case of $a_z = 0$, we find the standard consumption-smoothing result: consumption increases, but income increases much more. The case of $a_z < 0$ combines the income response with a substitution response that favors initial consumption. This generates a larger initial jump in consumption and a subsequent decline. Given the transitory nature of the shock, the net effect is that consumption tracks the shape of the income impulse response. The response of investment (not depicted) has a similar intuition as consumption.

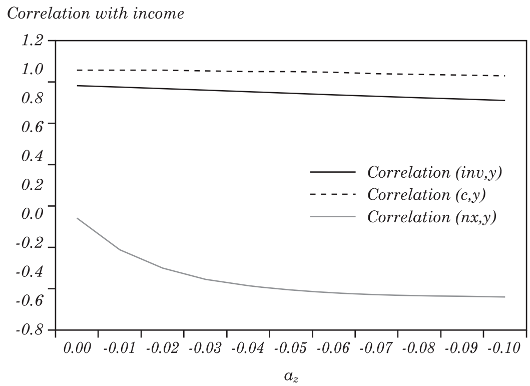
The impulse responses indicate that allowing the interest rate and productivity to comove overcomes some of the limitations of transitory productivity. Namely, consumption and investment respond more strongly to income and in a way that makes net exports negatively associated with income. To illustrate how this extension affects business cycle moments, we plot the key moments as a function of a_z in figure 4. As a_z becomes increasingly negative, the volatility of consumption rises relative to income. A positive productivity shock lowers interest rates, generating an increase in consumption above and beyond the income effect. In contrast with the orthogonal interest rate process of figure 2, the additional consumption volatility increases the correlation of consumption and income. This effect is driven by the fact that the interest rate moves one-for-one with productivity. A similar story holds for investment. These effects make net exports countercyclical, a key feature of the data for emerging markets.

Figure 4. Business Cycle Moments and a_z[a]

A. Standard deviation of investment, consumption, and net exports



B. Cyclicality of investment, consumption, and net exports

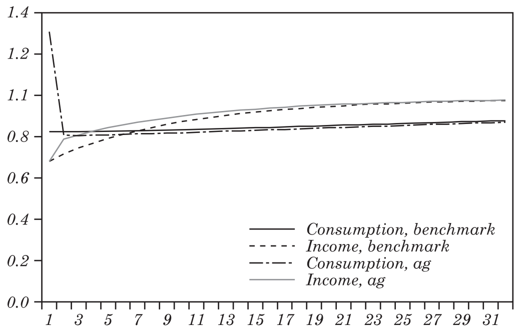


Source: Authors' computations.

a. Panel A shows the standard deviation of (HP-filtered, log) consumption, investment, and net exports relative to income as a function of a_z. Panel B shows the correlation of (HP-filtered, log) consumption, investment, and net exports with income as a function of a_z.

As noted above, an alternative approach is to allow the interest rate to respond to permanent productivity shocks, that is, to set $a_g < 0$. Figure 5 plots the impulse response functions to a shock to ε^g in the benchmark case and in the case of $a_g = -1$. Given that g has a permanent effect on income, consumption responds strongly to the initial shock in the benchmark case, exceeding the initial response of income. Allowing the interest rate to respond as well heightens the initial response of consumption. The interest rate falls back quickly to its initial level, however, as *g* is nearly i.i.d. This generates a sharp fall in consumption and then a leveling out, but income jumps and then continues to rise in response to a growth shock. Allowing $a_g < 0$ thus lowers the correlation of consumption with income, taking us further from the data. This effect is clearly demonstrated in figure 6. As we increase a_g (in absolute value), the variance of consumption and investment increase, while the correlations with income at business cycle frequencies fall. This reduces the cyclicality of net exports, drawing us further from the data.

Figure 5. Impulse Response to *g* Shock[a]



Source: Authors' computations.

a. Impulse response of consumption, investment, net exports, and income to a one percent shock to ε^g. Benchmark model sets $a_g = 0$; ag model sets $a_g = -0.1$.

Figure 6. Business Cycle Moments and a_g[a]

A. Standard deviation of investment, consumption, and net exports

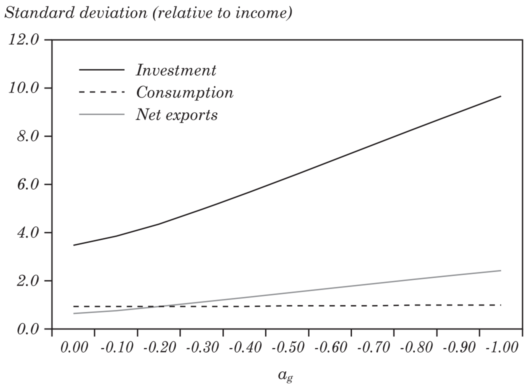
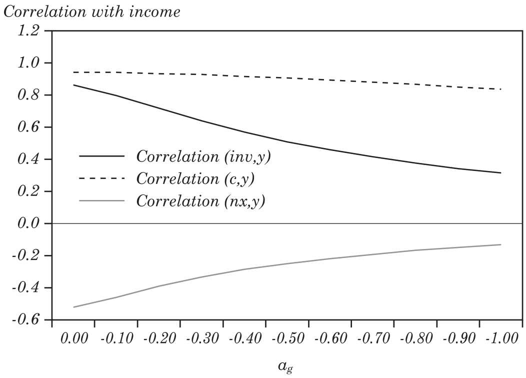


Figure 6. (continued)

B. Cyclicality of investment, consumption, and net exports



Source: Authors' computations.
a. Panel A shows the standard deviation of (HP-filtered, log) consumption, investment, and net exports relative to income as a function of a_g. Panel B shows the correlation of (HP-filtered, log) consumption, investment, and net exports with income as a function of a_g.

The poor performance of the model with $a_g < 0$ is due to the fact that growth rates are not very persistent, generating interest rates that similarly fluctuate. Alternatively, interest rates could be a function of the level of the stochastic trend, Γ, but this would imply a nonstationary interest rate.

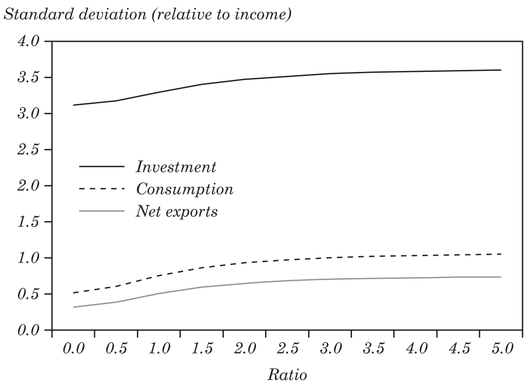
2.3 Productivity Shocks Alone

Aguiar and Gopinath (2007) consider a model in which $a_z = a_g = 0$. Here, we briefly summarize the intuition behind the identification of the relative variance, σ_g/σ_z. In response to a transitory shock to productivity, agents increase consumption by less than the increase in income, since they expect income to fall in the future and therefore save to smooth future consumption. On the other hand, if the economy is hit by a growth shock that implies permanently higher income and (depending on the persistence of the growth shock) an upward-sloping profile of income, the agents will increase consumption by at least as much as the increase in income. Therefore consumption is more volatile relative to income under permanent shocks than under transitory shocks. This difference in the response of $\sigma(c)$is shown in figure 7.

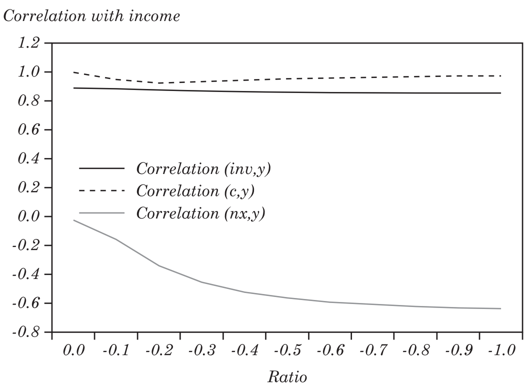
By observing the behavior of consumption, we can infer the relative importance of trend versus transitory shocks. It follows that given the response of consumption and income, we should expect net exports to

Figure 7. Business Cycle Moments and σ_g / σ_z [a]

A. Standard deviation of investment, consumption, and net exports



B. Cyclicality of investment, consumption, and net exports



Source: Authors' computations.

a. Panel A shows the standard deviation of (HP-filtered, log) consumption, investment, and net exports relative to income as a function of σ_g / σ_z. Panel B shows the correlation of (HP-filtered, log) consumption, investment, and net exports with income as a function of σ_g / σ_z.

be far more countercyclical for the economy with trend shocks, and the moment on net exports can be used to identify the underlying productivity shock.

2.4 Identification Strategy

Given the above results, we restrict $\sigma_r = a_g = 0$. That is, we consider a model in which the interest rate covaries with transitory productivity shocks, and we allow for both transitory and trend shocks to productivity. The patterns depicted in figures 4 and 7 indicate how we can identify the key parameters. Increases in the magnitude of a_z and σ_g/σ_z have a similar impact on the cyclicality of the current account. However, while both raise the relative volatility of consumption, net exports, and investment, the relationships differ. Figure 4 indicates that a_z has an almost linear effect on the relative variances, while figure 7 shows that the impact of σ_g/σ_z eventually dies out. In particular, for a large enough a_z, the relative volatility of net exports exceeds that of consumption. This reflects the differential sensitivity of investment and consumption to interest rate shocks. Therefore, the empirical moments of $\sigma(c)$ and $\sigma(nx)$, combined with the empirical covariance of net exports with output, pin down the relative magnitudes of a_z and σ_g/σ_g. Given the relative variance of trend and transitory shocks, the level of income volatility then identifies the level of σ_z and σ_g.

3. Estimates

In this section, we follow the above identification strategy to estimate σ_g, σ_z, and a_z by matching the following (HP-filtered) moments of the data: the standard deviations of income, consumption, and net exports; and the covariance of net exports with income. We use data from Mexico as a representative emerging market and Canada as a representative developed open economy. We fix other parameters at the values listed in table 1.

Table 1. Benchmark Parameter Values

Parameter	*Symbol*	*Value*
Time preference rate	β	0.98
Coefficient of relative risk aversion	σ	2
Cobb-Douglas utility parameter	γ	1, 0.36
Ratio of steady-state debt to GDP	b	0.10
Coefficient on interest rate premium	ψ	0.001
Labor exponent (production)	α	0.68
Depreciation rate	δ	0.05
Capital adjustment cost	ϕ	1.5
Persistence in z process	ρ_z	0.95
Persistence in g process	ρ_g	0.01

Source: Authors' estimations.

For each set of estimates, we report the relative importance of the random walk component of productivity. Beveridge and Nelson (1981) show that any I(1) series can be decomposed into a random walk component (denoted τ) and a stationary component. A natural measure of the importance of the random walk component is the ratio of the variance of the growth rate of the trend component to the growth rate of total TFP:

$$\frac{\sigma^2_{\Delta\tau}}{\sigma^2_{\Delta TFP}} = \frac{\alpha^2\sigma^2_g}{\left(1-\rho_g\right)^2 \sigma^2_{\Delta TFP}} = \frac{\alpha^2\sigma^2_g \Big/ \left(1-\rho_g\right)^2}{\left\{\left(2\sigma^2_z/1+\rho_z\right) + \left[\alpha^2\sigma^2_g/1-\rho^2_g\right]\right\}}. \tag{11}$$

We report the estimates for σ_g, σ_z, and a_z in table 2. In the columns labeled benchmark, we restrict $a_z = 0$. This corresponds to the benchmark model of Aguiar and Gopinath (2007). The remaining columns estimate a_z. The first two columns consider a model for Mexico in which labor is supplied exogenously. This corresponds to setting the Cobb-Douglas preference parameter on consumption (γ) to one, so that leisure does not enter utility. The next two columns allow labor supply to vary endogenously, setting $\gamma = 0.36$. The final two columns estimate the model using Canadian data and assuming endogenous labor supply.

For the benchmark model using Mexican data (column 1), σ_g is larger than σ_z, and the relative contribution of the random walk component to TFP is 1.02. This is similar to the results reported in Aguiar and Gopinath (2007). In the second column, we estimate a_z along with σ_z and σ_g. We find that $a_z < 0$, although we cannot reject $a_z = 0$ at standard significance levels. Even allowing for interest rate shocks, we estimate a relatively large σ_g, with an estimated contribution of the random walk component of 1.01.

Allowing labor supply to vary endogenously does not overturn this pattern. In both specifications, the random walk component of productivity is estimated to be roughly 1.0. The coefficient a_z is estimated to be small.

The case of Canada indicates a relatively small random walk component. In both specifications, the estimated relative random walk component is 0.4. The estimated coefficient a_z is also small and not significantly different from zero.

Table 2. Estimates for σ_z, σ_g, and a_z[a]

	Mexico				Canada	
	Exogenous labor		Endogenous labor		Endogenous labor	
Parameter	Benchmark	With a_z	Benchmark	With a_z	Benchmark	With a_z
σ_z	0.13	0.16	0.13	0.24	0.72	0.69
	(2.42)	(0.79)	(0.66)	(1.06)	(0.09)	(0.16)
σ_g	2.78	2.70	2.69	2.68	0.84	0.89
	(0.44)	(0.33)	(0.00)	(0.31)	(0.15)	(0.09)
a_z	–	–0.40	–	–0.01	–	0.01
	–	(1.85)	–	(0.55)	–	(0.02)
Random walk component	1.02	1.01	1.01	1.00	0.39	0.44
	(0.18)	(0.08)	(0.05)	(0.15)	(0.07)	(0.13)

Source: Authors' estimations.

a. Estimates were obtained from matching empirical moments of Mexico and Canada for respective columns. The moments used were the standard deviation of the HP-filtered log of income, the log of consumption, and net exports/GDP, as well as the covariance of HP-filtered net exports/GDP and the log of income. Exogenous labor model sets $\gamma = 1$; endogenous labor model sets $\gamma = 0.36$. In the columns labeled benchmark, we restrict $a_z = 0$; the remaining columns estimate a_z. Standard errors are in parentheses

Table 3 reports the implied business cycle moments from the estimated models, together with the corresponding empirical moments from Mexico and Canada. In the case of Mexico, both models perform well in matching key features of the data. The empirical relative volatility of consumption is 1.3, while the models with and without interest rate shocks both generate relative variances of 1.1. The cyclicality of net exports is –0.8 in the data and–0.7 and –0.6 in the models without and with interest rate shocks, respectively. In general, allowing for interest rate shocks does not markedly improve the fit of the model. A similar story holds for Canada, as reported in the final three columns of table 3.

The specification with interest rate shocks reveals that interest rates are countercyclical in Mexico and procyclical in Canada. The variance of the implied interest rates is negligible, however. This reflects the fact that while consumption is volatile in emerging markets, it is driven not by intertemporal substitution, but rather by income shocks.

4. Discussion and Conclusion

Emerging markets are characterized by large volatility in their income and consumption and large countercyclicality in net exports relative to developed small open economies. They also face a volatile interest rate process that is negatively correlated with their GDP level. A large literature attempts to explain these features of the data and infer the importance of productivity and interest rate shocks in explaining the patterns observed in the data. In this paper, we have performed a similar exercise by extending the framework in Aguiar and Gopinath (2007), which only allows for productivity shocks, to allow for both, a richer specification of interest rate shocks and interaction between productivity and interest rate shocks.

One finding, which supports other evidence in the literature, is that interest rate shocks that do not effect productivity cannot be the main explanation for business cycles in emerging markets. These markets are characterized by large movements in output at business cycle frequencies, which are associated with large movements in the Solow residual. Interest rate shocks alone do little to explain these large movements in output. It is important to uncover channels through which interest rate shocks affect productivity.

If interest rates are negatively correlated with the productivity shock, they can explain, at least qualitatively, both countercyclical net

Table 3. Implied Moments of the Business Cycle[a]

	Mexico			Canada		
Parameter	*Data*	*Model I*	*Model II*	*Data*	*Model I*	*Model II*
$\sigma(y)$	2.40	2.69	2.63	1.55	1.56	1.55
$\sigma(c)$ / $\sigma(y)$	1.26	1.09	1.10	0.74	0.71	0.72
$\sigma(nx)$ / $\sigma(y)$	0.90	0.74	0.84	0.57	0.59	0.60
$\sigma(\mathrm{i})$ / $\sigma(\mathrm{y})$	4.15	3.52	3.81	2.67	3.23	3.13
$\sigma(r)$		n.a.	0.08		n.a.	0.01
$\rho(y_t,y_{t-1})$	0.82	0.78	0.78	0.90	0.79	0.79
$\rho(c,y)$	0.92	0.98	0.98	0.87	0.87	0.85
$\rho(nx,y)$	–0.75	–0.68	–0.61	–0.12	–0.17	–0.13
$\rho(i,y)$	0.91	0.86	0.82	0.74	0.85	0.84
$\rho(r,y)$		n.a.	–0.01		n.a.	0.90

Source: Authors' estimations.
n.a. Not applicable.
a. Empirical moments and implied moments are from alternative models. Model I and model II for Mexico correspond, respectively, to the first two columns of estimates of table 2 (that is, the exogenous labor supply model). For Canada, model I and model II correspond to the respective columns of estimates for Canada in table 2.

exports and a consumption process that is more volatile than income. When we estimate the model to allow for the interaction between interest rates and productivity, we find a small negative correlation between productivity and interest rates. We also find that, even in this framework, trend shocks play a large role, which supports the main result in Aguiar and Gopinath (2007)—namely, that an important characteristic of emerging markets is that shocks to trend productivity are a predominant factor in explaining movements at business cycle frequencies, in contrast to developed markets.

In this paper, we have taken a reduced-form approach to modeling both the interest rate process and productivity shocks. Future work should examine the structural features of emerging markets that give rise to the particular form of these processes. In Aguiar and Gopinath (2006), we explore a model with Eaton-Gersovitz-style endogenous default. While this approach does generate default in equilibrium and can generate a countercyclical interest rate process, it fails to generate sufficient volatility in the market interest rate process. Further research is required to uncover the source of volatility in the interest rate process.

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What Drives the Current Account in Commodity Exporting Countries? The Cases of Chile and New Zealand

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As capital markets have become increasingly integrated, savings and investment within countries have tended to become less correlated, in what is known as the Feldstein-Horioka (1980) correlation, with the corollary that savings-investment gaps (that is, current accounts) have tended to become more variable. Many countries have also registered a trend toward larger gross external asset and liability positions relative to gross domestic product (GDP), even when net positions have changed little (Lane and Milesi-Ferretti, 2003). The increase in both external stocks and external flows relative to income allows a more efficient matching of borrowers and savers, but it also creates risks for both macroeconomic stability and financial stability associated with swings in sentiment in financial markets. An assesment of the main domestic and external factors that drive variations in the external accounts helps in understanding the macroeconomic implications that might stem from adjustments. We observe the current account from three reduced-form

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perspectives: as current account transactions, such as imports, exports, and interest payments on debt; as financial transactions; and as the domestic savings-investment gap. When financial accounts were closed, developments in the terms of trade and competitiveness were thought to drive trade flows and the current account. As capital markets have opened, the role of savings-investment decisions and financial flows have come to be seen as increasingly important. None of these three reduced-form views, however, tells us about causality or about the endogenous interactions among factors such as interest rates, exchange rates, savings, and investment. To understand the underlying driving forces, we need a structural model.

This paper uses an estimated open economy dynamic stochastic general equilibrium (DSGE) model to ask what factors account for current account developments in Chile and New Zealand, two small open economies that share many common features. Using a DSGE model to describe the evolution of the current account offers several methodological advantages. This type of model provides a framework for understanding the joint determination of major macroeconomic variables based on a coherent description of micro-foundations and equilibrium conditions. In particular, our model provides a rich, detailed macroeconomic framework for assessing the economic implications and policy recommendations associated with current account behavior in Chile and New Zealand. Several types of nominal and real rigidities are in place, making the transmission mechanisms quantitatively appealing. We also include a commodity sector in the model structure to capture the relevance of commodity exports in both countries. Seven domestic shocks and three external shocks are considered to explain current account fluctuations. These include variations in foreign financial conditions, foreign demand, export commodity prices, productivity, an investment-specific shock, and macroeconomic policy.

Chile and New Zealand are both small open economies whose main exports are based on natural resources. Both economies have liberalized their trade and capital accounts. Chile implemented reforms in the 1970s, including trade and financial liberalization, and in the 1990s, it embraced new reforms and a policy of bilateral trade agreements.[1] New Zealand's external sector reforms were mainly concentrated in 1984–85. Another common feature is the

1. Some of the reforms were scaled back after the crisis in 1982. For instance, tariffs were increased between 1983 and 1985. In the 1990s, capital controls were introduced to slow down capital inflows, but many of those controls were removed in 1999.

macroeconomic policy framework. The central banks of both countries gained autonomy in 1989, and both operate monetary policy within an inflation-targeting framework. Both governments have a commitment to prudent fiscal policy. Despite these similarities, the countries display several significant differences. Per capita income in New Zealand is more than twice that in Chile, and income distribution is more equal. In Chile, profits from commodity exports accrue to the government and foreign investors, while in New Zealand, they accrue mainly to domestic private agents. New Zealand has faced large procyclical swings in immigration, which are not a relevant phenomenon in Chile. Lastly, the structure of external liabilities differs significantly in the two economies. New Zealand has a much larger net stock of external debt (77 percent of GDP at year-end 2006) than Chile. However, New Zealand has been able to finance this external debt largely with domestic currency borrowing, which somewhat offsets the risks of a large external position. Chile, like most emerging markets, still relies mainly on foreign-currency-denominated debt.

In our estimated model, the main factors that account for fluctuations in the current accounts of both countries are investment-specific shocks, changes in foreign financial conditions, and variations in foreign demand. In New Zealand, fluctuations in commodity export prices have also been important. In both countries, foreign shocks account for about half of the variation in the current account. Monetary and fiscal policy shocks (that is, deviations from policy rules) play a relatively small role in both countries, although our estimation for Chile indicates that monetary restraint can help to reduce a current account deficit. In contrast, the estimated role of monetary restraint in New Zealand in improving the trade account is offset by the negative effect of higher domestic interest rates on debt service.

Although the model offers a very comprehensive description of both countries, it still omits relevant features that may be important in understanding the propagation of shocks. In our accounting exercise with the estimated model, fluctuations in unobservable shocks might partially capture the propagation effects of these omitted features. This should be taken into account when interpreting the shocks from a structural perspective.[2]

2. For instance, the model abstracts from domestic financial frictions that might be important as a mechanism for amplifying and propagating fluctuations. Thus, if financial frictions are relevant at business cycle frequencies, their effects will be attributed to other shocks in the model. Chari, Kehoe, and McGrattan (2007) discuss how to connect inferred shocks with required frictions in general equilibrium models.

Counterfactual experiments show that if Chile's external debt was denominated in Chilean pesos, the impact of foreign shocks on the domestic variables would be reduced, but the current account response to domestic supply shocks would be amplified. It would also mean that monetary policy had less scope to influence current account dynamics, because the positive effect of higher interest rates on the trade balance would be largely offset by a negative effect on the investment income balance through higher debt service. Moreover, a smaller movement in the real exchange rate would be required to generate an adjustment in the current account. For the case of New Zealand, counterfactual experiments suggest that changes in the degree of smoothness of the monetary policy rule would have little effect on the exchange rate and current account paths.

The paper is organized as follows. The next section briefly outlines the main macroeconomic developments in New Zealand and Chile over the last twenty years. Section two then describes the small open economy model that characterizes the main features of the Chilean and New Zealand economies. Model estimation is presented in section three. In section four, we analyze the main transmission mechanism implied by the model for both Chile and New Zealand, by describing the impulse response functions to different shocks. In section five, we evaluate the relative importance of these shocks by presenting the variance decomposition and the historical decomposition of the current accounts. Section six reports counterfactual experiments regarding the elimination of the original-sin problem for Chile and the influence of monetary policy on the path of the exchange rate and current account in New Zealand. Section seven concludes.

1. Current Account and Macroeconomic Framework Developments

In the 1970s Chile began an extensive program of economic reforms that included profound trade and financial liberalizations. A fixed exchange rate system was introduced at the end of that decade to help stabilize the economy. However, the persistence of inflation led to a substantial appreciation of the real exchange rate, which was exacerbated by a surge in capital inflows. The current account deteriorated sharply between 1978 and 1981, reaching a deficit of almost 12 percent of GDP. In 1981, the Central Bank spent international reserves for an amount equivalent to more than 4 percent of GDP to defend the peg. In June 1982 the government was forced to abandon the peg. This currency crisis was accompanied by a financial crisis and a severe recession in which GDP felt by almost 16 percent in 1982–83.

After this crisis, private capital flows into the economy ceased. The current account deficit was mostly financed with official loans from international agencies, and it was steadily reduced by a sharp increase in domestic savings. This increase in domestic savings can be explained, in part, by the pension reform of 1981, which gradually introduced a fully funded pension system (Bennett, Loayza, and Schmidt-Hebbel, 2001; Morandé, 1998), and by the tax reform of 1984 (Agosín, 1998). During this period, exchange rate policy centered on a crawling peg, and some of the trade liberalization of the 1970s was reversed.

In 1989, the Central Bank of Chile, like the Reserve Bank of New Zealand, obtained autonomy in the implementation of monetary policy. The new constitutional charter that granted autonomy established two main objectives for the Central Bank: stabilizing the value of the national currency and ensuring the normal functioning of payments, including foreign payments. The Central Bank of Chile began to announce explicit annual targets for inflation in 1990. In addition to the inflation targets, the Central Bank maintained the crawling peg for the exchange rate put in place after the 1982 crisis.

In June 1991, the Central Bank introduced a set of capital controls to counteract the effects of large capital inflows. The rationale behind these capital controls was that some of the inflows were only transitory, but they had potentially long-lasting effects through their impact on the real exchange rate.[3] These capital inflows coincided with a general surge in capital inflows to emerging market economies (Calvo, Leiderman, and Reinhart, 1996; Fernández-Arias and Montiel, 1996), associated with both pull and push factors—that is, an increase in the appetite for investing in emerging markets economies by large foreign investors. They also coincided with a period of fast domestic growth and a large demand expansion. In addition to imposing capital controls, the Central Bank accumulated large international reserves to ameliorate the systematic appreciation of the real exchange rate. The Central Bank also set targets for the current account deficits as

3. The capital controls were aimed at alleviating pressures on the real exchange rate from the capital inflows and modifying their composition in favor of long-term foreign direct investment.

a precautionary policy against a sudden reversal of capital inflows, which might have undermined the normal functioning of the payments systems with undesirable consequences for GDP and inflation (see Zahler, 1998). The current account objective introduced an extra weight on the stabilization of the aggregate demand in the monetary policy, on top of that implied by the commitment to reduce inflation (see Medina and Valdés, 2002).

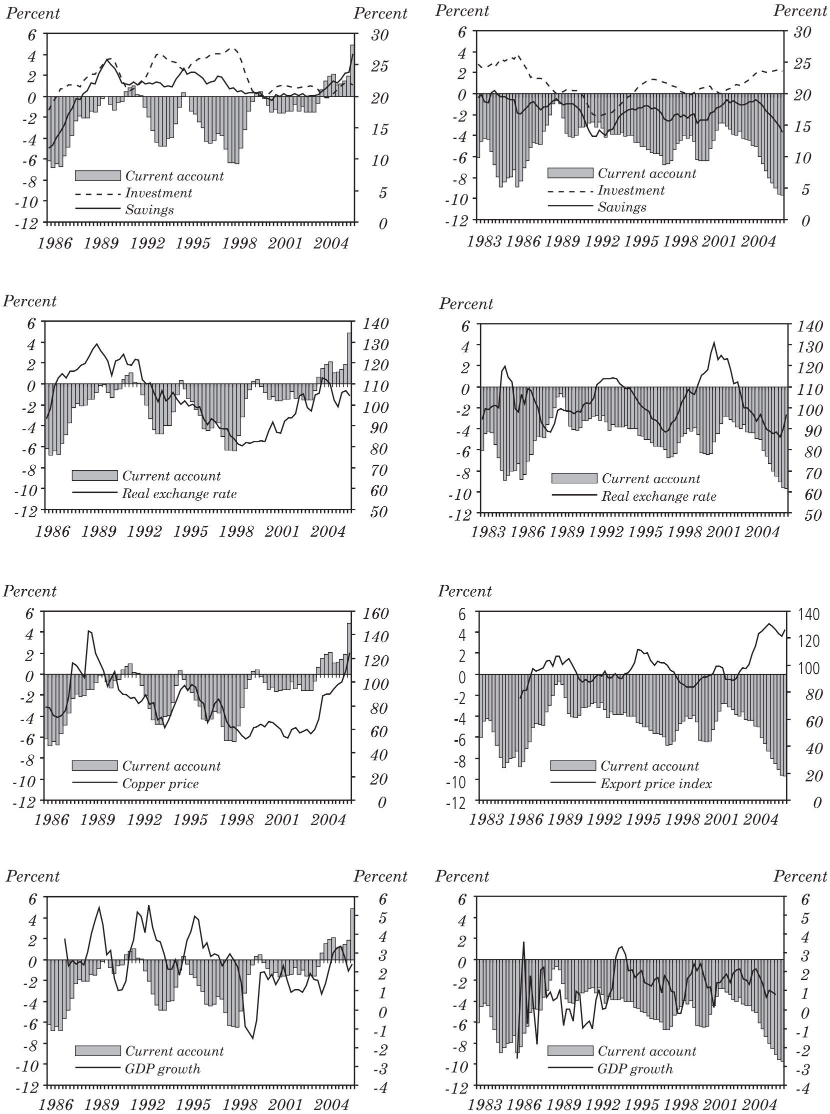
A short-lived current account reversal occurred after the 1994 Mexican crisis (see figure 1), but growth remained high. The Asian crisis of 1997 also led to a current account reversal. This time, however, it was accompanied by a sharp real depreciation of the currency, a significant reduction in GDP growth in 1998–99, and a drop in inflation from 4.6 percent in 1998 to 2.3 percent in 1999.

The events after the Asian crisis led the monetary authority to substantially revise its macroeconomic framework. The main new elements were the adoption of a full-fledged inflation targeting regime with a free-floating exchange rate, the deepening of the foreign exchange derivatives market, and the total opening of the capital account. Also, any explicit target for the current account deficit was eliminated (see Morandé, 2002; Massad, 2003). The Central Bank's transparency increased significantly with the publication of a regular inflation report and the public release of policy meeting minutes. A second key element was introduced into the macroeconomic policy framework in 2001. The Chilean government officially started implementing its fiscal policy through a structural balance rule. According to this rule, the government is committed to stabilizing public expenditures at a level consistent with potential output and with the long-run price of copper. This rule thus prevents excessive adjustments during a recession or unsustainable expenditure levels during booms. The commitment to debt sustainability and fiscal discipline has communicated a clear signal to the markets, which has helped lower the costs of external financing. Despite a period of low public savings after the Asian crisis, combined with growth rates below trend, Chilean sovereign bond spreads declined substantially, and their correlations with other emerging market spreads fell. More recently, the fiscal rule forced the government to save most of the windfall revenues from the high copper price.

New Zealand has received a net capital inflow every year since 1973. The decade prior to 1984 was characterized by large public sector deficits, and below-market interest rates drove a wedge between private savings and investment. On the trade side, competitiveness

Figure 1. Current Account and Economic Indicators: Chile and New Zealand

A. Chile   B. New Zealand



Source: Central Bank of Chile; Reserve Bank of New Zealand.

was eroded by the combination of a highly controlled economy, weak monetary control, declining terms of trade, an overvalued sliding-peg exchange rate, and the loss of favored trading status with Britain's entry into the European Economic Community. The current account deficit was financed by public borrowing abroad, which led to a buildup of public overseas debt. In 1984 external financing dried up as speculative pressures grew before the July election. Reserves were run down, resulting in a foreign exchange crisis.

After the election, New Zealand embarked on a major program of economic reform that included the liberalization of prices and financial markets, privatization, and the floating of the exchange rate in March 1985. This was followed by fiscal and labor market reforms in the early 1990s. The commitment to prudent macroeconomic policy was formalized in the 1989 Reserve Bank Act, which gave the central bank independence in implementing monetary policy and made explicit the inflation target objective. Fiscal debt continued to rise until the 1994 Fiscal Responsibility Act established a commitment to prudent fiscal policy. Public debt, including net external public debt, have since declined and are now close to zero.

The current account improved in the wake of the reforms, as the share of investment to GDP declined by almost 40 percent from 1986 to 1992 (see figure 1). The fall in investment was driven by a drop first in public investment after 1985 and then in nonresidential private investment, particularly nonresidential building, following the commercial property boom of the late 1980s and the stock market crash of 1987. From 1993 to 1997, New Zealand experienced strong GDP growth and a strong recovery in investment. The current account deficit deteriorated from about 3 percent of GDP to about 7 percent, reflecting the combination of a dip in national savings and the strong investment performance. The real exchange rate appreciated sharply, which discouraged exports and delivered cheap imported goods. The Reserve Bank changed the policy target agreement in 1999 to include a secondary objective of reducing output volatility. In 2004, the central bank was given broader authority to intervene in foreign exchange markets in periods of perceived exchange rate overshooting, as well as in cases of extreme market disorder (see Eckhold and Hunt, 2005).

Following the Asian crisis of 1997, slow domestic demand—particularly investment demand—and a large depreciation of the New Zealand dollar contributed to an improvement in the current account. The current account deficit deteriorated again between 2001 and 2006 (from about 3 percent of GDP to 9.7 percent) as a result of strong growth, expansion of investment, weak domestic saving, and an appreciating exchange rate. From a transactions perspective, the bulk of the current account deficit is accounted for by the investment income deficit, which averaged 5.9 percent of GDP from 1990 to 2006. This comprises interest payments on external debt and returns to nonresident ownership of New Zealand assets. The net stock of external liabilities was about 89 percent of GDP at the end of 2006, made up of net debt of about 77 percent of GDP and a net equity liability of about 12 percent of GDP.[4]

Domestically, liberalized domestic financial markets, international financial market integration, and a willingness among nonresidents to finance New Zealand dollar debt allowed New Zealand households to increase their borrowing. At the same time, the decline in inflation and nominal interest rates enabled households to service larger debts. Household indebtedness tripled as a share of disposable income, from 50 percent in 1990 to 150 percent in 2006. The rise in household indebtedness was associated with housing booms in the mid-1990s and in 2004; these booms have increased household collateral values and underpinned strong household demand. Given weak domestic savings, this borrowing has been largely funded externally, and the fall in public sector external debt has been replaced by private sector external debt.

2. The Model

The section briefly sketches the model economy.[5] We develop a small open economy model in the spirit of Christiano, Eichenbaum, and Evans (2005), Altig and others (2004), and Smets and Wouters (2003a, 2003b). The economy includes two types of households; Ricardian (optimizing, forward-looking) households make choices about consumption and borrowing, and they set wages; non-Ricardian households consume all their labor income and neither save nor borrow. Production technology uses labor and capital, and is subject to two stochastic shocks: a transitory shock and a permanent shock to

4. New Zealand's recent external imbalance has generated concern because it could constitute vulnerability to a sharp and abrupt current account reversal. See Edwards (2006a) for a quantitative analysis of the macroeconomic implications of current account reversals in New Zealand. The model in this paper might be used to explore these macroeconomic implications, but we leave this task for future work.

5. For a full version of the model, see the working paper version of this article (Medina, Munro, and Soto, 2007). The model is a modified version of the model in Medina and Soto (2006b).

labor productivity, which introduces a stochastic trend in the major aggregates. The economy grows at a constant rate, g_y, in steady state. Both prices and wages are sticky (subject to nominal rigidities à la Calvo), with partial indexation to past inflation. There are adjustment costs to investment, and the pass-through from the exchange rate to the price of imports is imperfect in the short run. To be consistent with the features of both Chile and New Zealand, we include a commodity sector whose production is based on a natural resource endowment and is assumed to be completely exported. Monetary policy is conducted through a policy rule for the interest rate, while fiscal policy is conducted through a structural rule in the case of Chile and a balanced budget rule in the case of New Zealand.

2.1 Households

The domestic economy is inhabited by a continuum of households. A share, $1-\lambda$, of the households correspond to Ricardian households with access to the capital market, and the remaining fraction, λ, are non-Ricardian households without access to this market. We assume that households exhibit habit formation in their preferences, captured by a parameter h. Each household consumes a basket composed of two types of final goods: home goods and foreign goods. The composition of this basket is determined optimally by minimizing its cost.

2.1.1 Consumption and savings decisions

Ricardian households have access to four types of assets: money, one-period foreign noncontingent bonds denominated in either domestic or foreign currency, and one-period domestic contingent bonds.[6] A Ricardian household chooses a consumption path by maximizing its utility subject to a budget constraint. The first-order conditions on different contingent claims over all possible states define the following Euler equation for consumption:

$$\beta E_t \left\{ (1+i_t) \frac{P_t}{P_{t+1}} \frac{\zeta_{C,t+1}}{\zeta_{C,t}} \left[\frac{C_t(j) - hC_{t-1}}{C_{t+1}(j) - hC_t} \right] \right\} = 1, \text{ for all } j \in (\lambda, 1], \tag{1}$$

6. The domestic contingent bond pays a unit of consumption in the next period in a particular state of nature. Assuming a full set of contingent bonds ensures that all Ricardian households consume the same amount, independent of their labor income.

where $C_t(j)$ and C_t are consumption by household j and aggregate consumption, respectively, P_t corresponds to the consumption-based price index, i_t is the domestic risk-free interest rate, and β is the discount factor. The variable $\zeta_{C,t}$ corresponds to a preference shock that shifts consumption. The behavior of Ricardian households provides a consumption-smoothing rationale for current account fluctuations: they can use the current account to save and borrow in response to shocks to net income. Non-Ricardian households have no access to assets and own no shares in domestic firms. Therefore, each period they consume all of their after-tax disposable income:

$$C_t(j) = \frac{W_t}{P_t} l_t(j) - \frac{\tau_{p,t}}{P_t}, \quad \text{for } j \in [0, \lambda], \tag{2}$$

where W_t is the wage rate, $l_t(j)$ is labor supply by household j, and $\tau_{p,t}$ are per capita lump-sum taxes.

By combining equation (1) with the first-order condition with respect to foreign bonds, we obtain the following expression for the uncovered interest parity (UIP) condition:

$$\frac{1+i_t}{(1+i_t^*)\Theta(B_t)} = E_t\left(\frac{e_{t+1}}{e_t}\right) + a_t \tag{3}$$

where e_t is the nominal exchange rate measured as units local currency per one unit of foreign currency. The variable a_t captures a covariance term and $\Theta(B_t)$ corresponds to the risk premium domestic agents have to pay when borrowing abroad, which is a function of the ratio of the net foreign asset position to GDP, B_t. The foreign interest rate, i_t^*, is assumed to follow a first-order autoregressive, or AR(1), process subject to independent and identically distributed (i.i.d.) shocks. These shocks, which we call shocks to foreign financial conditions or UIP shocks, capture all financial factors, including price, risk premiums, and any other factors associated with the exchange rate arbitrage not captured by $\Theta(.)$.

2.1.2 Labor supply and wage setting

Each household is a monopolistic supplier of a differentiated labor service. A set of perfectly competitive labor service assemblers hires labor from each household and combines it into an aggregate labor service unit, which is used as an input in the production of domestic intermediate goods. As in Erceg, Henderson, and Levin (2000), wage setting is subject to a nominal rigidity à la Calvo (1983). In each period, each Ricardian household faces a probability $1 - \phi_L$ of being able to reoptimize its nominal wage. In this set-up, the parameter ϕ_L is a measure of the degree of nominal rigidity. The larger this parameter, the less frequently wages are adjusted (that is, the stickier they are).

A household that is able to reoptimize its wage at t will maximize the expected discounted future stream of labor income net of the disutility from its work effort, subject to labor demand and an updating rule for its nominal wage in case the household cannot reoptimize in the future. This updating rule considers the trend in labor productivity, as well as a geometric weighted average of past consumer price index (CPI) inflation and the inflation target set by the monetary authority. The weights in this rule reflect the degree of indexation in wages. For simplicity non-Ricardian households are assumed to set wages equal to the average wage set by Ricardian households. Given the labor demand for each type of labor, this assumption implies that the labor effort of non-Ricardian households coincides with the average labor effort by Ricardian households.

2.2 Investment and Capital Goods

A representative firm rents capital goods to firms producing intermediate goods. It decides how much capital to accumulate each period, assembling new capital goods with a constant elasticity of substitution (CES) technology that combines home and foreign final goods. The firm may adjust investment each period, but changing the flow of investment is costly. The adjustment cost for investment is determined by a concave function $S(.)$. The assumption that adjusting the flow of investment is costly provides a tractable approach to modeling investment inertia (see Christiano, Eichenbaum, and Evans, 2005). The firm chooses the level of investment, I_t, and the rental price of capital, Z_t, to maximize expected future profits (rental returns on capital net of the cost of investment), subject to the law of motion of the capital stock, K_t, which accounts for depreciation and investment adjustment costs. The capital accumulation process is subject to a transitory investment-specific shock, $\zeta_{I,t}$, that alters the rate at which investment is transformed into productive capital.[7] The optimality conditions for the above problem are the following:

$$\frac{P_{I,t}}{P_t} = \frac{Q_t}{P_t}\left[S\left(\frac{I_t}{I_{t-1}}\right) + S'\left(\frac{I_t}{I_{t-1}}\right)\frac{I_t}{I_{t-1}}\right]\zeta_{I,t}$$
$$-E_t\left\{\Lambda_{t,t+1}\frac{Q_{t+1}}{P_{t+1}}\left[S'\left(\frac{I_{t+1}}{I_t}\right)\left(\frac{I_{t+1}}{I_t}\right)^2\right]\zeta_{I,t+1}\right\} \text{ and} \tag{4}$$

$$\frac{Q_t}{P_t} = E_t\left\{\Lambda_{t,t+1}\left[\frac{Z_{t+1}}{P_{t+1}} + \frac{Q_{t+1}}{P_{t+1}}(1-\delta)\right]\right\},$$

where δ is the depreciation rate; $P_{I,t}$ is the investment-based price index, which is a weighted average of home and foreign good prices; and $\Lambda_{t,t+1}$ is the relevant discount factor for firms. The previous two equations simultaneously determine the evolution of the shadow price of capital, Q_t, and real investment expenditure.

2.3 Domestic Production

Domestic final home goods are assembled from domestic intermediate goods using a CES technology and are sold both at home and abroad. The final home goods sector is assumed to be perfectly competitive, so the demand for a differentiated intermediate good will depend on its relative price and on the domestic and foreign demand for final home goods. The price of final home goods is a weighted average of the price of intermediate goods.

Intermediate goods are produced by firms that have monopoly power. These firms maximize profits by choosing the prices of their differentiated good subject to demand in the market (foreign or domestic) in which they are being sold, given the available technology. The technology to produce a particular intermediate good, z_H, is Cobb-Douglas:

$$Y_{H,t}(z_H) = A_{H,t}\left[T_t l_t(z_H)\right]^{\eta_H}\left[K_t(z_H)\right]^{1-\eta_H}, \tag{5}$$

7. Greenwood, Hercowitz, and Krusell (2000) argue that this type of investment-specific shock is relevant in explaining business cycle fluctuations in the United States.

where $Y_{H,t}(z_H)$ is the quantity of good z_H produced, $l_t(z_H)$ is the amount of labor used, and $K_t(z_H)$ is the amount of physical capital rented. The parameter η_H defines their corresponding shares in production, while $A_{H,t}$ represents a stationary productivity shock common to all firms. The variable T_t is a stochastic trend in labor productivity that introduces a unit root in the major aggregates.

With imperfect competition in the intermediate goods sector, price setting is assumed to follow a Calvo-type structure. In every period, the probability that a firm receives a signal for adjusting its price for the domestic market is $1 - \phi_{HD}$; the probability of adjusting its price for the foreign market is $1 - \phi_{HF}$. These probabilities are the same for all firms, independent of their history. If a firm does not receive a signal, it updates its price following a simple rule that weights past inflation and the inflation target set by the central bank. Given this pricing structure, the behavior of inflation is captured by a new-Keynesian Philips curve with indexation. In its log-linear form, inflation depends on last period's inflation, expected inflation in the next period, and marginal costs.

We also assume that a single firm produces a homogeneous commodity good that is completely exported abroad. Production evolves with the same stochastic trend as other aggregate variables, requires no labor or capital inputs, and is subject to a transitory stochastic production shock. Hence, production in this sector can be interpreted as the exogenous evolution of an endowment of natural resources. This sector is particularly relevant for the two economies, as it captures the copper sector in Chile and natural resources production in New Zealand.

2.4 Imports Retailers

We assume local-currency price stickiness to allow for incomplete exchange rate pass-through into import prices in the short run. Importing firms buy goods abroad and resell them domestically to assemblers of final foreign goods. Each importing firm has monopoly power in the domestic retailing of a particular good, and it adjusts the domestic price of its variety infrequently (à la Calvo, 1983), only when receiving a signal. The signal arrives with probability $1 - \phi_F$ each period. When a firm receives a signal, it chooses a new price to maximize the present value of expected profits subject to the domestic demand for its variety and the updating rule followed by nonoptimizing firms. As in the case of domestically produced goods, if a firm does not receive a signal, it updates its price following a passive rule that is a weighted average of past price changes and the inflation target set by the central bank.

In this setup, changes in the nominal exchange rate will not immediately be passed through to the prices of imported goods sold domestically. Exchange rate pass-through will therefore be incomplete in the short run. In the long run, firms freely adjust their prices, so the law of one price holds up to a constant (because of a steady-state markup). This feature of the model mitigates the expenditure-switching effect of exchange rate movements and matches the observed degree of substitution between foreign and home goods.

2.5 Fiscal Policy

When agents are Ricardian, defining a trajectory for the primary deficit is irrelevant for household decisions, as long as the budget constraint of the government is satisfied. When a fraction of the agents are non-Ricardian, however, the trajectory of the public debt and the primary deficit become relevant. The path of public expenditure may also be relevant on its own as long as its composition differs from the composition of private consumption. Here we assume the government consumes only home goods.

Fiscal policy is defined by the fiscal net asset position, net revenues (income tax revenues minus transfers to the private sector), and government expenditure. Given the budget constraint of the government, it is necessary to define a behavioral rule for two of these three variables.

In the case of Chile, we assume that about half of all households are non-Ricardian, so the timing of the fiscal variables is relevant for the private sector. The public asset position is denominated in foreign currency. Fiscal revenues come from two sources: tax income from the private sector, which is a function of the average tax rate and GDP, and the government's share (40 percent) of revenues from copper sales through the state company.

More importantly, we consider that the Chilean government follows a structural balance fiscal rule (see Medina and Soto, 2006a). The purpose of this fiscal rule is to avoid excessive fluctuations in government expenditure stemming from transitory movements in fiscal revenues. Government expenditure can increase if its net asset position improves, if interest payments on its debt fall, or if output is below potential (countercyclical policy). In the case of a transitory rise in fiscal revenues from copper price increases, the rule implies that the additional fiscal income should mainly be saved. The rule is subject to a transitory stochastic shock that captures temporary deviation of government expenditure from this fiscal rule.

In the case of New Zealand, we assume that all households are Ricardian ($\lambda = 0$).[8] Ricardian equivalence holds, and the particular mix of assets and liabilities and timing of taxes that finance government absorption is irrelevant. We therefore abstract from government debt, without lost of generality, and assume that lump-sum taxes are adjusted every period to keep the government budget balanced, subject to a stochastic shock to government expenditure.

An important difference between the policy rule assumed for Chile and the rule for New Zealand is that the former allows for accumulation or depletion of net assets by the government. However, the effects of a shock under either rule would be the same if all agents were Ricardian.

2.6 Monetary Policy Rule

Monetary policy in Chile is characterized as a simple feedback rule for the real interest rate, where the Central Bank responds to deviations of CPI inflation from the target and to deviations of output from its trend. We also allow the Central Bank to react to deviations of the real exchange from a long-run level. This is meant to capture the fact that the Central Bank of Chile had a target for the exchange rate over most of the sample period. We define the rule in terms of the real interest rate to be consistent with the Central Bank of Chile's practice during most of the sample period used to estimate the model.[9] Thus, we approximate the monetary policy rule as follows:

$$r_t = \psi_i r_{t-1} + (1-\psi_i)\begin{bmatrix}\psi_y y_t + (\psi_\pi - 1)(\pi_t - \overline{\pi}_t)\\ +\psi_{\text{RER}}\text{RER}_t\end{bmatrix} + \nu_t, \tag{6}$$

8. This reflects New Zealand's smaller share of poor households that do not have access to the capital market. This parameter is calibrated since its joint estimation with the habit formation parameter presents some identification problems.

9. From 1985 to July 2001, the Central Bank of Chile used an indexed interest rate as its policy instrument. This indexed interest rate corresponds roughly to an ex ante real interest rate (Fuentes and others, 2003).

where $\pi_t = P_t/P_{t-1} - 1$ is consumer price inflation, $\bar{\pi}_t$ is the inflation target set for period t, and $r_t = (1 + i_t) / (P_t/P_{t-1}) - 1$ is the net (ex post) real interest rate. The variable y_t is the (log) deviation of GDP from its balanced growth path, and RER_t is the (log) deviation of the real exchange rate from its long-run level. The variable ν_t is a monetary policy shock that corresponds to a deviation from the policy rule, and it is assumed to be an i.i.d. innovation.

As mentioned, Chile adopted a fully-fledged inflation-targeting framework in late 1999 and abandoned the target zone for the exchange rate. To capture this policy shift, we allow for a discrete change in all the parameters of the monetary policy rule, imposing $\Psi_{\mathrm{RER}} = 0$ for the second period, which starts in 2000.[10]

In the case of New Zealand, monetary policy is characterized as a simple feedback rule for the nominal interest rate where the Reserve Bank is assumed to respond to deviations of CPI inflation from target (assumed to be 2 percent for the period) and to deviations of output from its trend:[11]

$$i_t = \psi_i i_{t-1} + (1 - \psi_i)\left[\psi_y y_t + \psi_\pi (\pi_t - \bar{\pi}_t)\right] + \nu_t. \tag{7}$$

For New Zealand we assume that the parameters of this rule have remained constant over the whole sample period.

3. Model Estimation

We estimate the parameters of the model using a full-information Bayesian approach (see DeJong, Ingram, and Whiteman, 2000;

10. This change in parameter values is assumed to be permanent and unanticipated. This means that when agents make decisions, they expect that these parameters will remain constant forever.

11. The inflation target objective set out in the Policy Targets Agreement (PTA) between the Reserve Bank and the government is specified in terms of CPI inflation and a target band. In practice, the target changed over the period: it was initially set at 0 to 2 percent and later changed to 0 to 3 percent and then to 1 to 3 percent. The PTA also requires the Reserve Bank to avoid unnecessary instability in output, interest rates, and the exchange rate. The Reserve Bank did explicitly respond to exchange rate developments in 1986–88, when a monetary conditions index was used to guide policy between forecast rounds. Several papers suggest, however, that little is gained by including the exchange rate in the rule, even if the exchange rate is included in the loss function, because of unfavorable volatility tradeoffs; see West (2003). The gain in empirical fit from including the exchange rate in the rule is small (see Lubik and Schorfheide, 2007).

Fernández-Villaverde and Rubio-Ramárez, 2004; and Lubik and Schorfheide, 2006).[12] The estimation is based on the likelihood function obtained from the solution of the log-linear version of the model. Prior distributions for the parameters of interest are used to incorporate additional information into the estimation.[13]

The log-linear version of the model developed in the previous section forms a linear rational expectations system that can be written in canonical form as follows:

$$\mathbf{\Gamma}_0(\vartheta)\mathbf{z}_t = \mathbf{\Gamma}_1(\vartheta)\mathbf{z}_{t-1} + \mathbf{\Gamma}_2(\vartheta)\varepsilon_t + \mathbf{\Gamma}_3(\vartheta)\xi_t,$$

where $\mathbf{z}_t$ is a vector containing the model variables expressed as log-deviation from their steady-state values. It includes endogenous variables and ten exogenous variables, as follows: a preference shock ($\zeta_{C,t}$), a foreign interest rate shock (i_t^*), a stochastic productivity trend shock ($\zeta_{T,t}$), a stationary productivity shock ($\mathrm{A}_{H,t}$), an investment adjustment cost shock ($\zeta_{I,t}$), a commodity production shock ($Y_{S,t}$), a commodity price shock ($P_{S,t}{}^*$), a government expenditure shock ($\zeta_{G,t}$ for Chile and G_t for New Zealand), a monetary shock (ν_t), and a foreign output shock (Y_t^*). In their log-linear form, each of these variables is assumed to follow a first-order autoregressive process. The vector ε_t contains white noise innovations to these variables, and ξ_t is a vector containing rational expectation forecast errors. The matrices $\mathbf{\Gamma}_i$ (i = 0,…, 3) are nonlinear functions of the structural parameters contained in vector ϑ. The solution to this system can be expressed as follows:

$$\mathbf{z}_t = \Omega_{\mathbf{z}}(\vartheta)\mathbf{z}_{t-1} + \Omega_{\varepsilon}(\vartheta)\varepsilon_t, \tag{8}$$

where $\Omega_{\mathbf{z}}$ and Ω_{ε} are functions of the structural parameters. A vector of observable variables, $\mathbf{y}_t$, is related to the variables in the model through a measurement equation:

$$\mathbf{y}_t = \mathbf{H}\mathbf{z}_t + \mathbf{v}_t, \tag{9}$$

12. Fernández-Villaverde and Rubio-Ramírez (2004) and Lubik and Schorfheide (2006) discuss the advantages of this approach to estimating DSGE models.

13. One of the advantages of the Bayesian approach is that it can cope with potential model misspecification and possible lack of identification of the parameters of interest (Lubik and Schorfheide, 2006).

where $\mathbf{H}$ is a matrix that relates elements from $\mathbf{z}_t$ with observable variables and $\mathbf{v}_t$ is a vector containing i.i.d. measurement errors. Equations (8) and (9) correspond to the state-space form representation of $\mathbf{y}_t$. We assume that the white noise innovations and measurement errors are normally distributed. Using the Kalman filter, we can compute the conditional likelihood function, $L(\vartheta \mid \mathbf{Y}^T)$, for the structural parameters of the model, ϑ, where $\mathbf{Y}^T = \{\mathbf{y}_1,\ldots, \mathbf{y}_T\}$. Let $\mathrm{p}(\vartheta)$ denote the prior density on the structural parameters. The joint posterior density of the parameters is computed using Bayes' theorem:

$$\mathrm{p}\left(\vartheta \middle| \mathbf{Y}^T\right) = \frac{L\left(\vartheta \middle| \mathbf{Y}^T\right)\mathrm{p}(\vartheta)}{\int L\left(\vartheta \middle| \mathbf{Y}^T\right)\mathrm{p}(\vartheta)d\vartheta}. \tag{10}$$

We computed an approximated solution for the posterior mode of parameters using numerical optimization algorithms since the likelihood function has no analytical expression.[14] Prior parameter density functions reflect our beliefs about parameters values. In general, we chose priors based on evidence from previous studies for Chile and New Zealand. When the evidence on a particular parameter is weak or nonexistent, we impose more diffuse priors by setting a relatively large standard deviation for the corresponding density function.

3.1 Data

For Chile, we use quarterly data for the period 1990:1 to 2005:4. We choose the following observable variables: real GDP, Y_t; real consumption, C_t; real investment, INV_t; the ratio of real government expenditure to GDP, G_t/Y_t; the short-run real interest rate, r_t; a measure of core inflation computed by the Central Bank (IPCX1) as a proxy for inflation, π_t; the real exchange rate, RER_t; the ratio of the current account to GDP, $\mathrm{CA}_t/(P_{Y,t}Y_t)$; and real wages, W_t/P_t. We also include as an observable variable the international price of copper

14. The appendix describes the complete list of estimated parameters and presents the calibrated parameters chosen to match the steady state of the model with the long-run trends in the Chilean and New Zealand economies. The appendix also presents the prior distribution for each parameter contained in the parameter vector, ϑ, its mean, and an interval containing 90 percent of probability. See the working paper version of this article for a detailed analysis and description of calibrated parameters and prior distributions (Medina, Munro, and Soto, 2007).

(in dollars, deflated by a foreign price index) as a proxy for the real price of the commodity good, $pr^*_{S,t}$. In total, we have ten observable variables. The inflation rate is expressed as the deviation from its target, $\overline{\pi}_t$ In the case of real quantities, we use the first difference of the corresponding logarithm (except for the ratio of government expenditures to GDP):

$$\mathbf{y}_t^{CH} = \left\{ \begin{matrix} \Delta \ln Y_t, \Delta \ln C_t, \Delta \ln \mathrm{INV}_t, r_t, \pi_t, \\ \mathrm{RER}_t, \dfrac{\mathrm{CA}_t}{P_{Y,t} Y_t}, \dfrac{G_t}{Y_t}, \Delta \ln \left(\dfrac{W_t}{P_t} \right), pr^*_{S,t} \end{matrix} \right\}.$$

The short-run real interest rate corresponds to the monetary policy rate. This was an indexed rate from the beginning of the sample until July 2001. After July 2001, the monetary policy was conducted using a nominal interest rate. For the later period, we thus construct a series for the real interest rate, computing the difference between the nominal monetary policy rate and the current inflation rate.

For New Zealand, we use quarterly data for the period 1989:2 to 2005:4. We chose the following observable variables: real GDP; real consumption; real investment; commodity production (primary production plus commodity-based processing), $Y_{S,t}$; the short-run nominal interest rate, i_t; CPI inflation; the real exchange rate; the ratio of the current account to GDP; and real wages. We also include as an observable variable a commodity price index (in U.S. dollars, deflated by a foreign price index) as a proxy for the real price of the commodity good. In total, we have ten observable variables.

As in the case of Chile, real variables are expressed in first log differences and inflation as the deviation from its target. The set of observable variables for New Zealand is the following:

$$\mathbf{y}_t^{NZ} = \left\{ \begin{matrix} \Delta \ln Y_t, \Delta \ln C_t, \Delta \ln \mathrm{INV}_t, \Delta \ln Y_{S,t}, i_t, \\ \pi_t, \mathrm{RER}_t, \dfrac{CA_t}{P_{Y,t} Y_t}, \Delta \ln \left(\dfrac{W_t}{P_t} \right), pr^*_{S,t} \end{matrix} \right\}.$$

The short-run nominal interest rate is the overnight interest rate (the call rate prior to March 1999 and the official cash rate after March 1999). We subtract the inflation target from the nominal interest rate to make this variable stationary.

3.2 Posterior Distributions

The estimated modes of the parameter posterior distributions are broadly consistent with other studies for Chile and New Zealand (see table 1). The degree of habit in consumption is a little higher for New Zealand at 0.81 than for Chile at 0.57. The inverse of the labor supply elasticity is very low for New Zealand (0.001). For Chile, the estimated elasticity (0.16) is a little bit above other studies that only consider Ricardian households. The intratemporal elasticity of substitution for consumption is about 1.2 for both Chile and New Zealand, which is relatively low. The posterior estimate for the intratemporal elasticity of substitution for investment is very close to the prior estimate and may not be well identified in the data. The price elasticity of foreign demand, η^*, is two in New Zealand versus one in Chile. This means that exports respond more strongly to price signals (such as a currency depreciation) in New Zealand.

For Chile, nominal wages are reoptimized every five periods, with little indexation to past inflation. For New Zealand, wages are be reoptimized at eleven quarters, also with a low degree of indexation to past inflation. The less frequent wage adjustment in New Zealand may reflect a higher degree of credibility in monetary policy, which makes costly adjustment less necessary. Domestic prices are optimally adjusted frequently in both economies: every two quarters for Chile, on average, and every three quarters for New Zealand. The prices of home goods sold abroad and domestic imports are reoptimized much less frequently. This provides evidence of exchange rate disconnection in both countries in the short run, which reduces the expenditure-switching effects of the exchange rate.

Estimated monetary policy parameters are in line with other studies for both countries. In general, the degree of interest rate smoothing and the responses to both inflation and output growth are estimated to be higher for New Zealand. These parameters are not directly comparable because the policy rule specification is not the same in the two countries. However, the rule for the later period in Chile and the estimated rule for New Zealand are both characterized by pure inflation targeting and are quite similar: the interest rate smoothing parameters are 0.8 for Chile and 0.9 for New Zealand; the response to deviations of inflation from target are 1.6 and 1.5; and the response to the deviation of output growth from steady state are estimated at 0.31 and 0.39.

Table 1. Posterior Distributions (Mode)

	Mode posterior	
Parameter	*Chile*	*New Zealand*
σ_L	0.164	0.001
h	0.572	0.813
ϕ_L	0.806	0.911
χ_L	0.058	0.102
η_C	1.221	1.239
η_I	1.107	1.031
μ_S	2.288	1.694
ϕ_{HD}	0.486	0.631
χ_{HD}	0.127	0.086
ϕ_{HF}	0.966	0.915
χ_{HF}	0.227	0.181
ϕ_F	0.838	0.968
χ_F	0.806	0.178
$\psi_{I,1}$, ψ_i	0.670	0.897
$\psi_{p,1}$, ψ_p	1.244	1.455
$\psi_{y,1}$, ψ_y	0.184	0.389
$\psi_{rer,1}$	0.052	—
$\psi_{i,2}$	0.778	—
$\psi_{\pi,2}$	1.632	—
$\psi_{y,2}$	0.305	—
η^*	0.999	2.007
θ	0.016	0.001
ρ_{aH}	0.901	0.690
ρ_{yS}	0.642	0.907
ρ_{Y*}	0.736	0.653
$\rho_{\zeta C}$	0.227	0.332
$\rho_{\zeta I}$	0.862	0.412
$\rho_{\zeta G}$, ρ_G	0.315	0.393
ρ_{i*}	0.985	0.923
ρ_T	0.987	0.156
σ_{aH}	1.498	1.915
σ_{yS}	28.418	1.993
σ_{Y*}	10.275	8.847
σ_{i*}	0.332	0.360
σ_m	0.392	0.189
$\sigma_{\zeta C}$	5.032	6.291
$\sigma_{\zeta G}$, σ_G	12.180	9.739
$\sigma_{\zeta I}$	7.125	10.291
σ_T	0.190	0.498

Source: Authors' estimations.

The estimated volatility and persistence of the shocks are more similar than different. The only big difference in shock volatility is the much larger commodity production shocks in Chile. This likely reflects the fact that Chile has a single commodity, whereas New Zealand features a basket. Commodity production shocks are, however, less persistent in Chile, with an AR(1) coefficient of 0.64 versus 0.91 for New Zealand; this may be due to the agricultural nature of commodity production in New Zealand. In general, Chile is estimated to face more persistent domestic shocks. Investment-specific shocks are estimated to be more persistent in Chile, with an AR(1) coefficient of 0.86 versus 0.41 for New Zealand, as are labor productivity shocks, with an AR(1) coefficient of 0.99 versus 0.16 for New Zealand, and to a lesser degree transitory productivity shocks, with an AR(1) coefficient of 0.90 versus 0.69 for New Zealand.

4. Impulse Response Analysis

To analyze the main transmission mechanisms implied by the model, we explore the effects of the exogenous shocks on the current account and some other variables for Chile and New Zealand. Figures 2 and 3 present the impulse responses to all the shocks in the model. For Chile we show the responses under the policy rule prevailing after 2000. The differences under this rule and the one prevailing before 2000 are small (see Medina, Munro, and Soto, 2007).

4.1 Productivity and Endowment Shocks

We assess two types of productivity shocks—namely, a permanent labor productivity shock common to all firms and a transitory shock to domestic noncommodity production—and one shock to the commodity endowment. A permanent labor productivity shock increases output of all firms on impact, but not all the way to the new steady-state level.[15] As domestic households anticipate higher income in the future, they increase their consumption today. For the same reason, firms look to expand their production by increasing their demand for capital in anticipation of higher profits in the future. The increase in both consumption and investment leads to a lowering in the current account. Aguiar and Gopinath (in this volume) discuss the relevance

15. The variables are detrended by labor productivity.

Figure 2. Impulse-Responses: Chile

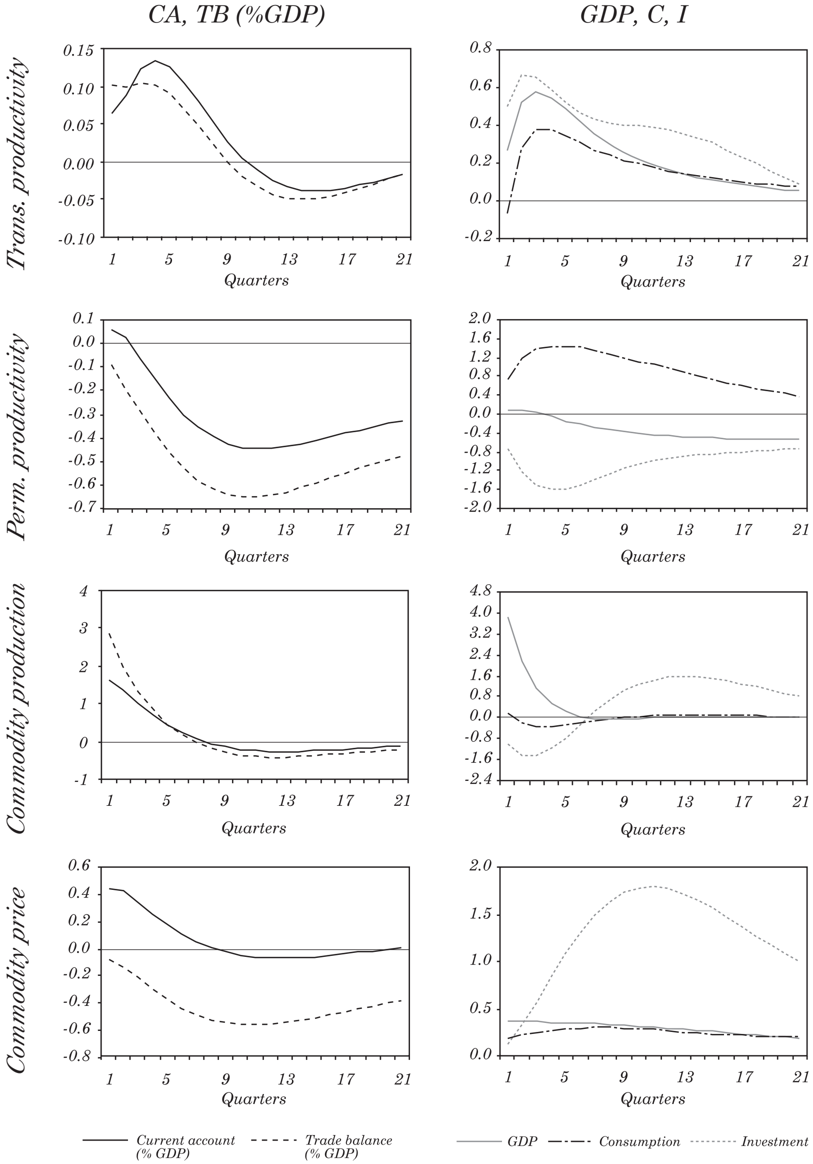
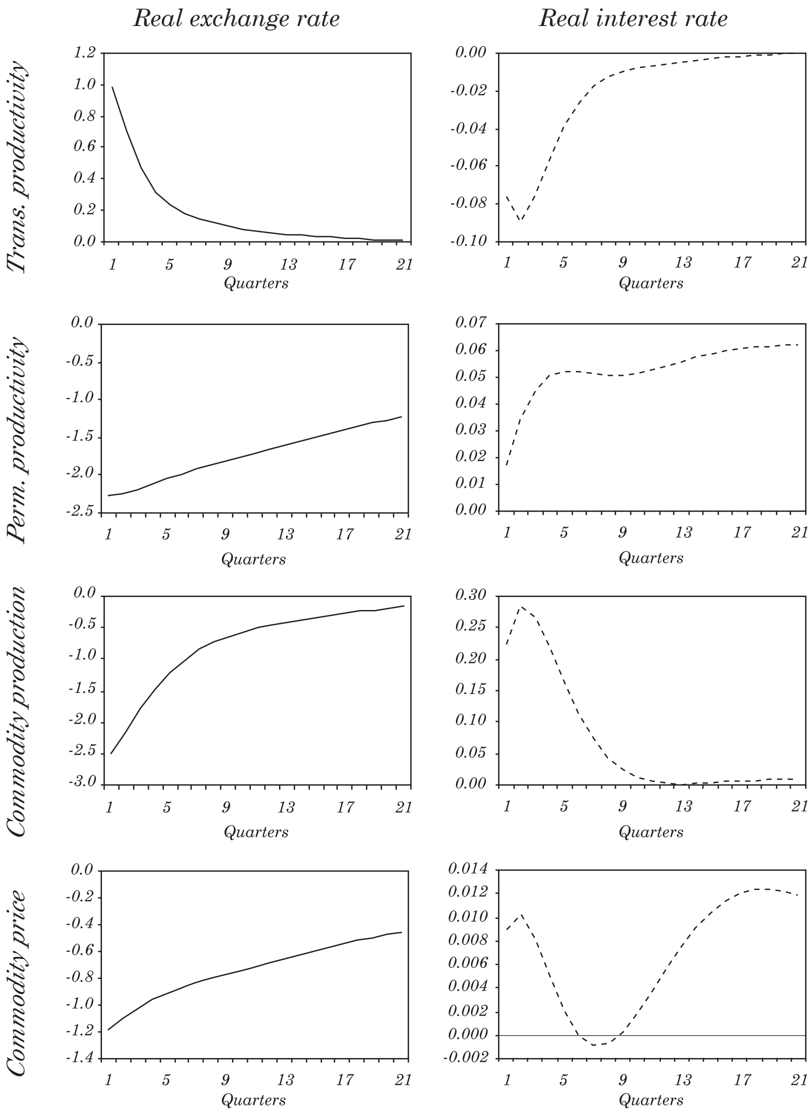


Figure 2. (continued)



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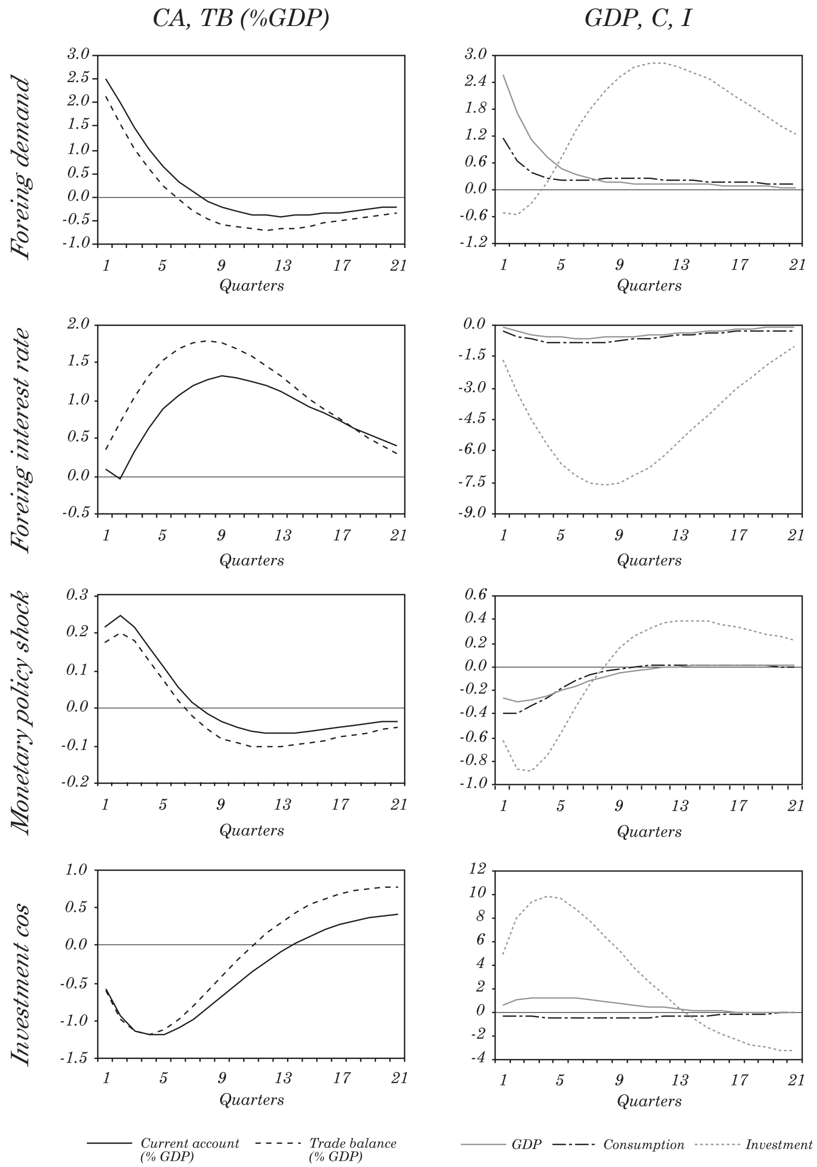

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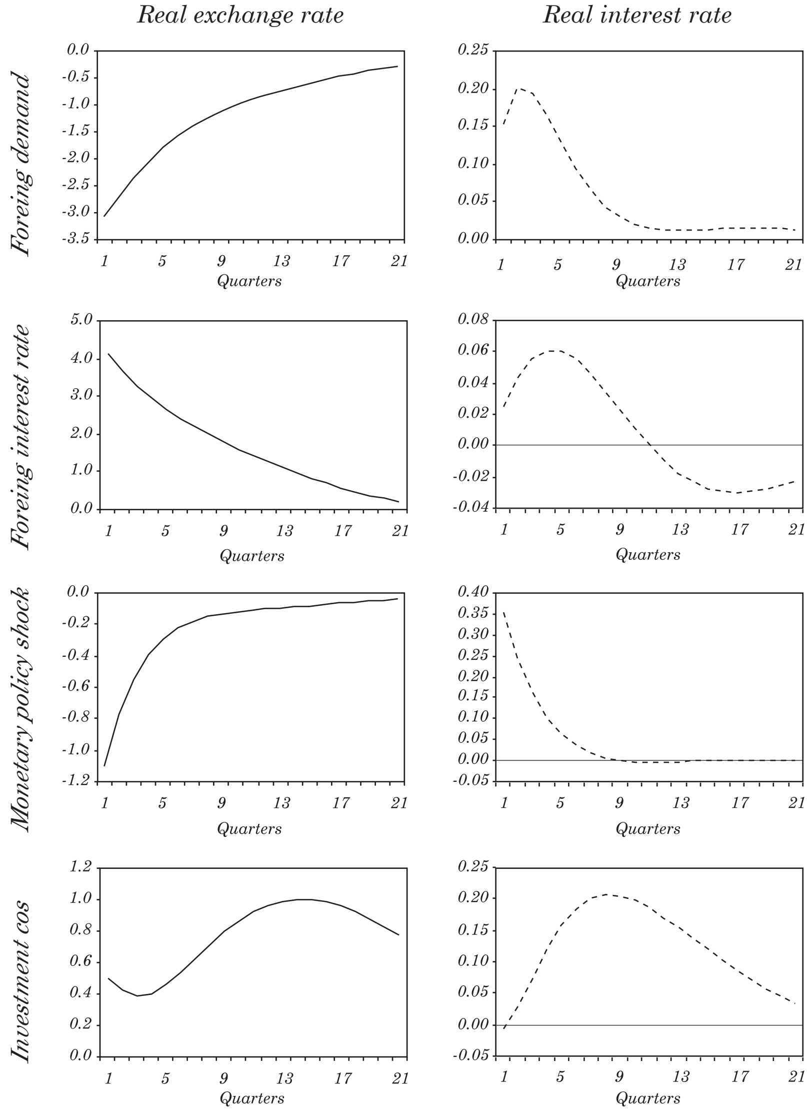
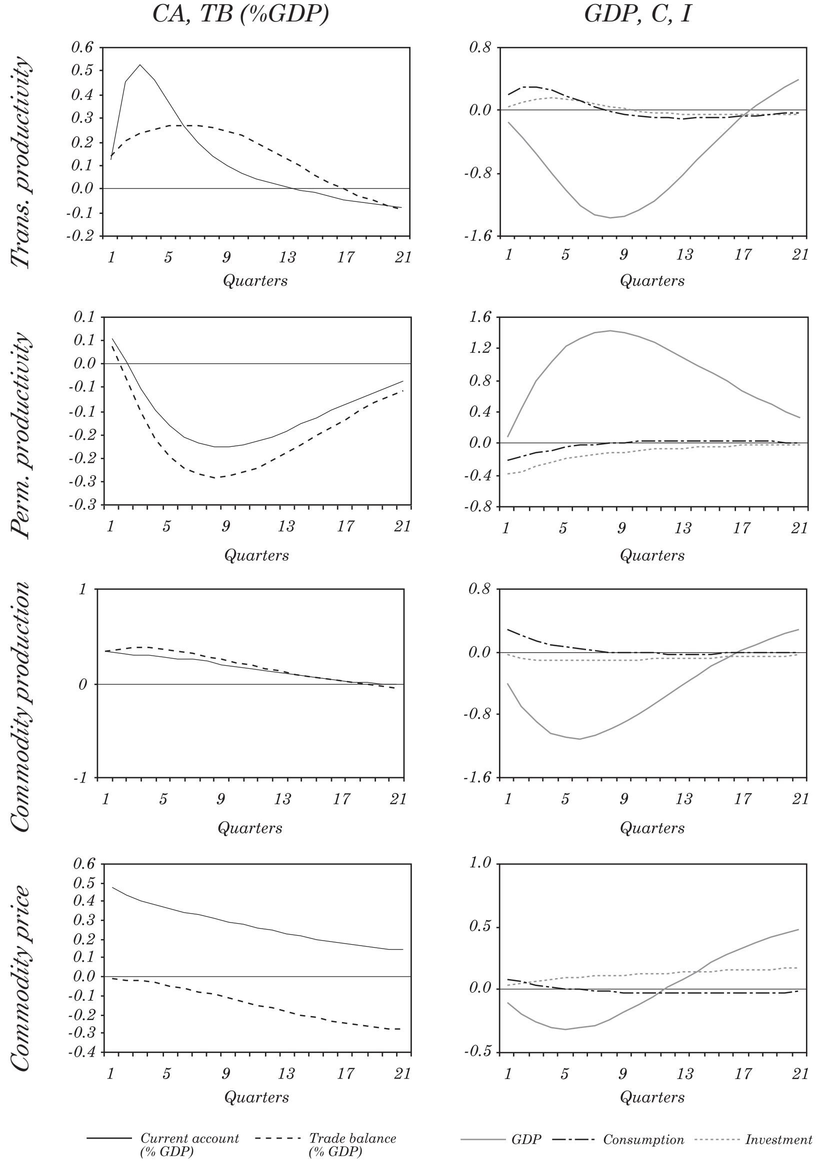


Source: Authors' computations.

Figure 3. Impulse-Responses: New Zealand



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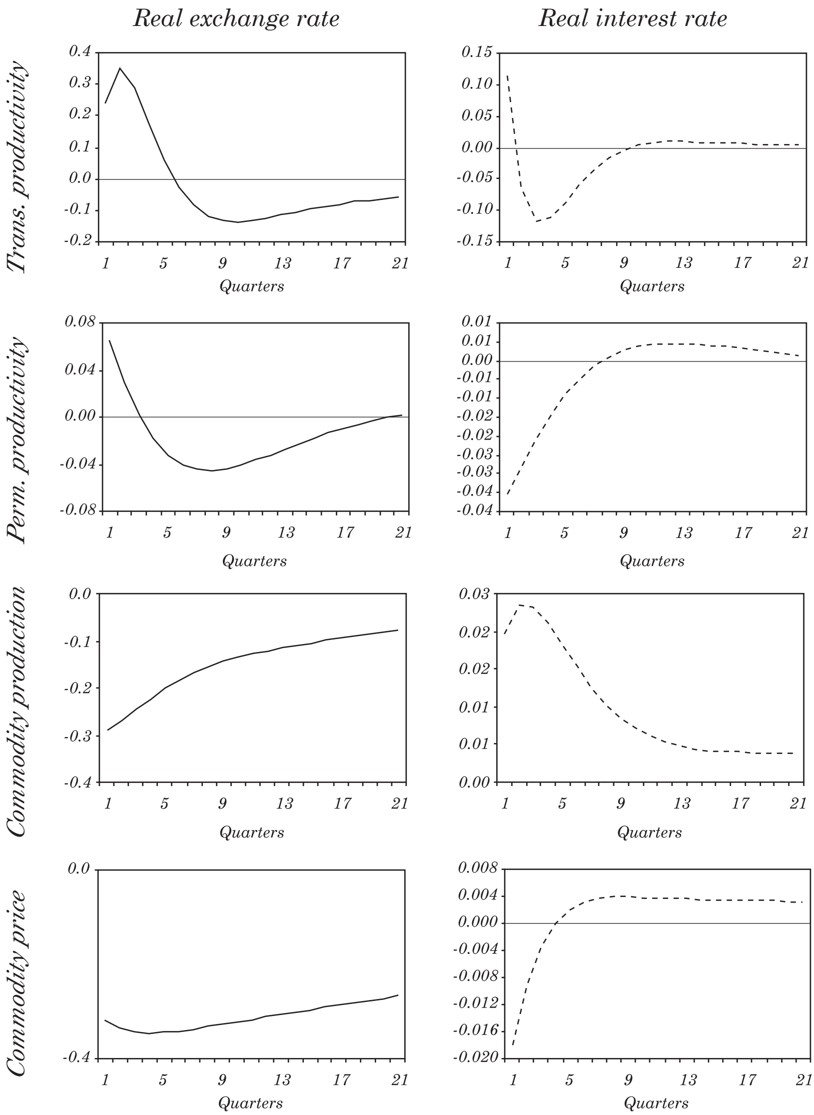

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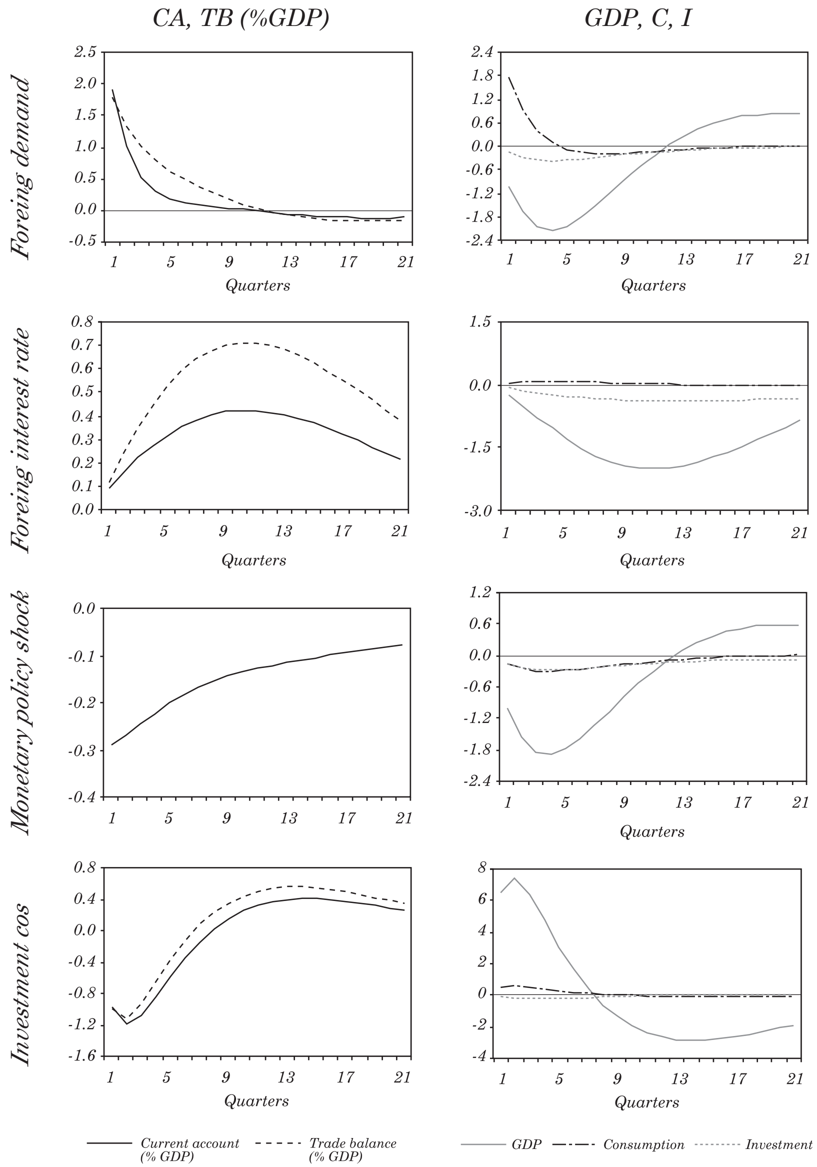

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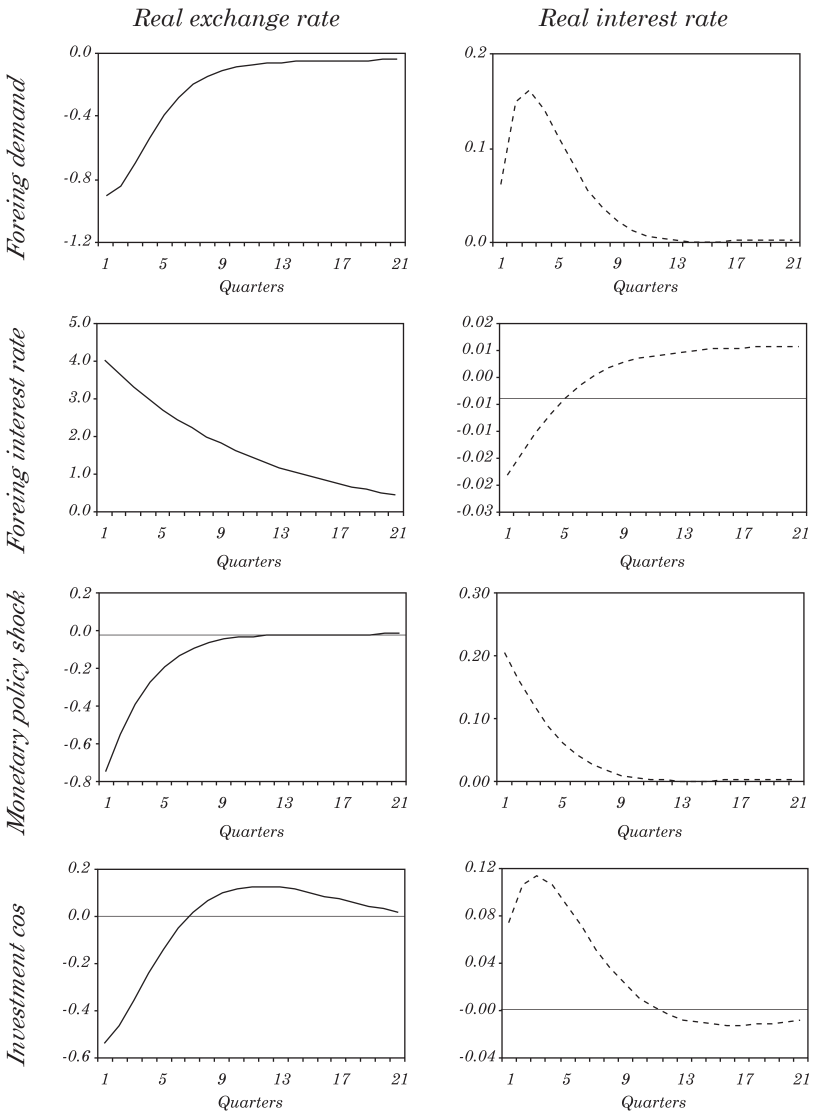


Source: Authors' computations.

of this type of shock for explaining current account behavior in a small open economy. They show that a standard real business cycle model for a small open economy requires a permanent productivity shock to generate the countercyclical current account surplus observed in emerging market economies.

Transitory productivity shocks have larger standard deviations and are more persistent in Chile than in New Zealand. In both economies, this type of shocks raises output, reduces employment, and boosts real wages. It also initially depreciates the real exchange rate. The fall in labor is explained by the income effect on the labor supply and the slow expansion of aggregate demand, which is due to intertemporal smoothing in consumption, consumption habits, and investment adjustment costs. In both countries, consumption rises, although in Chile it initially decreases slightly owing to the presence of non-Ricardian households, whose labor income falls. Chilean investment increases as the marginal productivity of capital rises. After a few quarters, however, it falls below its trend level. For New Zealand, the productivity shock is not persistent enough to induce an expansion in investment, and this variable falls below trend immediately after the shock. The current account, measured as fraction of GDP, improves in both countries, as a result of the transitory output expansion, consumption smoothing, the fall in investment (in New Zealand), and the expenditure-switching effect induced by a temporary real depreciation of the exchange rate.

A rise in the commodity endowment (that is, an exogenous increase in commodity production) directly implies an increase in domestic GDP and exports in both Chile and New Zealand. In both economies, this shock appreciates the real exchange rate. Consumption and investment also rise, as do imports. Exports expand more than imports, however, and the current account improves in response to this shock in both economies. The shock is more volatile but less persistent in Chile than in New Zealand.

4.2 Foreign Shocks

We explore three types of foreign shocks: a commodity price shock, a foreign output shock, and a foreign interest rate shock. Commodity price shocks are larger in Chile than in New Zealand (for Chile, they corresponds to copper price shocks, while for New Zealand they are shocks to a broader commodity export price index). A shock like this implies windfall revenues for the Chilean government and for foreign investors. Despite the intertemporal government consumption smoothing implied by Chile's fiscal rule, the persistence of the shock leads the government to moderately increase its expenditure on home goods, as its debt service falls. This expansion in aggregate demand raises output. Private consumption increases because of the increase in the current income of non-Ricardian households and because the shock expands the overall wealth of the country. The growth in output increases the marginal product of capital, which leads to a boom in investment. In the case of New Zealand, the windfall is received by households that own 90 percent of commodity export firms. Thus, the shock raises permanent income, and consumption increases smoothly over time. The increase in consumption leads to a rise in output and in investment. In both economies, the current account improves. The positive export price effect of the shock on the current account is moderated to some degree by a decline in export volumes, an expansion of investment in response to higher demand (which draws in imports), and exchange rate appreciation.[16] In New Zealand, the higher debt repayments in response to the monetary tightening that follows the shock also dampens the shock's effect on the current account. In Chile, the investment income account deteriorates because of higher profits for foreign investors. For both countries, the trade-balance-to-GDP ratio measured at constant prices declines as a consequence of the fall in export volumes and the increase in imports.

A foreign demand shock increases demand for home goods, and domestic output rises in both economies. Consumption increases with income, putting upward pressure on domestic prices and an exchange rate appreciation in anticipation of the endogenous monetary policy tightening. In both countries, investment increases to boost production, but only slowly owing to adjustment costs. The stronger exchange rate reduces the cost of imports, which also contributes to the expansion in investment since investment is import intensive. The direct effect of foreign output on exports dominates the increase in imports, and the current account improves in response to this shock.

16. For New Zealand, the currency appreciation—the so-called commodity currency effect—is smaller than implied by reduced-form estimates (here a 10 percent rise in commodity export prices leads to an exchange rate appreciation of about 1 percent, versus 5–7 percent in reduced-form estimates). The difference may be the result of the covariance of world commodity prices with other factors such as world demand or the UIP shock, not captured by our model. A larger commodity currency effect would reduce the positive effect of this shock on the current account.

A foreign interest rate shock (a shock to the foreign cost of capital) shock in figures 2 and 3 leads to a 4 percent real depreciation of the domestic currency in both countries. The real exchange rate depreciation triggers an expenditure switching effect that boosts exports and lowers imports. In Chile, the improvement in the trade balance is mainly due to contraction of imports, while in New Zealand it is mainly due to the expansion of exports. This is the result of the different pricing structures for imports and the currency denomination of foreign liabilities. In Chile, import prices are reoptimized more often than in New Zealand, and there is a very high degree of indexation to last period's inflation. Higher import prices in domestic currency thus generate a much more persistent effect on inflation. The depreciation leads to a strong monetary policy response in Chile that depresses consumption and investment, reinforcing the effect of higher import prices on consumption and especially on import-intensive investment and thereby reducing imports. In Chile, the depreciation also leads to valuation effects: the domestic currency value of foreign currency liabilities increases, and the resulting higher debt repayment further depresses aggregate demand. In New Zealand, the real depreciation effect is muted by a high degree of local currency pricing (with very infrequent reoptimization and indexation mainly to the inflation target). Also, a larger export response and smaller fall in aggregate demand prevent a fall in output. In both countries, this shock leads to a current account improvement.

4.3 Expenditure Shocks

Identified investment shocks—namely, decreases in the cost of transforming one unit of investment into one unit of capital—are a little larger in New Zealand, but more persistent in Chile.[17] They lead to a boom in investment that increases output and employment. In the case of Chile, the increase in output raises current income, and non-Ricardian household consumption surges. Total consumption

17. The shocks are associated with a change in the supply of capital goods and may reflect other sources of fluctuations that are absent from the model. As noted above, in a model with financial frictions, a shock like this could be obtained if the severity of the financial constraints varies with the cyclical position of the economy. Alternatively, changes in the efficiency through which the financial sector transferred savings to productive capital investment might be attributed to this shock, as well. This shock captures financial sector developments or other factors that affect the capital accumulation process that are not modeled explicitly.

rises, despite the monetary contraction. In New Zealand, since all households are assumed to be Ricardian, the monetary contraction causes a fall in consumption. For both countries, the current account initially deteriorates, mainly as a result of the investment-driven rise in imports. However, the increase in the capital stock eventually leads to higher production and higher exports, so that the current account balance increases above trend after a couple of years.

Both the consumption preference shock and government expenditure shock play a minor role in explaining the current account in Chile and New Zealand. We therefore do not report the impulse responses for them in the present article. For further details see Medina, Munro, and Soto (2007).

A consumption preference shock leads to a consumption boom that raises output and increases demand for labor and capital inputs. The monetary authority increases the interest rate and the real exchange rate appreciates. Despite the increase in the demand for capital and a small fall in the cost of imports, the intertemporal substitution effect driven by the monetary policy response generates a contraction in investment. This shock deteriorates the current account. Initially, the rise in consumption draws in imports, while exports fall because of the real appreciation of the currency. In New Zealand, the drop-off in investment dominates the boom in consumption after a couple of quarters, so that imports fall below trend. This effect improves the trade account, but it is offset by the investment income deterioration and thus does not improve the current account. In Chile, the fall in imports stemming from the contraction in investment leads to a slight improvement in the current account after several quarters.

A government expenditure shock in Chile corresponds to a deviation from the structural balance rule described above. It increases aggregate demand and boosts output and employment. The monetary policy responds by increasing the interest rate, which depresses investment and Ricardian consumption. Despite the increase in consumption by non-Ricardian households, overall consumption falls. The shock also implies an appreciation of the exchange rate because of the rise in the interest rate and because of the composition of government spending, which is biased toward home goods. Although the fiscal balance worsens in response to this shock, the contraction in private expenditure causes a small and short-lived improvement in the current account. In the case of New Zealand, the government expenditure shock also boosts output and depresses consumption and investment. Since the government consumes only home goods, whereas households consume both home and foreign goods, and given that investment utilizes foreign goods, the crowding out effect of public spending in New Zealand implies a short-run improvement in the current account. As monetary policy tightens and the interest rate increases, debt service also increases and the current account deteriorates. In the medium term, when the interest rate has eased, the current account improves again as a consequence of the fall in imports.

4.4 Monetary Shock

A monetary shock induces a contraction in aggregate demand (consumption and investment), output, and employment. In both countries, exports fall because of the appreciation of the currency, and imports fall because of the contraction of consumption and investment. In the case of Chile, given the estimated elasticities of substitution and the calibrated shares of foreign goods in consumption and investment, the intertemporal positive effect on the current account dominates the negative intratemporal effect on this variable. Therefore, the current account initially improves. However, it deteriorates a little several quarters after the shock, as imports pick up in response to the recovery in investment while exports remain depressed. In New Zealand, the current account improves initially because of the contraction in imports. It deteriorates one quarter after the shock, because domestic currency debt service costs rise with the domestic interest rate. The current account therefore falls despite an improvement in the trade balance. After some quarters, the trade balance effect dominates and the current account improves, but it falls again as imports pick up while exports remain low. Our model and estimation thus indicate that monetary policy is more effective at reducing the current account deficit in Chile than New Zealand, and a key difference is related to the denomination of external debt.

5. What Drives the Current Account in Chile and New Zealand?

We use the estimated model to better understand the evolution of the current account in both countries. We first discuss the variance decomposition of the current account. We then use our identified shocks to show the contribution of each one to the historical evolution of the current account of both countries over the sample period. The variance and historical decompositions abstract from the steady-state current account position, which is –1.8 percent of GDP for Chile and about –5.0 percent for New Zealand. The latter is mainly associated with investment income payments on New Zealand's large stock of external liabilities.

5.1 Variance Decomposition

To analyze the variance decomposition of the current account for Chile and New Zealand, we group shocks into four categories, as before: foreign shocks, domestic supply shocks, domestic demand shocks, and monetary shocks. In both countries, foreign shocks explain about half or more than half of the variation in the current account at all horizons (see table 2).[18] The most important foreign shock in both cases is the shock to the foreigninterest rate. Given the uncovered interest rate parity condition, this shock captures not only fluctuations in the foreign interest rate, but also the unobserved currency risk premium, and any capital flow effects that influence the exchange rate. This shock is very persistent in both countries, with estimated AR(1) coefficients of 0.985 in Chile and 0.923 in New Zealand. Its main effect on the current account occurs about two years after the shock. It accounts for 58–71 percent of current account variance at the three- to four-year horizon in Chile, and 40–44 percent in New Zealand. The foreign demand shock has a strong but transitory short-term effect, accounting for about 40 percent of current account variation in the first year after the shock in both countries.

While the effects of these two shocks are similar, the effect of the third foreign shock, the commodity export price shock, is quite different in the two countries. In Chile, a change in the copper price has a brief short-term effect, accounting for about two percent of current account variation in the first year.[19] In New Zealand, a change in the price

18. This result is consistent with Munro and Sethi (2007), who use a smaller shock model to analyze New Zealand's current account.

19. The variance decomposition is computed using the mode estimate of the variance of each shock. The recent copper price shock was much larger than historical shocks, so the share of this shock in explaining the recent current account event is likely much higher. See the historical decomposition below.

Table 2. Current Account Variance Decomposition: Foreign Shocks
Percent

Country and horizon	*Foreign demand*	*Commodity export price*	*Foreign interest rate (UIP)*	*Total*
Chile 1990–99				
1 year	40.9	1.6	5.3	47.8
2 years	1.7	0.1	45.6	47.4
3 years	3.9	0.2	71.3	75.4
4 years	6.2	0.1	62.0	68.3
Chile 2000–04				
1 year	45.3	2.0	3.4	50.7
2 years	3.3	0.2	44.7	48.2
3 years	4.6	0.2	69.1	73.9
4 years	8.2	0.2	57.5	65.9
New Zealand				
1 year	39.6	7.5	2.3	49.4
2 years	11.1	19.9	27.4	58.4
3 years	1.0	15.6	44.1	60.7
4 years	1.5	9.3	39.6	50.4

Source: Authors' computations.

of agricultural exports has a larger and more medium-term effect, accounting for 15–20 percent of current account variation at the two- and three-year horizons. The difference likely reflects the different ownership structures, with the windfall gains going to private agents in New Zealand and to the government and foreign investors in Chile. The 60 percent share of the windfall that goes to foreign investors in Chile directly offsets the improved trade balance through an investment income deficit. It may also be explained by the fact that Chile's government has saved a large part of its share of the windfall revenues from copper.[20]

Domestic supply and demand shocks in Chile each account for about half of the remaining variation in the current account, with monetary policy shocks accounting for very little (see tables 3 and 4). In

20. De Gregorio (2006) argues that although the structural balance rule was not in place before 2000, the government behaved very much as if the rule was already in place in the 1990s. In fact, during most of our sample period, Chile maintained a stabilization fund linked to the copper price, which smoothed out the effects of shocks to this variable.

Table 3. Current Account Variance Decomposition: Domestic Supply Shocks

Country and horizon	*Productivity*		*Commodity output*	*Total*
	Transitory	*Permanent*		
Chile 1990–99				
1 year	1.4	3.1	17.2	21.7
2 years	0.7	12.1	0.7	13.5
3 years	0.1	16.5	1.7	18.3
4 years	0.6	19.7	2.7	23.0
Chile 2000–04				
1 year	0.5	0.8	20.5	21.8
2 years	0.4	9.2	1.7	11.3
3 years	0.0	17.6	2.3	19.9
4 years	0.2	23.0	4.1	27.3
New Zealand				
1 year	5.6	0.3	4.5	10.4
2 years	10.0	5.4	3.2	28.6
3 years	3.4	6.8	7.7	17.9
4 years	0.4	3.8	1.9	6.1

Source: Authors' calculations.

New Zealand, domestic demand shocks are relatively more important, and monetary policy shocks again explain very little.[21]

The contribution of domestic demand shocks to variation in the current account mainly comes from the inferred investment-specific shock. In Chile this accounts for 30–40 percent of current account variation in the first two years; in New Zealand it explains 40 percent in the first year, with persistent effects at longer horizons. The contribution of domestic supply shocks in Chile is mainly from commodity output fluctuations in the short term (17–20 percent of the variance in the first year) and from permanent labor productivity shocks in the longer term (16–20 percent of current account variance in the third and fourth years). In New Zealand, variations in commodity production affect the current account with a similar magnitude, but with the main effect in the second year; and both permanent and transitory productivity shocks are important.

21. These policy shocks are deviations from the policy rules. The endogenous component of monetary policy—that is, the reaction function—may be important to determine the relative contribution of other shocks. See subsection 6.2 below.

Table 4. Current Account Variance Decomposition: Domestic Demand and Monetary Policy Shocks

	Domestic demand shocks				
Country and horizon	*Investment-specific*	*Consumer preference*	*Government expenditures*	*Total*	*Monetary policy shock*
Chile 1990–99					
1 year	30.0	0.2	0.1	30.3	0.4
2 years	39.0	0.0	0.0	39.0	0.0
3 years	6.2	0.0	0.0	6.2	0.1
4 years	8.7	0.0	0.0	8.7	0.1
Chile 2000–04					
1 year	26.7	0.1	0.1	26.9	0.8
2 years	40.4	0.0	0.0	40.4	0.1
3 years	6.0	0.0	0.0	6.0	0.2
4 years	6.5	0.0	0.0	6.5	0.3
New Zealand					
1 year	39.0	0.5	0.3	39.8	0.6
2 years	11.6	0.2	0.2	12.0	1.0
3 years	21.1	0.2	0.1	21.4	0.2
4 years	41.0	1.3	0.5	42.7	0.9

Source: Authors' calculations.

Government spending shocks are estimated to account for a small part of current account variance in both countries. The effect is a little larger in New Zealand than in Chile, and it is probably understated a little given our assumption that the government consumes only home goods. In the case of Chile, these shocks correspond to the government deviating from the policy rule. Therefore, they do not capture in full the effects of fiscal policy—broadly defined—on the evolution of the current account.

The fact that investment-specific shocks play an important role in explaining the current account shows the positive shock absorber role performed by this variable in both countries. With an open capital account, households, in the aggregate, can smooth consumption in the face of shocks by using the current account to borrow and lend, much as an individual uses a bank account.

5.2 Historical Decomposition of the Current Account

This subsection highlights how some major developments can be interpreted in terms of the model shocks and the current account responses to those shocks. Figures 4 and 5 present the historical contribution of each shock to the evolution of the current account for Chile and New Zealand respectively.

Figure 4. Historical Decomposition of the Current Account: Chile, 1990–2005

Deviation from steady state (in percent)

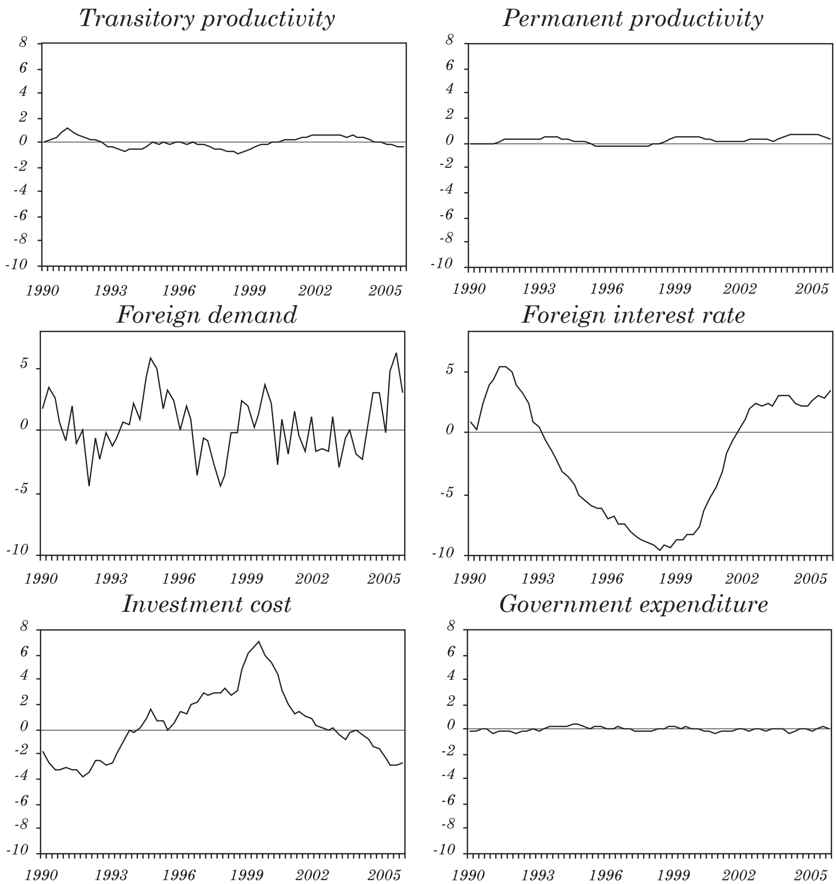
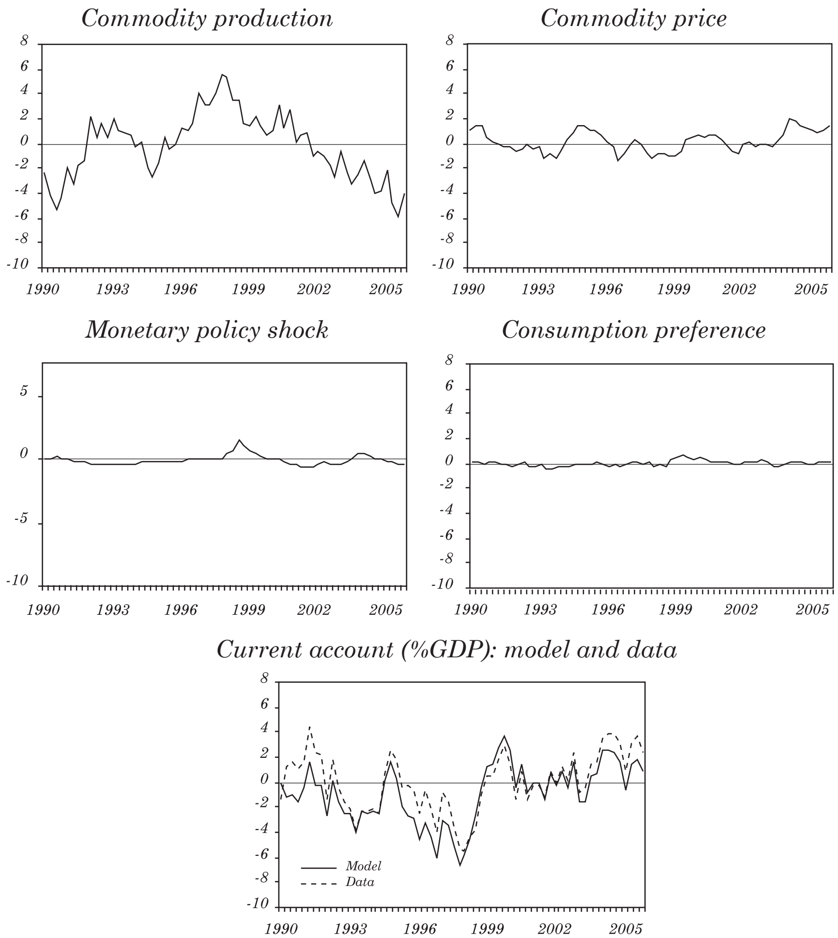


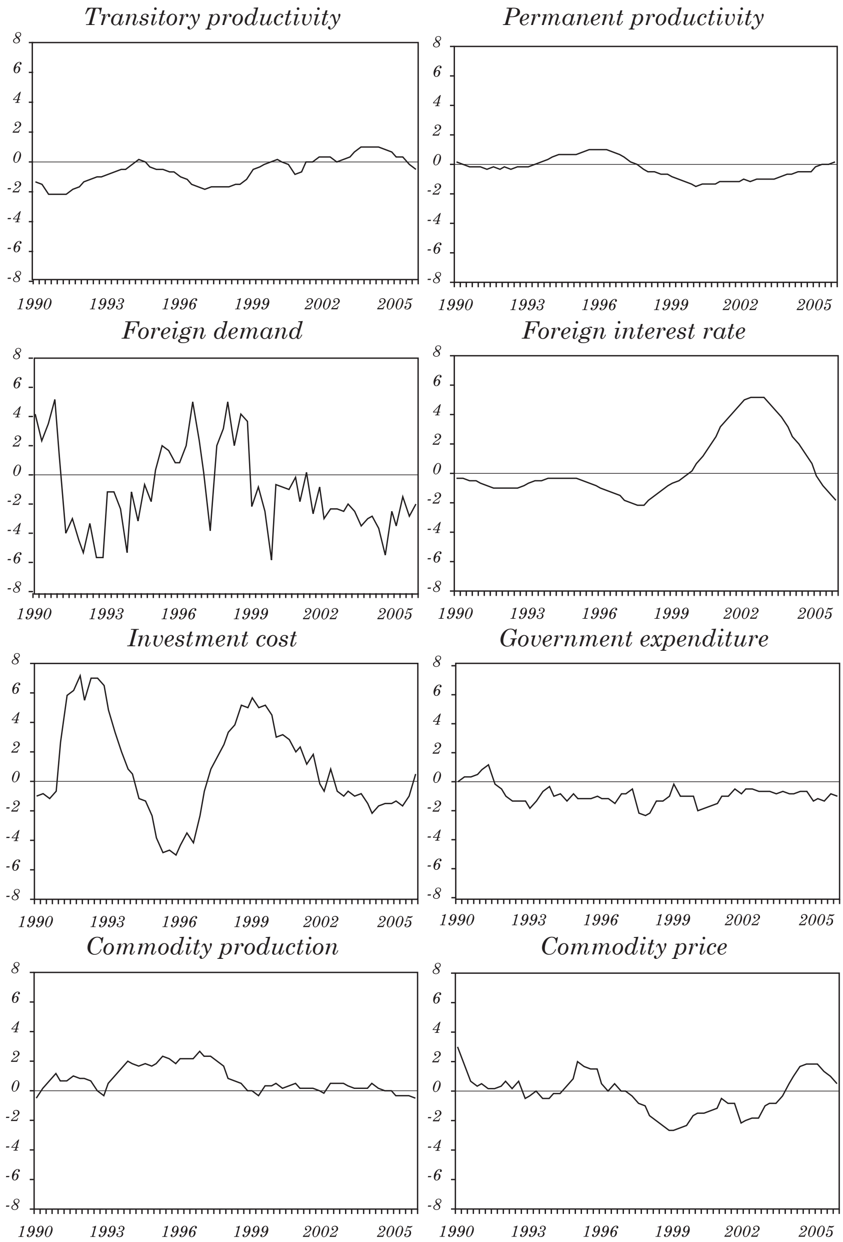
Figure 4. (continued)



Source: Authors' calculations.

Figure 5. Historical Decomposition of the Current Account: New Zealand, 1990–2005

Deviation from steady state (in percent)



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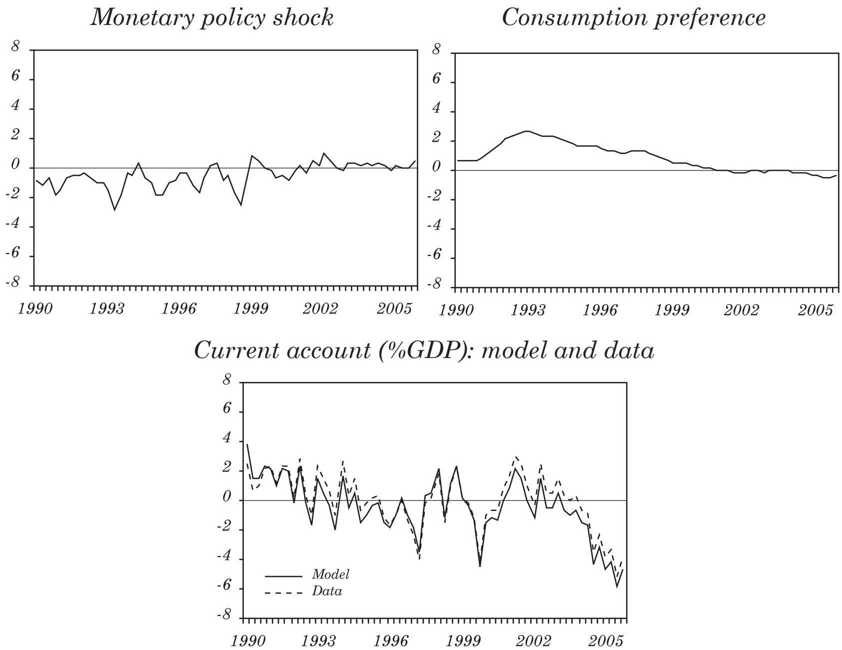


Source: Authors' calculations.

5.2.1 Chile

The evolution of the current account in Chile over the period is characterized by a phase of moderate deficits from 1990 until 1999–2000 and then by a period in which the current account oscillated between small deficits and surpluses. The deficits observed at the beginning of the 1990s are explained mostly by a boom in investment, triggered by favorable domestic conditions, and by a weakness in foreign activity that depressed exports (figure 4). According to the model, the small reversal of the current account in 1995, which coincides with the Mexican crisis, is explained by favorable external conditions that boosted exports. In fact, an index of foreign output constructed by averaging the output of Chile's main trade partners grew more than 4.5 percent at the beginning of that year.

Foreign financial conditions also played an important role in explaining the evolution of the current account in the 1990s. From 1991 until 1999, easing foreign financial conditions (reflected in a stronger exchange rate) put downward pressure on the current account. The improvement in foreign financial conditions of that period seems to capture the observed large capital inflows and the associated real exchange rate appreciation. The current account reversed dramatically in 2000, after the Asian crisis and during the Argentine crisis. The reversal in the current account began before the reversal in foreign financial conditions, however. In 1999 a dramatic negative investment shock depressed investment and imports. This last shock could be capturing the stress experienced by the domestic financial sector after the Asian crisis. While there was an important contractionary monetary shock in late 1998, the model does not attribute a large share of responsibility for the fall in investment and the reversal of the current account to that shock.

Despite the fact that the country's spread has been falling since the 2001 Russian crisis, the model identifies tightening external financial conditions as one of the reasons why the current account improved after 2000. As mentioned before, these shocks to foreign financial conditions capture more than the observed movements in the foreign interest rate and the risk premium faced by the country. They also capture any change in market conditions that affects the exchange rate so that the UIP condition holds. In the case of Chile, for example, this shock could be capturing the significant capital outflows of the last few years of the sample, which were associated with foreign investment by Chilean companies in Latin America and the portfolio strategies of pension fund administrators (AFPs). The decline in natural resources GDP and a small investment boom after 2002 would have led to a current account deficit, had no other shock hit the economy. More recently, an export expansion triggered by more robust growth in trading partners, combined with the copper-price boom, explains the current account surpluses observed over recent quarters.

5.2.2 New Zealand

According to our estimation, the largest swings in the current account during the period have come from investment-specific shocks (see figure 5). In the model, a positive investment adjustment shock means that a given amount of investment is transformed more efficiently into productive capital, thereby reducing the cost of capital. This shock may also capture effects such as financial constraints that affect investment. Investment-specific shocks were negative during the labor market reforms of the early 1990s, positive in the mid-1990s (a period of rising investment), and negative in the late 1990s (possibly related to the end of the domestic housing boom or financial crises in other countries). This last shock had a relatively small effect on the recent current account deterioration, compared with the shock in the mid-1990s. While both periods were characterized by investment booms and current account deteriorations, the effects of foreign financial conditions on the exchange rate are estimated to have been more important in recent years.

The estimated foreign demand shock shows weak foreign demand in the early 1990s (following recession in some trading partners), strong foreign demand through the rest of the 1990s, and weak foreign demand after about 2001. The foreign demand shock has a strong, but transitory short-term effect, and the effect on the current account follows a similar pattern.[22] As shown in figure 5, the relatively low world price of commodity exports in 1998–2003 had a negative effect on the current account position, while the rise in commodity export prices in 2004–05 had a positive effect on the current account position, much as one would expect. Over all, from 1997 to 2002, the main factors that are estimated to have led to an improvement in the current account position were the investment-specific shock and the contribution of changes in foreign financial conditions to the depreciation of the New Zealand dollar.

The estimated historical shocks show periods of New Zealand dollar strength in 1996 and in 2004–05 and weakness in 2000–01. The foreign interest rate/UIP shock is not only persistent, but its main effect on the current account occurs through the volume of imports and exports with a lag of about two years. Thus, the weak New Zealand dollar of 2000–01 had a positive influence on the current account balance in 2002–03 (see figure 5). The lagged response implies that the strong New Zealand dollar seen in 2004–05 may continue to have a negative effect on the current account balance through 2007, all else being equal.

6. Conterfactual Experiments

This section explores conterfactual experiments for the evolution of the current account of Chile and New Zealand. First, we analyze

22. This shock appears to pick up the effect of government imports (in the model the government is assumed to consume only home goods). This is seen clearly in the two spikes in 1997 and 1999, which correspond to the import of two navy frigates. Government imports have expanded in the past year or two on a smaller scale, so the effect of foreign demand is likely to be overstated and government spending correspondingly understated.

the dynamics of the estimated model under a scenario that eliminates Chile's original-sin problem, assuming that external debt is denominated completely in Chilean pesos rather than in foreign currency. Second, we explore whether a more or less aggressive monetary policy response in New Zealand would change the current account responses to different shocks.

6.1 Chile without Original Sin

According to Eichengreen, Hausmann, and Panizza (2005), if a country is unable to borrow abroad in its own currency, it suffers from so-called original sin. Chile faces this problem. Most of the country's debt is denominated in U.S. dollars, creating an aggregate currency mismatch on its balance sheets. Consequently, external shocks could be amplified in the domestic economy. To shed light on the macroeconomic implication of issuing debt in domestic currency, we explore the dynamics of the model under a scenario in which Chile's entire external debt is denominated in Chilean pesos.

The responses of the main aggregate variables for the estimated model for Chile assuming an external debt denominated in pesos are shown in figure 6. For purpose of comparison, these are plotted together with the impulse response functions of the original estimated model, in which the external debt is denominated in U.S. dollars. GDP is less sensitive to external shocks (namely, commodity price, foreign demand, and interest rate shocks) when the external debt is in Chilean pesos, although the difference is moderate. This result may indicate that eliminating the valuation effects in the foreign income investment of the current account would help isolate aggregate domestic demand from fluctuations in external conditions.

The model predicts that the responses of the current account to some supply shocks would be larger if the external debt was denominated in Chilean pesos. In particular, the improvement in the current after a transitory productivity shock is around 1 percent in the short run when the debt is denominated in pesos, whereas this response is small in the baseline estimation. Permanent productivity shocks would generate a more significant worsening in the current account surplus with a peso denomination of external debt. We also observe that when the external debt is in pesos, the required movement in the exchange rate to generate an adjustment in the current account would be smaller.

In terms of monetary policy, interest rate innovations become less effective in influencing the current account if the external debt

Figure 6. Impulse-Responses: Changing the External Debt Denomination in Chile

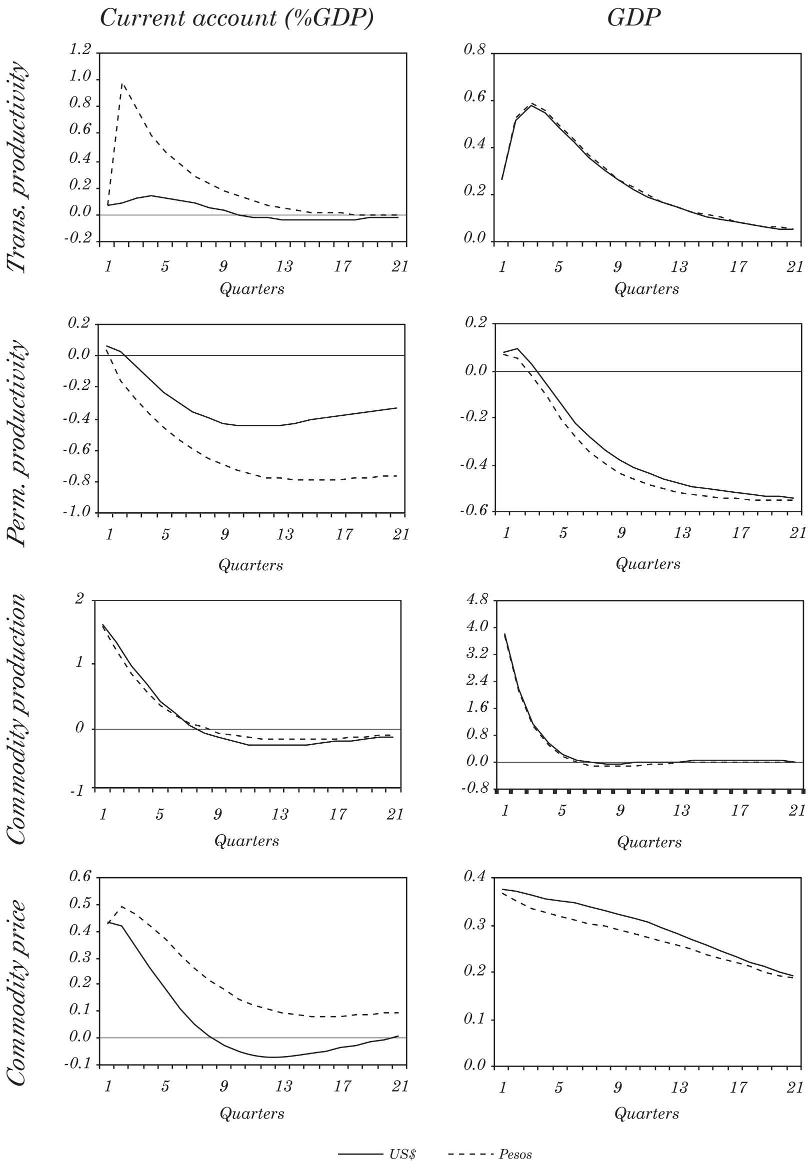


Figure 6. (continued)

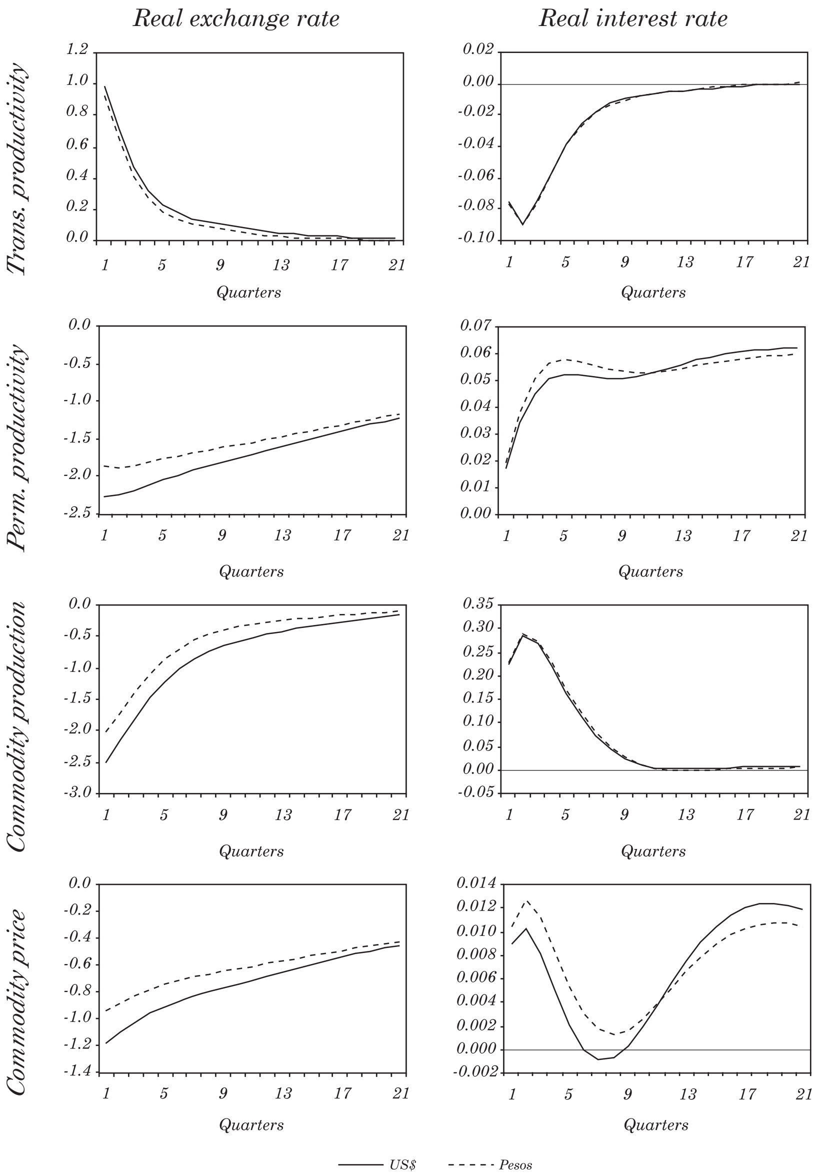


Figure 6. (continued)

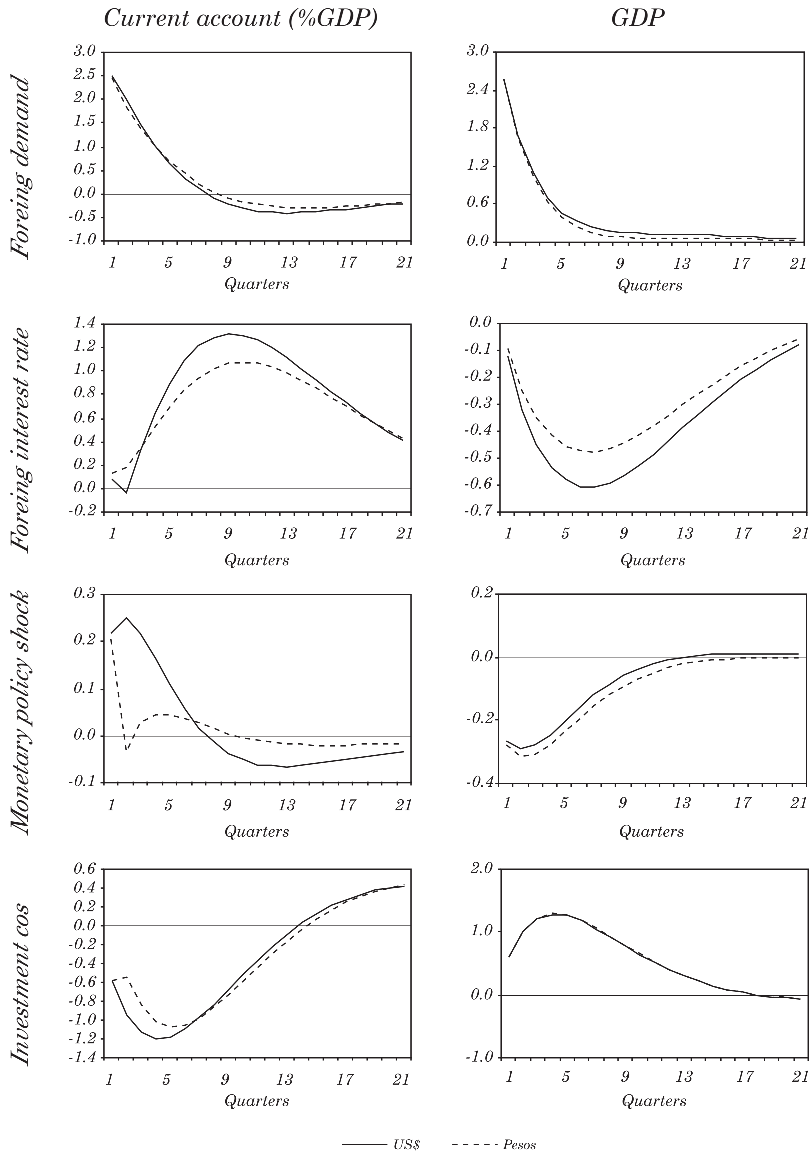
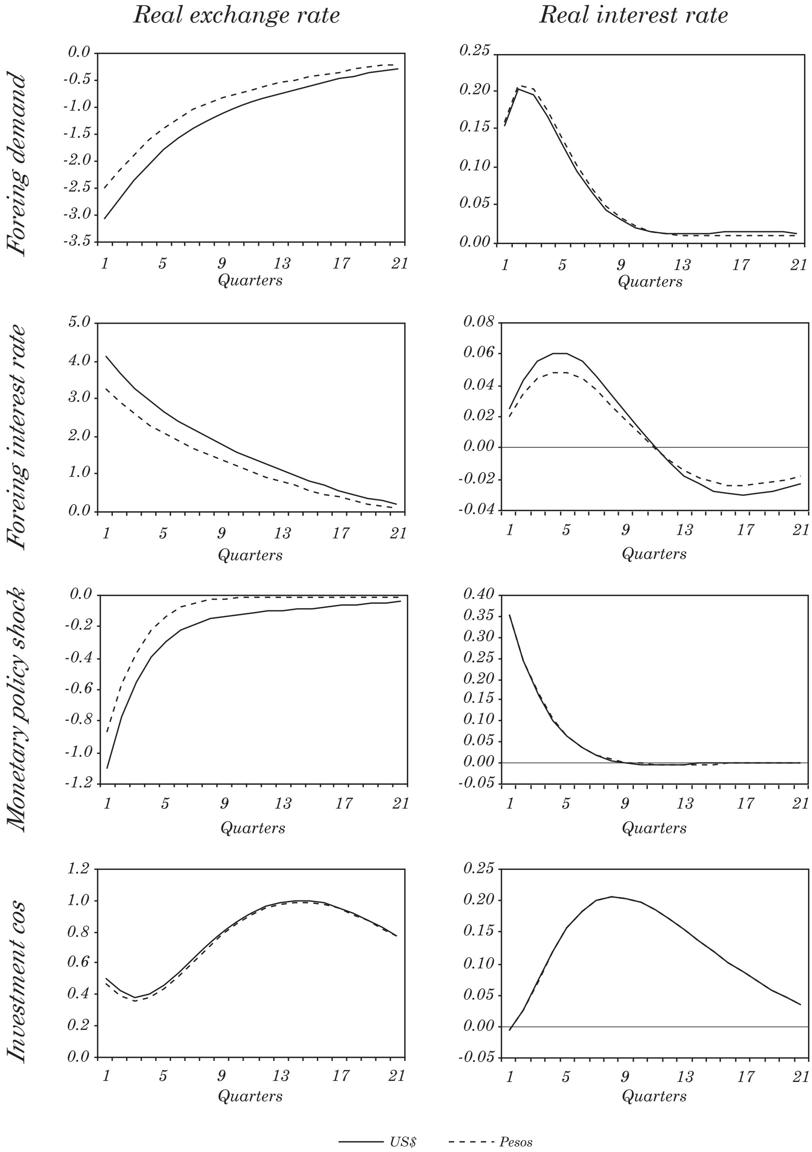


Figure 6. (continued)



Source: Authors' computations.

is denominated in pesos. This response is similar to the one found in the estimated model for New Zealand. A domestic-currency denomination for the external debt makes foreign investment income more related to the domestic interest rate. Thus, a tighter monetary policy directly increases debt service payments, offsetting its impact on the trade balance.

6.2 The Effect of a More or Less Aggressive Monetary Policy in New Zealand

While we don't usually associate the current account with monetary policy, in an open economy tight monetary policy may spill demand into the current account by putting upward pressure on the exchange rate and providing cheap imports. The variance and historical decompositions in the previous sections attribute almost no role to monetary policy shocks in explaining the exchange rate and the current account. It is still possible, however, that the endogenous monetary policy response embodied in the reaction function may be relevant to the behavior of the exchange rate and the current account.[23] There is a perception in some circles that the strong exchange rate, supported by high domestic interest rates, has been detrimental for exporters and is responsible for New Zealand's large imbalances. This suggests that a less aggressive monetary policy response might help moderate the effects of shocks on the current account dynamics. Others argue that, to avoid large exchange rate fluctuations, monetary policy should aim to avoid being out of phase with the foreign business cycle, suggesting that a more aggressive monetary policy response is appropriate. The experiments in this subsection address these opposing claims. We conduct the two counterfactual experiments by adjusting the interest-rate-smoothing parameter. The results are shown in figure 7.

First, we increase the smoothing parameter from the estimated 0.90 to 0.95, which heightens the degree of smoothing and correspondingly softens the response to inflation and output. Since the estimated smoothing parameter is already high, the differences are not great. We are most interested in the shocks that account for the bulk of current account and exchange rate variance: namely, the foreign interest rate, investment cost, foreign output, and commodity price shocks. In the

23. Edwards (2006b) discusses the relationship between monetary policy and external imbalances in New Zealand and explores the potential benefits of changing the current monetary policy framework.

Figure 7. Impulse-Responses: Changing the Aggressiveness of Monetary Policy in New Zealand

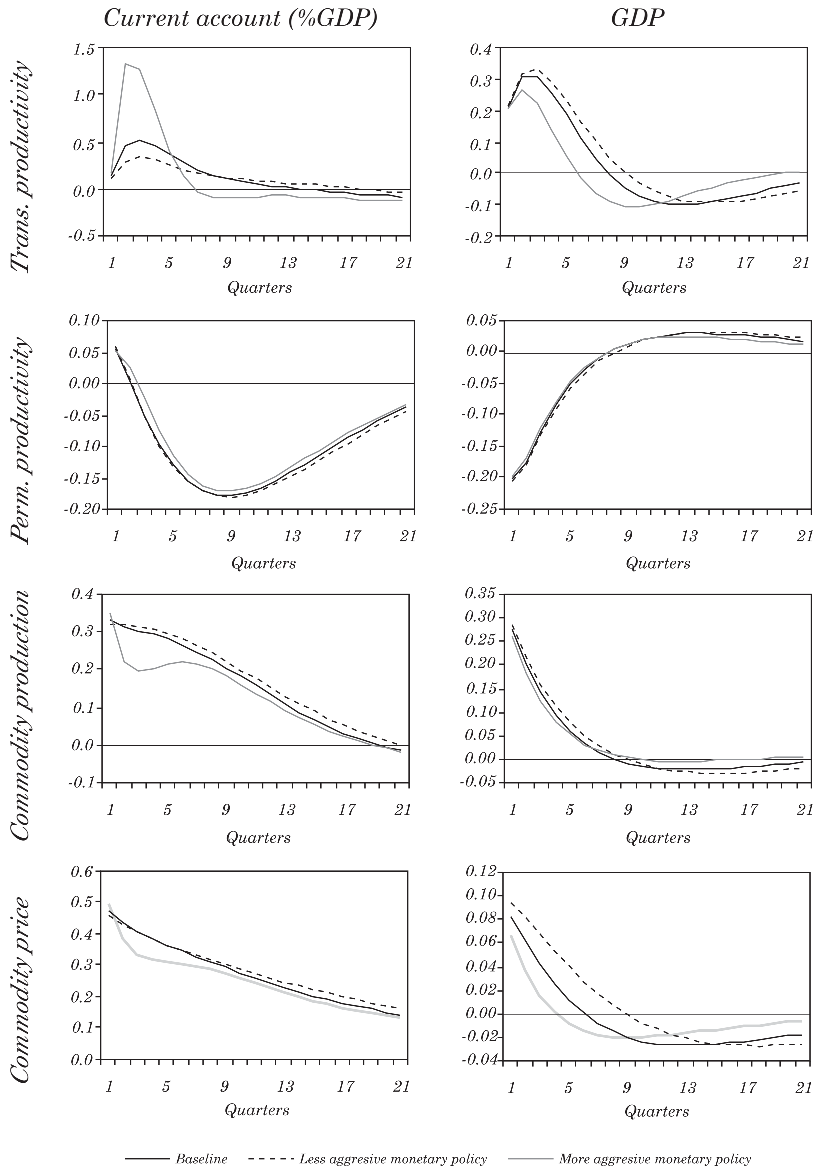


Figure 7. (continued)

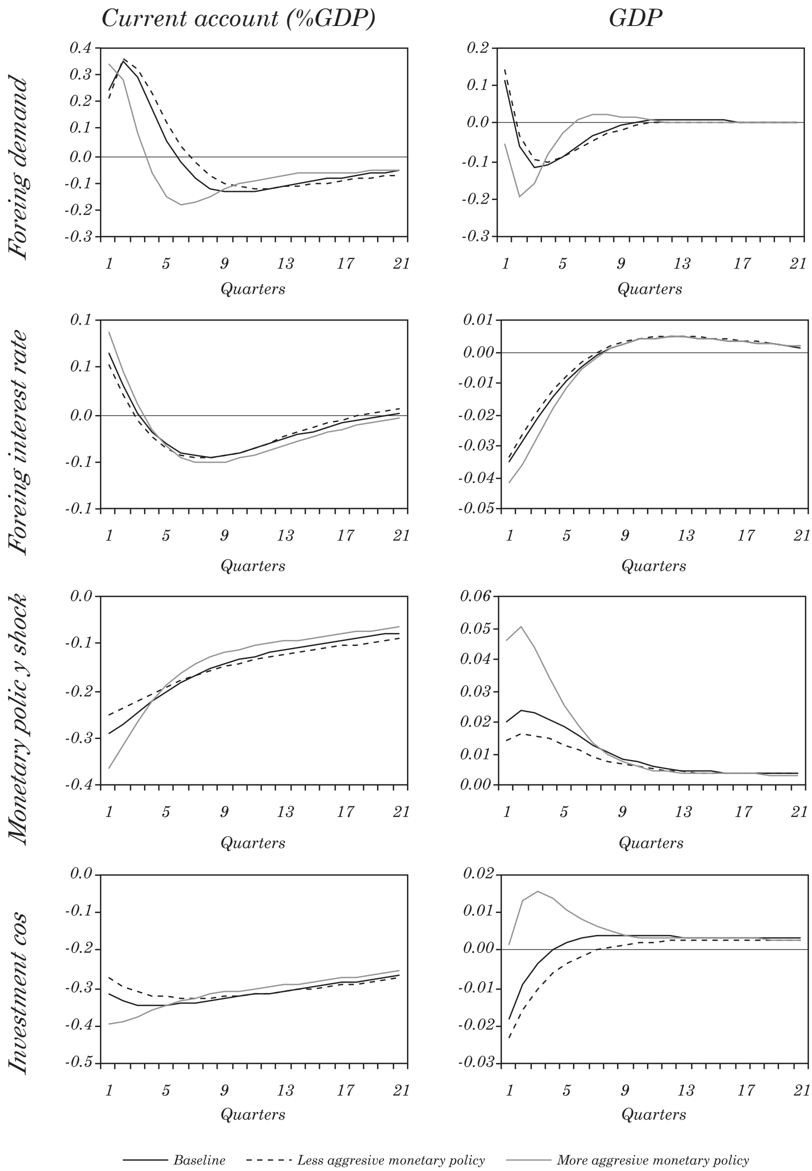


Figure 7. (continued)

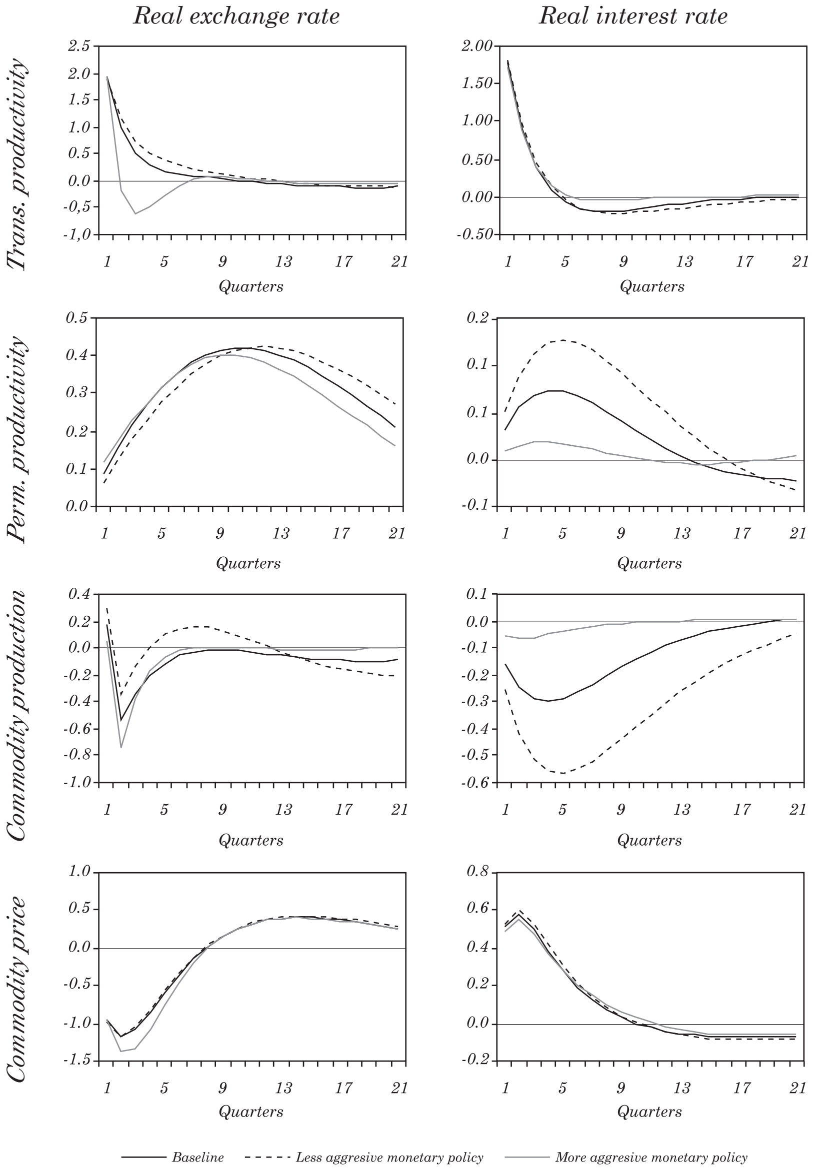
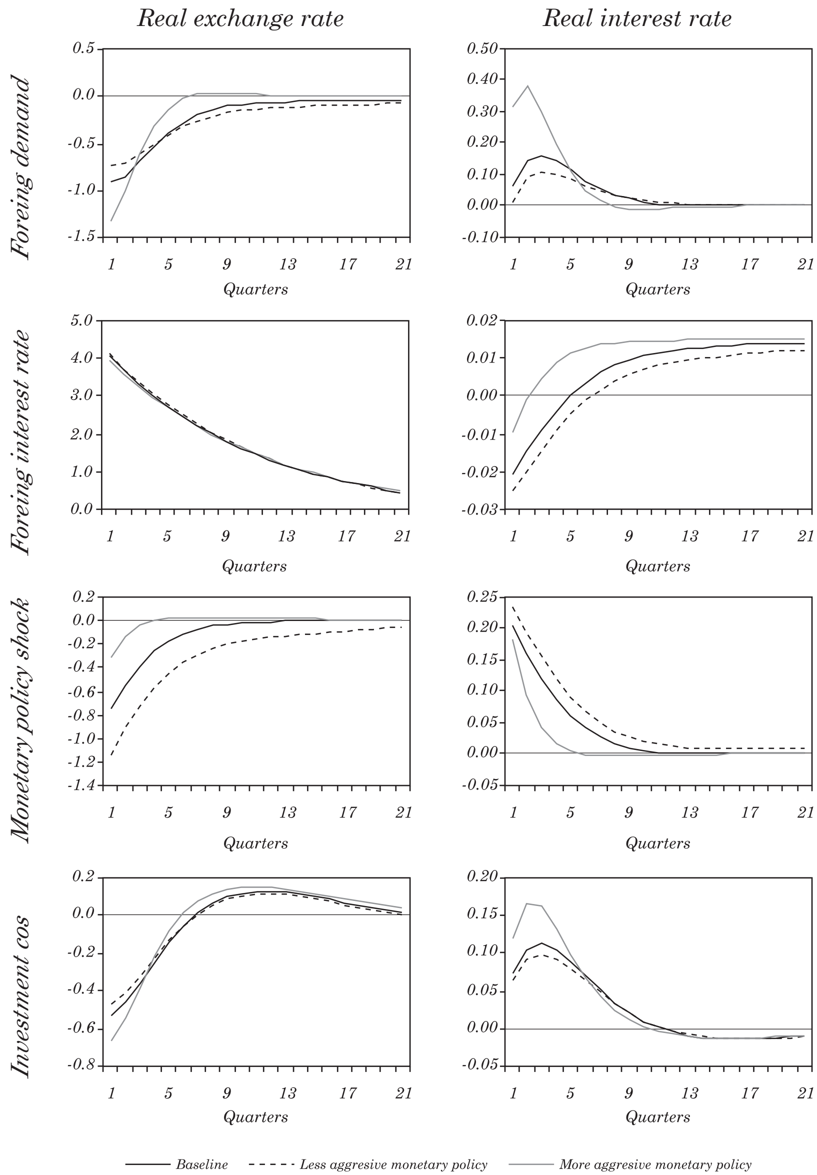


Figure 7. (continued)



Source: Authors' computations.

face of a foreign cost of capital (UIP) shock, which accounts for the bulk of exchange rate variance, there is hardly any difference in the exchange rate response. The current account responds a little later and is more persistent. The less aggressive response slightly reduces exchange rate volatility in the other three cases, while the effect on the current account is small.

Second, we reduce the degree of smoothing to 0.60, implying a substantially stronger monetary response to inflationary pressure and output fluctuations in an effort to aggressively stabilize the business cycle. In the face of a foreign cost of capital (UIP) shock (which accounts for the bulk of exchange rate variance), there is almost no difference in the real exchange rate response. For the other three shocks of interest, the more aggressive monetary policy response increases real exchange rate volatility. The effect on the current account works mainly through the effect of sharper interest rate movements on the investment income account. In the case of a commodity price shock and a foreign output shock, the deterioration works to offset the improvement in the trade balance. For the investment-specific shock, the investment income deterioration reinforces the trade balance deterioration.

7. Conclusions

This paper used an open economy DSGE model with a commodity sector and nominal and real rigidities to investigate the factors that account for current account developments in two small commodity-exporting countries. We are interested in assessing these factors in a coherent framework to better understand the macroeconomic and financial stability risks associated with the increase in both external stocks and external flows that has resulted from financial market integration.

We estimated the model with Bayesian techniques, using Chilean and New Zealand data. The structural factors that explain the behavior of the current account were fairly similar for the two countries. We find that foreign financial conditions, investment-specific shocks, and foreign demand account for the bulk of the variation of the current accounts in both cases. Monetary and fiscal policy shocks (that is, deviations from policy rules) are estimated to have relatively small effects. For New Zealand, fluctuations in export commodity prices have also been important in explaining the current account. In both countries, foreign shocks account for about half, or more than half, of current account variation at horizons up to four years.

We carried out policy experiments to explore counterfactual experiments on the current account dynamics. If Chile's external debt was denominated in Chilean pesos, GDP and aggregate demand components would be more resilient to external shocks (commodity price, foreign demand, and interest rate). Monetary policy innovations would also have less effect on the current account. Moreover, the required movement in the real exchange rate to generate an adjustment in the current account would tend to be smaller. Our counterfactual experiment for New Zealand revealed that, in the framework of our model, a more or less aggressive monetary policy can do little to offset the effects of shocks to foreign financial conditions, which account for the vast bulk of exchange rate variance. For the other three shocks that are important for the current account, a less aggressive monetary policy response reduces exchange swings, while having little effect on the current account. However, the scope for more smoothing is limited by the already-high estimated coefficient in the policy rule.

Appendix

Description of the Parameters

Table A1. Description of the Estimated Parameters

Parameter	*Country*	*Description*
σ_L	Both	Inverse of the labor supply elasticity
h	Both	Habit-formation coefficient
ϕ_L	Both	Calvo probability of reoptimizing nominal wages
χ_L	Both	Weight of past inflation in indexation of nominal wages
η_C	Both	Elasticity of substitution between home and imported goods in consumption
η_I	Both	Elasticity of substitution between home and imported goods in investment
μ_S	Both	Adjustment cost in investment coefficient
ϕ_{HD}	Both	Calvo probability of reoptimizing home goods prices sold domestically
χ_{HD}	Both	Weight of past inflation in indexation of prices of home goods sold domestically
ϕ_{HF}	Both	Calvo probability of reoptimizing home goods prices sold abroad
χ_{HF}	Both	Weight of past inflation in indexation of prices of home goods sold abroad
ϕ_F	Both	Calvo probability of reoptimizing imported goods prices
χ_F	Both	Weight of past inflation in indexation of imported goods prices
$\psi_{i,1}$	Chile	Smoothing coefficient in monetary policy rule, 1990–99
$\psi_{\pi,1}$	Chile	Reaction to inflation deviation in monetary policy rule, 1990–99
$\psi_{y,1}$	Chile	Reaction to GDP growth deviation in monetary policy rule, 1990–99
$\psi_{rer,1}$	Chile	Reaction to RER deviation in monetary policy rule, 1990–99
$\psi_{i,2}$	Chile	Smoothing coefficient in monetary policy rule. 2000 onward
$\psi_{\pi,2}$	Chile	Reaction to inflation deviation in monetary policy rule, 2000 onward
$\psi_{y,2}$	Chile	Reaction to GDP growth deviation in monetary policy rule, 2000 onward

Table A1. (continued)

Parameter	*Country*	*Description*
ψ_i	New Zealand	Smoothing coefficient in monetary policy rule
ψ_π	New Zealand	Reaction to inflation deviation in monetary policy rule
ψ_y	New Zealand	Reaction to GDP growth deviation in monetary policy rule
$\eta*$	Both	Foreign demand elasticity to home goods
θ	Both	Elasticity of the external premium to NFA-GDP ratio
$\rho_{\alpha H}$	Both	Persistence of transitory productivity shock
ρ_{Ys}	Both	Persistence of commodity production shock
ρ_{Y*}	Both	Persistence of foreign demand shock
$\rho_{\zeta C}$	Both	Persistence of preference shock
$\rho_{\zeta I}$	Both	Persistence of investment adjustment cost shock
ρ_G	Both	Persistence of government expenditure shock
$\rho_{\iota*}$	Both	Persistence of foreign interest rate shock
ρ_T	Both	Persistence of permanent productivity shock
$\sigma_{\alpha H}$	Both	Standard deviation of transitory productivity shock
σ_{Ys}	Both	Standard deviation of commodity production shock
σ_{Y*}	Both	Standard deviation of foreign demand shock
$\sigma_{\iota*}$	Both	Standard deviation of foreign interest rate shock
σ_μ	Both	Standard deviation of monetary policy shock
$\sigma_{\zeta C}$	Both	Standard deviation of preference shock
$\sigma\ G$	Both	Standard deviation of government expenditure shock
$\sigma_{\zeta I}$	Both	Standard deviation of investment adjustment cost shock
σ_T	Both	Standard deviation of permanent productivity shock

Source: Authors' construction.

Table A2. Calibrated Parameters
Percent

Parameter	*Chile*	*New Zealand*	*Definition*
g_y (annual basis)	3.0	1.5	Steady-state per capita productivity growth
π (annual basis)	3.0	2.0	Steady-state inflation rate
r (annual basis)	4.1	3.0	Steady-state real interest rate
δ (annual basis)	6.8	8.0	Depreciation rate of capital
χ	0.40	0.90	Domestic ownership of commodity production
$(X - M) / Y$	2	1.3	Steady-state ratio of net exports to GDP
CA / Y	–1.8	–5.0	Steady-state ratio of current account to GDP
B	0.30	0.70	Steady-state debt-GDP ratio
G / Y	12	17	Steady-state ratio of government expenditure to GDP
Y_S / Y	10	14	Steady-state ratio of commodity production to GDP
I / Y	26.6	22.8	Steady-state investment-GDP ratio
C / Y	59.3	58.8	Steady-state consumption-GDP ratio
γ_C	70	70	Home goods share in consumption
γ_I	40	25	Home goods share in investment
ρ_{pS^*}	0.98	0.99	Autoregressive coefficient of commodity price
σ_{pS^*}	8.85	3.51	Standard deviation of commodity price innovation
ρ_ν	0.00	0.00	Autoregressive coefficient of monetary policy shocks
η_H	0.66	0.68	Labor share in the home goods production
λ	0.50	0.00	Fraction of non-Ricardian households

Source: Authors' construction.

Table A3. Prior Distributions

Parameter	*Country*	*Mean/mode*	*Standard dev./ d.f.*	*Shape*	*90% interval*
σ_L	Both	1000	1000	Gamma	0.051 – 2.996
h	Both	0.500	0.250	Beta	0.097 – 0.903
ϕ_L	Both	0.750	0.100	Beta	0.570 – 0.897
χ_L	Both	0.500	0.250	Beta	0.097 – 0.903
η_C	Both	1000	5.000	Inv. gamma	0.655 – 3.045
η_I	Both	1000	5.000	Inv. gamma	0.655 – 3.045
μ_S	Both	2000	3.000	Inv. gamma	1.271 – 9.784
ϕ_{HD}	Both	0.750	0.100	Beta	0.570 – 0.897
χ_{HD}	Both	0.500	0.250	Beta	0.097 – 0.903
ϕ_{HF}	Both	0.750	0.100	Beta	0.570 – 0.897
χ_{HF}	Both	0.500	0.250	Beta	0.097 – 0.903
ϕ_F	Both	0.750	0.100	Beta	0.570 – 0.897
χ_F	Both	0.500	0.250	Beta	0.097 – 0.903
$\psi_{i,1}$, $\psi_{i,2}$	Chile	0.700	0.100	Beta	0.524 – 0.853
$\psi_{p,1}$, $\psi_{p,2}$	Chile	1500	0.150	Gamma	1.262 – 1.755
$\psi_{y,1}$, $\psi_{y,2}$	Chile	0.500	0.150	Gamma	0.281 – 0.770
$\psi_{rer,1}$, $\psi_{rer,2}$	Chile	0.200	0.100	Gamma	0.068 – 0.388
ψ_i	New Zealand	0.750	0.100	Beta	0.570 – 0.897
ψ_π	New Zealand	1500	0.100	Gamma	1.339 – 1.668
ψ_y	New Zealand	0.500	0.100	Gamma	0.348 – 0.675
η^*	Both	1000	4.000	Inv. gamma	0.645 – 3.659
θ	Chile	0.010	4.000	Inv. gamma	0.006 – 0.037
θ	New Zealand	0.001	4.000	Inv. gamma	0.001 – 0.004
ρ_{aH}	Both	0.700	0.200	Beta	0.321 – 0.965
ρ_{yS}	Both	0.700	0.200	Beta	0.321 – 0.965
ρ_{Y*}	Both	0.700	0.200	Beta	0.321 – 0.965
$\rho_{\zeta C}$	Both	0.700	0.200	Beta	0.321 – 0.965
$\rho_{\zeta \mathrm{I}}$	Both	0.700	0.200	Beta	0.321 – 0.965

Table A3. (continued)

Parameter	*Country*	*Mean/mode*	*Standard dev./ d.f.*	*Shape*	*90% interval*
ρ_G	Both	0.300	0.050	Beta	0.221 – 0.385
ρ_{i*}	Both	0.950	0.050	Beta	0.849 – 0.998
ρ_T	Both	0.700	0.200	Beta	0.321 – 0.965
σ_{aH}	Both	1000	3.000	Inv. gamma	0.635 – 4.892
σ_{yS}	Both	1000	3.000	Inv. gamma	0.635 – 4.892
σ_{Y*}	Both	1000	3.000	Inv. gamma	0.635 – 4.892
σ_{i*}	Chile	0.250	3.000	Inv. gamma	0.159 – 1.223
σ_{i*}	New Zealand	0.500	3.000	Inv. gamma	0.318 – 2.446
σ_m	Both	0.200	3.000	Inv. gamma	0.127 – 0.978
$\sigma_{\zeta C}$	Both	1000	3.000	Inv. gamma	0.635 – 4.892
σ_G	Both	1000	3.000	Inv. gamma	0.635 – 4.892
$\sigma_{\zeta \mathrm{I}}$	Both	1000	3.000	Inv. gamma	0.635 – 4.892
σ_T	Both	0.200	3.000	Inv. gamma	0.127 – 0.978

Source: Authors' calculations.

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International Reserve Management and the Current Account

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> Several factors, apart from the exchange rate regime, influence the comfort level in regard to reserves. Illustratively, they would include vulnerability to the real sector shocks, strength of the fiscal and financial sectors, current account balance, the changing composition of capital flows, a medium-term view of growth prospects encompassing business cycles, etc. In a sense, official reserves have to reflect the balancing and comforting factors relative to external assets and liabilities in the context of a rational balance sheet approach.
>
> —*Y. V. Reddy, Reserve Bank of India*

> Following the Asian crisis of the late 1990s it was likely that countries might choose to build up large foreign exchange reserves in order to be able to act as a "do it yourself" lender of last resort in U.S. dollars.
>
> — *Mervyn King, Bank of England*

This paper assesses the costs and benefits of active international reserve management. The first part outlines and appraises various channels through which international reserve management may enhance economic performance, focusing on two important channels: it lowers the real exchange rate volatility induced by terms-of-trade shocks; and it provides self-insurance against sudden stops and fiscal shocks, thereby reducing the downside risk associated with adverse shocks. Two additional channels, for which the evidence is weaker, are as follows: international reserve management is alleged

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to lead to higher growth by fostering exports (that is, it operates through a mercantilist motive); and it has a greater capacity to smooth adjustment to shocks over time, thereby reducing the speed of adjustment of the current account.

My analysis of international reserve management supplements the insights of earlier literature, which focus on using international reserves as a buffer stock, in the context of managing an adjustable-peg or managed-floating exchange rate regime.[1] While valid, the buffer stock approach best fits a world with limited financial integration, where trade openness determines countries' vulnerabilities to external shocks. In the absence of reserves, balance-of-payments deficits would have to be corrected via a reduction in aggregate expenditures, imposing adjustment costs. As greater trade openness increases the exposure to trade shocks, minimizing adjustment costs requires higher reserve holdings. The rapid financial integration of developing countries and the financial crises of the 1990s have led analysts to focus on the growing exposure to sudden stops and on capital flow reversals.[2] In such a world, financial markets may force an adjustment well before commercial trade flows would adjust on their own, which raises the importance of exposure to financial shocks and the costs associated with disintermediation triggered by adverse liquidity shocks.

Section 1 empirically evaluates the impact of international reserves on real exchange rate volatility in the presence of terms-of-trade shocks. The evidence suggests that international reserves play a role in the mitigation of terms-of-trade shocks in developing countries, but not among member countries of the Organization for Economic Cooperation and Development (OECD). Economic structure matters greatly: exports of natural resources double both the impact of terms-of-trade shocks on the real exchange rate and the impact of the mitigation associated with international reserve management on the real exchange rate. These results are consistent with the notion that the limited development of capital markets in developing

1. Optimal reserves balance the macroeconomic adjustment costs incurred in the absence of reserves with the opportunity cost of holding reserves (see Frenkel and Jovanovic, 1981). The buffer stock model predicts that average reserves depend negatively on adjustment costs, on the opportunity cost of reserves, and on exchange rate flexibility; and positively on GDP and on reserve volatility, which is frequently driven by the underlying volatility of international trade. Overall, the literature of the 1980s supported these predictions; see Frenkel (1983), Edwards (1983), and Flood and Marion (2002).

2. See Calvo (1998), Calvo, Izquierdo, and Mejía (2003), and Edwards (2004a, 2004b) for an assessment of sudden stops in developing countries.

countries hampers the authorities ability to mitigate the volatility associated with shocks. Section 2 models such a mechanism, explaining possible effects of international reserve management in the presence of costly financial intermediation of long-term investment. Section 3 summarizes the debate about international reserve management and mercantilist motives, outlining the empirical and theoretical limitations of the mercantilist approach. Section 4 evaluates the impact of international reserves on current account persistence. The results support the notion that a higher buildup of reserves improves countries buffer against shocks, thereby reducing the speed of adjustment of the current account. This outcome is consistent with the importance of current account adjustments in allowing for smoother consumption, in the presence of limited financial integration and sudden stops. Section 5 concludes with a discussion of the limitations of international reserve management.

1. Real Exchange Rate Volatility, Terms of Trade, and International Reserves

This section focuses on some of the challenges facing a developing country with limited development of its internal capital market, a growing integration with the global financial system, and a large exposure of the current account to terms-of-trade effects. This description applies especially to commodity-exporting countries, which are subject to large terms-of-trade shocks. While favorable terms-of-trade shocks tend to induce real appreciation and capital inflows, the downturns associated with adverse shocks impose daunting challenges. The literature of the 1990s identified large adverse effects of exogenous volatility on gross domestic product (GDP) and economic growth in developing countries.[3] Fundamentally, this issue hinges on the nature of nonlinearities affecting the economy, in that strong concavity may generate first-order adverse effects of volatility on GDP and growth. An important channel that may explain such negative level and growth effects of volatility are imperfect capital markets.

3. See Ramey and Ramey (1995), Aizenman and Marion (1993), and the references in Aizenman and Pinto (2005) for the association between macroeconomic volatility and growth. See IDB (1995) and Calderón and Schmidt-Hebbel (2003) for the impact of terms-of-trade shocks and other foreign shocks on growth in Latin America and in developing countries.

Aghion and others (2006) illustrate these considerations: they find that real exchange rate volatility reduces growth for countries with relatively low levels of financial development. This and other studies suggest that factors mitigating real exchange rate volatility may be associated with superior economic performance. The large hoarding of international reserves by developing countries in recent years raises the question of the extent to which these reserves have affected the volatility of the real effective exchange rate. For most countries, terms-of-trade shocks are the most important source of exogenous volatility, frequently leading to real exchange rate volatility and potentially magnifying business cycle volatility. This issue is pertinent for developing countries, as they are exposed to terms-of-trade volatility, the standard deviation of which is three times the volatility of industrial countries. Relatively small, shallow domestic financial systems and the lack of sectoral diversification in most developing countries limit the authorities' ability to mitigate terms-of-trade shocks by internal adjustment. Sovereign risk and the lack of proper financial instruments inhibit their ability to hedge against these shocks by relying on the global financial system (see Caballero, 2003; Caballero and Panageas, 2003). Developing countries may be left with self-insurance as a last resort for dealing with terms-of-trade shocks.

In Aizenman and Riera-Crichton (2006), we confirm this possibility. We start by applying a rudimentary panel regression methodology and show that the main result is robust to adding controls and to a more sophisticated estimation method. Specifically, the benchmark regression is

$$\begin{aligned} \ln(\mathrm{REER})_{i,t} = \quad & a_1 + \alpha_1 \left[\mathrm{TO} * \ln(\mathrm{TOT})\right]_{i,t} \\ & + \alpha_2 \left[\mathrm{TO} * \ln(\mathrm{TOT}) * \mathrm{RES}\right]_{i,t} + \varepsilon_{i,t}, \end{aligned} \tag{1}$$

where the independent variable is the log of the real effective exchange rate (REER), defined so that a higher REER indicates real appreciation. The term a1 represents country fixed effects, TOT is the terms of trade, TO = ln{1 + [(IM + EXP) / 2GDP]} is the trade openness measure, and RES = ln[1 + (International Reserves / GDP)] is a proxy for the ratio of international reserves to GDP.

The specification of regression (1) follows the observation that TO * $\widehat{\mathrm{TOT}}$ is a first-order approximation of the income effect associated with a terms-of-trade improvement rate of $\widehat{TOT}$, where the income effect is defined as the GDP rate of change induced by a terms-of-trade shock. I henceforth refer to TO * $\widehat{TOT}$ as the effective terms-of-trade shock. By design, equation (1) implies that the elasticity of the real exchange rate with respect to the effective terms-of-trade change is[4]

$$\frac{\partial \ln(\text{REER})}{\text{TO} * \partial \ln(\text{TOT})} = \alpha_1 + \alpha_2 * \text{RES}. \tag{2}$$

Regression (1) thus provides information about the degree to which hoarding international reserves may affect REER dynamics induced by terms-of-trade shocks. Table 1 reports the regression results for 1970–2004. Column 1 presents the baseline regression pooling all countries, subject to data availability.[5] The elasticity of the real effective exchange rate with respect to the effective terms-of-trade shock is well above one: a one percent improvement of the effective terms of trade induces a real effective exchange rate appreciation of about 1.8 percent. Hoarding international reserves lessens the elasticity of the real effective exchange rate with respect to the terms of trade by more than twice the ratio of international reserves to GDP—that is, column 1 implies that $\partial \ln(\text{REER}) / [\text{TO}^*\partial\ln(\text{TOT})] \cong 1.8(1 - 2^*\text{RES})$.

Equation (2) is the elasticity of the real effective exchange rate with respect to the effective terms of trade. This implies that the elasticity of the real effective exchange rate with respect to the terms of trade is $\partial \ln(\text{REER}) / \partial\ln(\text{TOT}) = \text{TO}^*(\alpha_1 - \alpha_2{}^*\text{RES}) \cong \text{TO}^*1.8(1 - 2^*\text{RES})$. For a country with a trade openness of 0.2, and a ratio of international reserves to GDP of 0.1, the elasticity of the real effective exchange rate relative to the terms of trade is 0.25*1.8(1 – 2*0.1) = 0.36. This is in line with De Gregorio and Wolf (1994), who find that the elasticity of the real effective exchange rate with respect to the terms of trade, unconditional of the reserve position, is about 0.4.

4. Throughout the discussion, I presume that trade openness and the ratio of international reserves to GDP are characterized by low volatility relative to terms-of-trade volatility.

5. See table 2 for regressions of the real effective exchange rate on the effective terms of trade and international reserves in the absence of interaction terms. For developing countries, the elasticity of the real effective exchange rate with respect to the effective terms of trade is well above one, whereas the elasticity of the real effective exchange rate with respect to the ratio of the stock of international reserves to GDP is well below minus one. In other words, a higher reserves-to-GDP ratio is associated, on average, with a depreciated real effective exchange rate.

Table 1. The Real Effective Exchange Rate versus Terms-of-Trade Shocks and Mitigation through Reserve Accumulation[a]

Explanatory variable	*All countries*	*Developing countries*	*Commodity exporters*	*Latin America*	*Asia*
Log effective TOT	1.802***	1.836***	4.376***	1.642**	2.269**
	(0.244)	(0.255)	(0.779)	(0.802)	(1.104)
Log effective TOT *Reserves / GDP	−3.873***	−3.937***	−10.676	−0.537	−4.672**
	(0.746)	(0.766)	(7.013)	(9.164)	(2.280)
Sample statistic					
No. observations	1,863	1,260	253	343	202
R^2	0.4549	0.4367	0.6162	0.3903	0.2161
Period	1970–2004	1970–2004	1970–2004	1980–2004	1970–2004

Source: Author's estimations.

* Statistically significant at the 10 percent level. ** Statistically significant at the 5 percent level. *** Statistically significant at the 1 percent level.

a. The dependent variable is the log of the real effective exchange rate. Robust standard errors are in parentheses. The table reports only the significant coefficients, suppressing the coefficients dealing with industrial countries and manufacturing exporters (for the full results, see Aizenman. 2006, available online at papers.nber.org/papers/w12734.pdf).

Table 2. The Effect of the Log of the Effective Terms of Trade and Stock of Reserves on the Log of the Real Effective Exchange Rate[a]

Explanatory variable	*All countries*	*Developing countries*	*Industrial countries*	*Asia*	*Latin America*	*Commodity exporters*	*Manufacturing exporters*
Log effective TOT	1.384***	1.358***	1.137***	–0.415	1.644***	3.220***	0.581
	(0.181)	(0.195)	(0.355)	(0.406)	(0.482)	(0.434)	(1.006)
Reserves / GDP	–1.084***	–1.254***	0.520**	–2.727***	0.179	–2.315***	–1.990***
	(0.126)	(0.137)	(0.217)	(0.301)	(0.602)	(0.470)	(0.641)
Summary statistic							
No. observations	1863	1217	646	202	343	253	271
R^2	0.4689	0.4461	0.6021	0.3212	0.3905	0.6603	0.4307

Source: Author's estimations.
* Statistically significant at the 10 percent level. ** Statistically significant at the 5 percent level. *** Statistically significant at the 1 percent level.
a. The dependent variable is the log of the real effective exchange rate. Robust standard errors are in brackets.

Aggregation matters. Columns 2 and 3 show that this result applies to developing, but not to industrial countries. This is consistent with the notion that limited development of the capital market in developing countries hampers their ability to mitigate the volatility associated with shocks. Economic structure matters greatly: exports of natural resources magnify the impact of the effective terms-of-trade shocks and the mitigation associated with international reserves by a factor exceeding two. The international reserve effect is insignificant for that group, yet it is significant for the lagged terms-of-trade shock, as I show below. In contrast, these interactions are insignificant for manufacturing-intensive countries. The last two columns focus specifically on Latin America and Asia. Terms-of-trade shocks induce large effects in both regions, whereas international reserves induce a powerful mitigation of the terms-of-trade shock in Asian countries, but not in Latin America.

Table 3 verifies the robustness of prior results, redoing the base regression of the case for evaluating the adjustment to the one-year lagged terms-of-trade shock on the contemporaneous real effective exchange rate:

$$\begin{aligned}\ln(\text{REER})_{i,t} &= a_1 + \alpha_1\left[\text{TO} * \ln(\text{TOT})\right]_{i,t-1} \\ &\quad + \alpha_2\left[\text{TO} * \ln(\text{TOT}) * \text{RES}\right]_{i,t-1} + \varepsilon_{it}.\end{aligned} \tag{1'}$$

The signs are identical to table 1. The main difference is that shocks are apparently absorbed faster in Latin America and Asia than in other regions; most of the coefficients on the lagged shocks are insignificant for these blocks.

Table 4 reports country-specific results for several Latin American countries. The last two columns represent the total effect of changes in the terms of trade (amplified by trade openness) on the real exchange rate, taking into account the mitigation offered by international reserves:

$$\text{Total effect, 1990–99} = \frac{\partial \ln(\text{REER})}{\partial\left[\text{TO} * \ln(\text{TOT})\right]} = \left[\alpha_1 + (\alpha_2 * \text{RES}_{1990-99})\right];$$

$$\text{Total effect, 2000–04} = \frac{\partial \ln(\text{REER})}{\partial\left[\text{TO} * \ln(\text{TOT})\right]} = \left[\alpha_1 + (\alpha_2 * \text{RES}_{2000-04})\right].$$

Table 3. The Real Effective Exchange Rate versus the Lagged Effective Terms of Trade and Mitigation through Reserve Accumulation[a]

Explanatory variable	*All countries*	*Developing countries*	*Commodity exporters*	*Latin America*	*Asia*
Lagged log effective TOT	1.773***	1.806***	4.362***	1.205	1.762
	(0.278)	(0.289)	(0.759)	(0.827)	(1.103)
Lagged log effective TOT*Rerserves / GDP	–3.557***	–3.633***	–11.528*	4.654	–4.024*
	(0.887)	(0.910)	(6.473)	(10.059)	(2.388)
Summary statistic					
No. observations	1852	1263	252	343	201
R^2	0.4465	0.4302	0.6165	0.3898	0.2047
Period	1970–2004	1970–2004	1970–2004	1980–2004	1970–2004

Source: Author's estimations.
* Statistically significant at the 10 percent level. ** Statistically significant at the 5 percent level. *** Statistically significant at the 1 percent level.
a. The dependent variable is the log of the real effective exchange rate. Robust standard errors in brackets. The table reports only the significant coefficients, suppressing the coefficients dealing with industrial countries and manufacturing exporters (for the full results, see Aizenman. 2006, available online at papers.nber.org/papers/w12734.pdf).

Overall, the results suggest that reserves play a role in the mitigation of terms-of-trade shocks only in developing countries. While this role differs widely across countries, the mitigation role of international reserves is important, especially in countries with abundant natural resources, like Argentina, Chile, Ecuador, and Mexico.

Table 4. The Log of the Real Effective Exchange Rate versus the Terms of Trade: Selected Individual Countries[a]

Explanatory variable	*Argentina*	*Chile*	*Ecuador*	*Mexico*
Terms of trade	44.994 (6.597)***	8.436 (1.561)***	7.158 (1.322)***	3.841 (2.048)*
TOT*Reserves	−793.738 (113.969)***	−50.188 (13.080)***	−46.25 (21.816)**	−177.211 (71.729)**
No. observations	25	23	23	23
R^2	0.5594	0.6338	0.6600	0.1901
Total effect, 1990–99	−0.764380	−1.465110	3.386239	−5.692390
Total effect, 2000–04	−27.473900	−0.973320	5.400608	−9.719750
Volatility of TOT	0.0099	0.0517	0.0573	0.0360

Source: Author's estimations.
* Statistically significant at the 10 percent level. ** Statistically significant at the 5 percent level. *** Statistically significant at the 1 percent level.
a. The dependent variable is the log of the real effective exchange rate.

The results reported above focus on the association between the level of ln(TOT) and RES on ln(REER). Aizenman and Riera-Crichton (2006) also verify that a higher ratio of international reserves to GDP is associated with a lower REER volatility. This result is consistent with Hviding, Nowak, and Ricci (2004), who focus on the association of the ratio of international reserves to GDP with REER volatility, controlling for exchange rate regimes. Aizenman and Riera-Crichton (2006) also confirm that the mitigation effects identified in equation (2) continue to hold when the regressions control for exchange rate regimes and for the composition of capital flows.[6]

6. See Broda and Tille (2003) for the role of exchange rate flexibility in accommodating the adjustment to terms-of-trade shocks.

2. The Model: Financial Intermediation, Self-Insurance, and the Real Exchange Rate

A growing literature identifies financial intermediation, in the presence of collateral constraints, as a mechanism for explaining the hazard associated with credit cycles induced by shocks. The prominent role of bank financing in developing countries suggests that capital flights, triggered by adverse terms-of-trade shocks or contagion, impose adverse liquidity shocks. This section outlines a model describing the conditions under which the ex ante hoarding of international reserves may provide a self-insurance mechanism that would mitigate the real effects of liquidity shocks, ultimately reducing the adverse effects of terms-of-trade volatility on GDP. For simplicity, I focus on an ex ante/ex post model dealing with the determination of the GDP level and the real exchange rate in one investment cycle. By applying the logic of endogenous growth, one may extend the model to address the impact of terms-of-trade shocks on growth.

As my focus is on developing countries, I assume that all financial intermediation is done by banks, which rely on debt contracts. Specifically, I consider the case in which investment in a long-term project should be undertaken prior to the realization of liquidity shocks. Shocks may thus force costly liquidation of earlier investments, thereby reducing output. I solve the optimal demand for deposits and international reserves via a bank that finances investment in long-term projects. The bank's financing uses callable deposits, which expose the bank to liquidity risk. Macroeconomic liquidity shocks, stemming from sudden stops and capital flights, cannot be diversified away. In these circumstances, hoarding reserves saves liquidation costs and potentially leads to large welfare gains—gains that hold even if all agents are risk neutral. In this framework, deposits and reserves tend to be complements: more volatile liquidity shocks will increase both the demand for reserves and deposits. This is another example of hoarding international reserves as self-insurance against nondiversifiable liquidity shocks.[7]

I model financial intermediation and the real exchange rate by combining Diamond and Dybvig's (1983) insight with Aghion, Bacchetta, and Banerjee's (2004) modeling of market imperfections

7. See Ben-Bassat and Gottlieb (1992), Rodrik and Velasco (2000), García and Soto (2004) Aizenman and Lee (2007), Jeanne and Ranciere (2005), and Rodrik (2006) for studies addressing various aspects of self-insurance and international reserves.

in a collateral-dependent small open economy.[8] I construct a minimal model to explain the self-insurance offered by international reserves, in the form of mitigating the output effects of liquidity shocks with endogenous real exchange rate determination. Investment in a long-term project should be undertaken prior to the realization of liquidity shocks, so the liquidity shock may force costly liquidation of the earlier investment, reducing second-period output. I simplify further by assuming that there is no separation between the bank and the entrepreneur: the entrepreneur is the bank owner and uses the bank to finance investment.

I consider a small open economy in which a traded good is produced with capital and a country-specific nontraded factor. The traded sector includes commodity exports, which generate revenue determined by the realization of terms-of-trade shocks (equal to the relative price of the exported commodities vis-à-vis other traded goods). The traded good is the numeraire. The relative price of the nontraded factor is denoted by p, and it is referred to as the real exchange rate There is a continuum of lenders and borrowers, and their number is normalized to 1.

I focus now of the evolution of the economy throughout one investment cycle, where gestation lags imply that capital should be installed well before a specific nontraded input is hired. To simplify, the supply of the specific factor is inelastic, at a level Z. The lenders in the economy cannot invest directly, but lend their saving at the international interest rate. Depositors are entitled to a real return of r_f on the loan that remains deposited for the duration of investment. The safe return reflects a risk-free investment opportunity, either in the form of a foreign bond or as storage technology. The borrowers are entrepreneurs who have investment opportunity, but are credit constrained. The actual investment should be undertaken prior to the realization of liquidity shocks. The production function is a Cobb-Douglas constant-returns-to-scale (CRS) technology:

$$y_2 = \frac{1}{a}\bar{K}_1^{\beta} z^{1-\beta}, \tag{5}$$

where $\bar{K}_1$ is the nonliquidated capital invested at period 1 and z is the level of the country-specific input, hired at a relative price of p_1. Premature liquidation of capital is costly and is associated with a

8. The model extends the one-sector framework outlined in Aizenman and Lee (2007).

proportionate adjustment cost of θ. Specifically, reducing the capital stock by one dollar yields a net liquidity of $1/(1 + \theta)$.

The time line associated with financial intermediation is summarized in figure 1. At the beginning of period 1, the entrepreneur with initial wealth of H_1 borrows μH_1.[9] The combined liquidity of $(1 + \mu)H_1$ finances planned investment, K_1. Setting aside liquid reserves R:

$$(1+\mu)H_1 = K_1 + R_1. \tag{6}$$

Figure 1. The Time Line

Beginning of period 1:

Entrepreneurs with initial wealth H_1, subject to collateral constraint μ, use bank financing μH_1. The combined liquidity, $(1 + \mu)H_1$, finances investment, K_1, and hoarding of reserves, R_1, such that $(1 + \mu)H_1 = K_1 + R_1$.

End of period 1:

A liquidity shock materializes; an adverse shock, δ (where $\delta < 0$), induces a deposit drop of $l(-\delta)\mu H_1$. Then, reserves, R_1, are used to finance any liquidity shock and to hire the nontraded–specific input, z (at p_1). Costly liquidation of capital from K_1 to $\bar{K}_1$(where $\bar{K}_1 \leq K_1$) would boost liquidity by $(K_1 - \bar{K}_1 / (1 + \theta)$, where $\theta \geq 0$.

Period 2:

Output materializes, $y_2 = \dfrac{1}{a}\bar{K}_1^{\beta} z^{1-\beta}$. Nonliquidated deposits are paid a return of r_f. Any unused reserves yield a return of r_f.

9. Collateral constraints can be shown to arise as a result of capital market imperfections in the presence of moral hazard and costly monitoring; see Holmström and Tirole (1997) and Aghion, Banerjee, and Piketty (1999).

Next, a liquidity shock, δ, is realized. A positive shock is inconsequential, because banks can accommodate positive liquidity shocks by purchasing a risk-free bond or investing in the risk-free low-yield storage technology. I therefore concentrate on adverse liquidity shocks, which reduce desirable deposits from μH_1 to $\mu H_1(1 + l\delta)$, where $\delta < 0$, $l > 0$. The model focuses on the impact of adverse liquidity shocks on optimal investment and liquidity: I do not model the reasons for the shock. Such a shock may reflect external developments, such as a higher foreign interest rate, contagion, or a reaction to a signal revealing the future terms of trade. For example, suppose that the public learns of a signal, δ, that determines the second-period foreign currency earnings from commodity exports. A negative terms-of-trade shock may induce anticipation of an economic slowdown, triggering capital flights and reducing deposits from μH_1 to $\mu H_1(1 + l\delta)$. Independently of the exact source of the adverse liquidity shock, gestation lags associated with tangible investment and costly liquidation expose the bank to the downside risk associated with abrupt adjustment.

The bank uses reserves to meet the liquidity shock and to purchase the nontraded input. The liquidly shock may be met by costly liquidation of capital if needed. Consequently, the ultimate capital is

$$\bar{K}_1 = \begin{cases} K_1 - (1+\theta)\max\left[(-\delta)l\mu H_1 + p_1 z - R_1,\ 0\right] & if \quad \delta < 0 \\ K_1 \quad if \quad \delta \geq 0 \end{cases} \tag{7}$$

I assume that the liquidity constraint is binding and that the marginal productivity of the nontraded input exceeds the return on liquid reserves. The producer's surplus is

$$\Pi = \begin{cases} \dfrac{1}{a} K_1^{\beta} \left[\dfrac{(1+\mu)H_1 - K_1}{p_1}\right]^{1-\beta} - (1+r_f)\mu H_1 \qquad if \quad \delta \geq 0 \\ \left. \begin{array}{l} \dfrac{1}{a} \bar{K}_1^{\beta} \left\{\dfrac{\left[1+\mu(1+l\delta)\right]H_1 - K_1 + (K_1 - \bar{K}_1)/(1+\theta)}{p_1}\right\}^{1-\beta} \\ -(1+r_f)\mu H_1(1+l\delta) \end{array} \right| if \quad \delta < 0 \end{cases} \tag{8}$$

where p_1 may depend on δ.

To gain further insight, it is useful to focus on the simplest discrete example, in which an adverse liquidity shock of $\delta = -\varepsilon$ (where $0 \leq \varepsilon < 1$) has a 50 percent probability of taking place and the incidence of no liquidity interruption similarly has a 50 percent probability of occurring. The value of ε corresponds to the volatility of the liquidity shock, δ. The asymmetric nature of tangible investment implies that only negative liquidity shocks may require real adjustment. In these circumstances, the expected profits are as follows:

$$\begin{aligned} E(\Pi) = {} & 0.5\left\{\frac{1}{a}K_1^{\beta}\left[\frac{(1+\mu)H_1 - K_1}{p_1}\right]^{1-\beta} - (1+r_f)\mu H_1\right\} \\ & + 0.5\left\langle \begin{array}{l} \dfrac{1}{a}\bar{K}_1^{\beta}\left\{\dfrac{\left[1+\mu(1-l\varepsilon)\right]H_1 - K_1 + (K_1 - \bar{K}_1)/(1+\theta)}{p_1}\right\}^{1-\beta} \\ -(1+r_f)\mu H_1(1-l\varepsilon) \end{array} \right\rangle, \end{aligned} \tag{9}$$

where $K_1 \geq \bar{K}_1$.

The equilibrium is then characterized by the following three propositions:

—First, if no liquidation would take place in the bad state ($K_1 = \bar{K}_1$), then optimal planned capital (K_1) is the solution to

$$\frac{\beta}{K_1} - \frac{1-\beta}{(1+\mu)H_1 - K_1} + \left\{\frac{\beta}{K_1} - \frac{1-\beta}{\left[1+\mu(1-\varepsilon l)\right]H_1 - K_1}\right\} = 0. \tag{10a}$$

If liquidation would occur in the bad state ($K_1 > \bar{K}_1$), then the optimal planned capital (K_1) is determined by

$$\begin{aligned} & \left(\frac{K_1}{\bar{K}_1}\right)^{\beta}\left[\frac{\beta}{K_1} - \frac{1-\beta}{(1+\mu)H_1 - K_1}\right] \\ & -\theta\left\{\frac{\beta^2}{\bar{K}_1} + \frac{(1-\beta)^2}{\left[1+\mu(1-\varepsilon l)\right]H_1(1+\theta) - \theta K_1 - \bar{K}_1}\right\} = 0, \end{aligned} \tag{10b}$$

where

$$\bar{K}_1 = \beta\left\{\left[1+\mu(1-\varepsilon l)\right]H_1(1+\theta) - \theta K_1\right\}. \tag{11}$$

—Second, the threshold volatility associated with partial liquidation in bad times, denoted by $\tilde{\varepsilon}$, is

$$\tilde{\varepsilon} = \left(1 + \frac{1}{\mu}\right)\frac{2\theta}{1+\theta}\frac{1-\beta}{l(1-\theta\beta)}. \tag{12}$$

Hence, a small enough leverage and a large enough adjustment cost implies $\tilde{\varepsilon} > 1$, such that the liquidation option would not be exercised. In these circumstances, the optimal investment and the ex ante hoarding of international reserves are

$$\begin{aligned} K_1 &= \beta(1+\mu)H_1 - 0.5\beta l\varepsilon\mu H_1; \\ R_1 &= (1-\beta)(1+\mu)H_1 + 0.5\beta l\varepsilon\mu H_1. \end{aligned} \tag{13}$$

The adjustment to the adverse liquidity shock is facilitated by real exchange rate depreciation:

$$\begin{aligned} p_{1|\delta=-\varepsilon} &= \frac{(1-\beta)(1+\mu)H_1 - \varepsilon(1-0.5)\beta l\mu H_1}{Z}; \\ p_{1|\delta=0} &= \frac{(1-\beta)(1+\mu)H_1 + 0.5\varepsilon\beta l\mu H_1}{Z}. \end{aligned} \tag{14}$$

—Third, if $\tilde{\varepsilon} < 1$, the partial liquidation option would be exercised in bad times only if the volatility exceeds the threshold, $\tilde{\varepsilon} < \varepsilon < 1$. For volatility below the threshold, $\varepsilon < \tilde{\varepsilon} < 1$, no liquidation would take place, and the equilibrium is characterized by equations (13) and (14).

The proof of this proposition is as follows:

—The characterization of the planned investment and the ex ante hoarding of reserves (equation 13) follows by solving K_1 from equation (10a).

—The optimal stock of capital following partial liquidation (equation 11) is obtained by maximizing the profits in bad times relative to $\bar{K}_1$ (the second line of equation 8). Note that K_1 was preset at the beginning of the planning horizon.

—The volatility threshold inducing liquidation in bad times, $\tilde{\varepsilon}$, is obtained by noting that at $\varepsilon = \tilde{\varepsilon}, K_1 = \bar{K}_1$. –In other words, the liquidation is zero at the lowest volatility associated with liquidation in bad times. After solving equation (11) for the case where $K_1 = \bar{K}_1$, I infer that

$$\bar{K}_{1|\varepsilon=\tilde{\varepsilon}} = \frac{\beta(1+\theta)}{1+\beta\theta}\left[1+\mu(1-\tilde{\varepsilon}l)\right]H_1.$$

The actual level of $\tilde{\varepsilon}$ is solved from equation (10b), after substituting both K_1 and $\bar{K}_1$ with

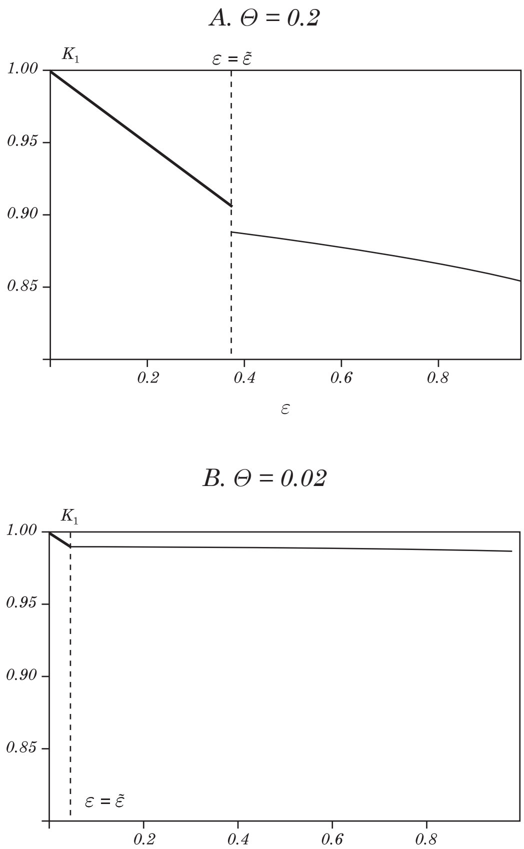
$$\frac{\beta(1+\theta)}{1+\beta\theta}\left[1+\mu(1-\tilde{\varepsilon}l)\right]H_1.$$

Smaller leverage and larger adjustment costs imply a higher threshold of volatility associated with liquidation (see equation 12). In the no-liquidation range $(\varepsilon > \tilde{\varepsilon})$, equation (13) implies that investment drops by half of the anticipated liquidity shock. This drop is financing an equal increase in the ex ante hoarding of international reserves, which will mitigate the effects of adverse liquidity shocks in bad times. The adverse liquidity shock would induce a real depreciation of $(\varepsilon\beta l\mu H_1)/Z$ (see equation 14). The extra liquidity induced by hoarding reserves and the real deprecation in bad times allow the economy to adjust fully without the need to liquidate tangible capital. This comes, however, at the cost of a drop in planned investment and output.

If $\tilde{\varepsilon} < 1$, the regime is mixed: for volatility far enough above the threshold, the regime is characterized by a partial liquidation of capital in bad times; for volatility below the threshold, the liquidation option would not be exercised. Hence, high enough volatility induces a regime switch from no liquidation to the partial liquidation of capital.

Figure 2 provides an example of the two regimes, tracing the optimal planned investment, K_1, as a function of volatility. Given that $R_1 = (1 + \mu)H_1 - K_1$, the patterns of reserves as a function of volatility are the mirror image of the patterns of the planned investment: $dR_1/d\varepsilon = -dK_1/d\varepsilon$. Panel A (B) corresponds to a relatively high (low) adjustment cost, $\theta = 0.20$ ($\theta = 0.02$). Under relatively low volatility, liquidation would not be exercised, whereas higher volatility would reduce the planned investment and increase the level of reserves. These reserves would be used to meet adverse liquidity shocks, eliminating the need to engage in a costly ex post liquidation of productive investment. High enough volatility implies that the liquidation option would supplement the defensive hoarding of reserves. Note that liquidation mitigates the adverse impact of higher volatility on the planned investment, as can be seen by comparing the slopes of the two lines below and above the volatility threshold, $\tilde{\varepsilon}$. This mitigation involves a deadweight loss associated with adjustment costs.

Figure 2. Volatility and Planned Investment[a]



Source: Author's construction.

a. The simulation corresponds to the case n which $\beta = 0.5$; $l = 1.0$; $H = 1.0$; and $\mu = 1.0$.

The regime switch to the partial liquidation regime triggers a discrete drop of the planned investment, and a matching discrete jump in the ex ante hoarding of reserves. This follows from the observation that the switch to the partial liquidation regime increases the marginal valuation of liquid reserves. The intuition for this is straightforward: in the partial liquidation regime, an extra unit of liquid reserves eliminates the need to liquidate $1 + \theta$ capital, saving the deadweight loss of θ. This marginal benefit of liquidity is absent in the no-liquidation regime. Consequently, at the regime switch, there is discontinuity where the ex ante demand for liquidity jumps, inducing a drop in planned investment. This drop increases with the adjustment costs, as is vividly illustrated by the contrast between the two panels of figure 1. This point can be confirmed by comparing equations (11) and (13a) at the threshold volatility associated with regime change. If the no-liquidation and liquidation regimes are denoted NL and LQ, respectively, then at $\varepsilon = \tilde{\varepsilon}$,

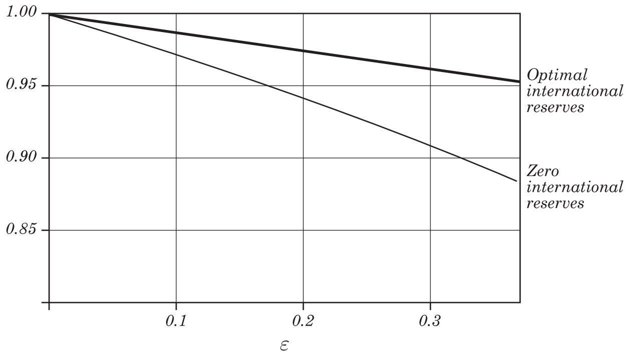
$$K_{1|\mathrm{NL}} - \bar{K}_{1|\mathrm{LQ}} = \theta^2 \frac{\beta(1-\beta)}{(1+\theta)(1-\beta\theta)}(1+\mu)H_1. \tag{15}$$

A key variable is the adjustment cost parameter, θ, which measures the flexibility of capital market adjustment. Greater flexibility of the adjustment reduces the role of international reserves, as well as the overall impact of volatility on investment and the real exchange rate.

Hoarding reserves mitigates the volatility of the real exchange rate and of the adverse effects of liquidity shocks on GDP. To fully appreciate this observation, it is useful to evaluate the expected output in the absence of the precautionary adjustment of international reserves. Using the parameters specified in panel A of figure 2, I set planned capital at $K_1 = 1$. The actual capital in the presence of a liquidity shock and the absence of the precautionary adjustment in international reserves would have been $\bar{K}_1 = 1 - \mu\varepsilon l H_1(1+\theta)$. The solid line in figure 3 plots the expected output in this regime as a fraction of the output that would have obtained if the liquidity shock had been zero. The bold line is the expected normalized output for the case in which reserves are adjusted to prevent the need to liquidate capital, as in equation 1). The figure vividly illustrates the first-order gain associated with the precautionary adjustment of international reserves. The precautionary adjustment of reserves also reduces volatility and the real effective exchange rate.

The present model is not detailed enough to identify who would hold the international reserves—private banks or the central bank. In the presence of capital controls, as in China, the international reserves would be held by the central bank. With full integration of capital

Figure 3. Volatility and Relative Expected Output[a]



Source: Author's construction.
a. The simulation corresponds to the case in which $\theta = 0.2$; $\beta = 0.5$; $l = 1.0$; $H = 1.0$; and $\mu = 1.0$. The bold curve corresponds to no liquidation and optimal precautionary demand for reserves; the solid curve corresponds to zero precautionary demand, with all the adjustment made through liquidation.

markets and convertibility and with an efficient market for excess reserves that allows diversifying idiosyncratic shocks, the bulk of the international reserves may be held by private banks. However, given moral hazard considerations (as in Levy Yeyati, 2008) or the absence of an efficient market for excess reserves, the bulk of the international reserves would be held by the central bank.

The model described above is stylistic, in that I do not derive the collateral constraint endogenously and I do not claim that the debt contract or the resolution of the liquidity shock is the most efficient solution. If the debt contract is taken as exogenously given, the resulting role of international reserves can be characterized.[10] The model suggests that adverse liquidity shocks triggered by a deterioration in the terms of trade are accommodated by lower reserves and real depreciation, adjustments that limit the necessary liquidation of capital. While the above framework dealt with one investment cycle, it can be extended into a dynamic set up, in which

10. See Ranciere, Tornell, and Westermann (2003) for further discussion of the mutual benefits of transfers from an unconstrained traded sector to a constrained nontraded sector in the presence of liquidity pressure. I also do not model the mechanism inducing capital flight in the presence of adverse terms-of-trade shocks. This may reflect both contagion and the possibility of multiple equilibrium, or fundamental forces (such as the search for a higher return on savings). For further discussion of fundamentals-based crises, see Allen and Gale (1998) and Goldfajn and Valdés (1997); for panic-based crises, see Chang and Velasco (2000).

the next cycle resembles a similar sequence, subject to updating the entrepreneurs' initial wealth by the profits of the previous investment cycle and by any outside income. In the extended setup, improvements (deterioration) in the terms of trade would tend to lead to a further real exchange rate appreciation (depredation). This would be the case when the entrepreneurs' outside income includes proceeds from the exported commodity, implying that higher wealth would increase the future demand for the nontraded input. This would also be the case if the nontraded input has other uses, which cause the demand for the input to rise with the wealth of the economy.

The above discussion provides only one possible mechanism to account for the buffering role of international reserves. Although I focus on the adjustment to terms-of-trade shocks, the buffering role of international reserves also applies when the shocks stem from the financial sector, in the form of a sudden stop or reversal of the current account. For example, Calvo, Izquierdo, and Talvi (2003) study a model in which a sudden stop of capital inflows results in an abrupt current account reversal, inducing a sizable real exchange rate depreciation. In their model, the required real depreciation and the growth costs of the sudden stop depend negatively on the country's degree of openness. This observation is consistent with the Mundell-Fleming tradition, whereby the expenditure-reducing effort, for any given level of expenditure switching, is inversely related to the marginal propensity to import. The tests reported in Edwards (2004b) confirm these perditions. Hence, the buffering role of international reserves reported in this paper may be especially relevant for countries that are exposed to sudden stops and current account reversals and more closed to international trade.[11]

The greater financial and commercial integration of developing countries implies that sudden stops and current account reversals may be associated with complex feedbacks between financial and real shocks, which affect other markets through financial and trade linkages (for example, through bilateral trade, competition in third markets, and financial contagion; see Glick and Rose, 1999; Calvo, 1999; Forbes, 2004). When push comes to shove, having deep international reserves allows the central bank to be of lender of last resort independently of the sources of capital flight, which improves the

11. This suggests that countries specializing in the export of commodities, with limited diversification of their exports, tend to be more vulnerable. They may be relatively closed to trade both as a result of low trade openness and because their export supply is relatively inelastic with respect to the real exchange rate.

bank's capacity to address sudden stops and reversals of capital inflows (see Calvo, 2006). In principle, what matters is a country's ability to come up with hard currency when a crisis occurs. The optimal reserves and optimal debt should therefore be decided jointly. A country that has borrowed externally to its limit may need more reserves than one that has room for more borrowing.[12]

3. International Reserve Management and Mercantilist Motives

The discussion in the previous section viewed international reserve management in the context of reducing the costs of economic volatility, reflecting the desire for self-insurance against exposure to future sudden stops. This view faces a well-known contender in a modern incarnation of mercantilism: the accumulation of international reserves is triggered by concerns about export competitiveness. This explanation has been advanced by Dooley, Folkerts-Landau, and Garber (2003), especially in the context of China. The issue is of more than academic importance: the precautionary approach links reserve accumulation directly to exposure to sudden stops, capital flight, and volatility, whereas the mercantilist approach views reserve accumulation as a residual of an industrial policy that may impose negative externalities on other trade partners. Dooley, Folkerts-Landau, and Garber interpret reserve accumulation as a by-product of promoting exports, which are needed to create better jobs to absorb abundant labor in traditional sectors, mostly agriculture. Under this strategy, reserve accumulation may facilitate export growth by preventing or slowing appreciation:

> We argued that a sensible development policy might involve creating a distortion in the real exchange rate in order to bias domestic investment toward export industries. Sensible here means that the resulting capital stock will be superior to that generated by a badly distorted domestic financial system and other relative price distortions typical of emerging market countries. (Dooley, Folkerts-Landau, and Garber, 2005.)

The mercantilist explanation for hoarding international reserves presumes that a monetary policy that affects the level of

12. See Zhou (2005) for conformation of this observation.

the exchange rate has permanent real effects. While the view that monetary instability has adverse long-run real consequences is well supported by empirical studies, there is no comparable body of evidence that validates the long-run real impact of setting the level of the nominal exchange rate. Indeed, anecdotal evidence suggests that the neoclassical adjustment mechanism works even in China—economic growth leads to real appreciation independently of the exchange rate regime.

The growing importance of foreign direct investment, and the observation that countries experiencing a large foreign direct investment inflow do occasionally hoard international reserves, underscored an extended version of the revived Bretton Woods system, in which international reserves are viewed as collateral reducing the risk associated with FDI:

> Delivering goods and services up front is a crude form of collateral. But there is no credible alternative. Market participants individually could pledge financial assets in the center country, but the only way that the aggregate of the periphery can acquire assets in the U.S. is to run a current account surplus. In an important sense, the goods and services already delivered to the U.S. support the stock of U.S. claims on the periphery; it is the collateral that powers the entire development strategy.
>
> The nature of the social collateral is so obvious it is hard to see. If the center cannot seize goods or assets after a default, it has to import the goods and services before the default and create a net liability. If the periphery then defaults on its half of the implicit contract, the center can simply default on its gross liability and keep the collateral. The periphery's current account surplus provides the collateral to support the financial intermediation that is at the heart of Asian development strategies. The interest paid on the net position is nothing more than the usual risk free interest paid on collateral. (Dooley, Folkerts-Landau, and Garber, 2005.)

The wide-reaching implications of Dooley, Folkerts-Landau, and Garber (2005) have propagated a spirited debate that goes well beyond the scope of this paper.[13] Some view the modern mercantilist approach as a valid interpretation for most East Asian countries, arguing that they follow similar development strategies. This interpretation is intellectually intriguing, yet it remains debatable. Observers point

13. See Caballero, Farhi, and Gourinchas (2006); Eichengreen (2006a); Glick and Spiegel (2005).

out that high export growth is not the new kid on the block—it is the story of East Asia over the last fifty years. Yet, the large increase in hoarding reserves has occurred mostly after 1997. Indeed, in the cases of Japan and Korea, the policy tool of choice during their rapid growth phase was selective favorable financing of targeted sectors, not hoarding international reserves.[14] Both countries began hoarding international reserves after the end of the high growth phase.

Aizenman and Lee (2007) test the importance of precautionary and mercantilist motives in accounting for the hoarding of international reserves by developing countries. While variables associated with the mercantilist motive (like lagged export growth and deviation from purchasing power parity) are statistically significant, their economic importance in accounting for reserve hoarding is close to zero and is dwarfed by other variables. Overall, the empirical results in Aizenman and Lee (2007) are in line with the precautionary demand. The effects of financial crises have been localized, in that reserve hoarding has increased in the aftermath of crises mostly in countries located in the affected region, but not in other regions. A more liberal capital account regime is found to increase the amount of international reserves, in line with the precautionary view. These results, however, do not imply that the hoarding of reserves by countries is optimal or efficient. Making inferences regarding efficiency would require a detailed model and much more information, including an assessment of the probability and output costs of sudden stops and the opportunity cost of reserves.

Aizenman and Lee (2006) propose a new interpretation of the association between mercantilism, economic growth, and the hoarding of reserves based on the development strategies of East Asian countries in the second half of the twentieth Century. The history of the region suggests that export promotion was largely achieved through preferential financing, which effectively subsidized investment in targeted sectors. This was achieved in several ways, including direct subsidies funded by state banks; financial repression, to the extent that favored sectors enjoyed preferential access to cheaper external borrowing; and moral suasion, whereby private banks were encouraged to provide favorable financing. Aizenman and Lee refer to this policy as financial mercantilism and contrast

14. Both Japan and Korea were closed to foreign direct investment in their rapid growth periods. The view that foreign direct investment is the key for successful development in East Asia thus remains debatable.

it with monetary mercantilism, a policy that hinges on hoarding international reserves.

The history of Japan and Korea features the near absence of monetary mercantilism during the fast growth phase, although financial mercantilism was vigorously applied. In both countries, the switch to large hoarding of international reserves occurred at times of collapsing growth. Thus, if monetary mercantilism played any significant role in these countries, it was in periods of disappointing growth. The legacy of financial mercantilism was a deterioration of the balance sheets of affected banks. The circumstances under which floundering growth leads to the switch from financial mercantilism to a large hoarding of reserves are associated with a growing fragility of the banking system—and while financial fragility is relatively sustainable in times of rapid growth, it may induce a banking crisis when growth flounders.[15] Precautionary motives may then lead countries to hoard international reserves to mitigate the possible transmission of a banking crisis to a currency crisis. Given limited data, such a response may be observationally equivalent to the predictions of monetary mercantilism. It is hard to disentangle precautionary hoarding from monetary mercantilism using good data on international reserves but spotty data on nonperforming loans. Moreover, monetary mercantilism and precautionary hoarding may be mutually reinforcing: the benefit of competitiveness may reduce the effective cost of hoarding reserves and induce governments to prefer reserve hoarding over alternative precautionary means.

China's hoarding of reserves picked up sharply after the Asian crisis. Unlike Japan and Korea, China is accumulating reserves without having gone through a sharp slowdown in economic growth. The recent history of Japan and Korea probably encouraged China to adopt a dual strategy of financial mercantilism and rapid hoarding of international reserves. As much as China is growing even faster than Japan and Korea in their early years and is going through its takeoff process in the era of a highly integrated global financial market, China arguably faces a much greater downside risk of social

15. The research triggered by Kaminsky and Reinhart (1999) points out that greater financial fragility increases the odds of a currency crisis. Hutchison and Noy (2005) report that "the onsets of 31 percent of banking crises were accompanied by currency turmoil. Furthermore, there is a statistically significant correlation between lagged banking crises and contemporaneous currency crises, but not vice versa." This observation is consistent with the insight of models of financial fragility, exemplified by Chang and Velasco (2000).

and political instability associated with a crisis than did Japan or Korea. This greater downside risk of recession and financial crisis may explain the Chinese eagerness both to push financial mercantilism and to aggressively hoard reserves to buffer the downside risk of the economy's growing financial fragility.[16] Given the sheer size of China and its reserve hoarding, however, other countries in the region may be tempted to engage in competitive hoarding to mitigate their loss of competitiveness in third markets.

Monetary mercantilism is also associated with negative externalities akin to competitive devaluation. When one country hoards international reserves in response to short-run competitiveness concerns, other countries may adopt a similar policy to preempt any competitive advantage gained by the first country. These circumstances may lead to competitive hoarding of reserves, which, in turn would dissipate any competitiveness gains. Aizenman and Lee (2007) provide a simple framework illustrating the welfare losses associated with competitive hoarding. These losses may provide a novel argument in favor of regional funds, viewed as a mechanism for coping with regional negative externalities. The greater importance of manufacturing in East Asia relative to Latin America, combined with the deeper financial repression in some East Asian countries, suggests that the case for an Asian fund is stronger than that for a similar regional fund among Latin American countries.[17]

Recent empirical research, while still preliminary, provides evidence consistent with this discussion. The mercantilist motive predicts that countries exporting to the same third market and competing for market shares there may engage in competitive hoarding. This implies a keeping-up-with-the-Joneses pattern of hoarding international reserves, in line with Cheung and Qian (2006). They find evidence of an interdependence of holdings of international reserves in East Asia; this finding is robust to the

16. In the case of China, the ratio of banks' nonperforming loans to international reserves is estimated to range somewhere between 20 percent (according to the Bank of China) and more than 90 percent (see Jim Peterson, "Balance Sheet: China Offers Fertile Soil for Investor Unhappiness," *International Herald Tribune*, 11 September 2006). These numbers highlight the uncertainty of estimating the economywide burden of financial weakness, which itself would add to the demand for precautionary hoarding.

17. The presumption is that the real exchange rate has greater consequences on the competitiveness of manufacturing exporters than on countries specializing in commodities and raw materials; for further discussion of regional funds, see Eichengreen (2006b).

presence of standard macroeconomic determinants, a few controls, and a few alternative specifications of the so-called Joneses variable. For ten East Asian countries, they find that a dollar increase in international reserves by one country is associated with an increase of about 0.6 dollar by the other nine peer countries. The evidence about the undervaluation of China, however, is inclusive.[18] This may reflect the low explanatory power of tests dealing with the real exchange rate, as well as the possibility that the neoclassical adjustment mechanism operates even for countries engaging in competitive hoarding of international reserves.

4. Current Account Persistence and International Reserves

The purpose of this section is to ascertain the degree to which a higher ratio of international reserves to GDP ratios is associated with greater capacity to smooth adjustment to shocks over time, resulting in more persistent current account patterns. In contrast, a low level of reserves may require a fast, rigid adjustment of the current account to shocks, when deviations from a balanced current account position are hard to sustain. I evaluate this possibility by applying the methodology of Taylor (2002), in which the speed of adjustment of the current account (CU) back toward its equilibrium or steady-state level is captured by the value of β in the following regression:[19]

$$\Delta\left(\frac{\mathrm{CU}}{\mathrm{GDP}}\right)_t = \beta\left(\frac{\mathrm{CU}}{\mathrm{GDP}}\right)_{t-1} + \varepsilon_t. \tag{16}$$

The autoregressive reinterpretation of equation (16), $(\mathrm{CU/GDP})_t \cong (1 + \beta)\ (\mathrm{CU/GDP})_{t-1} + \varepsilon_t$, clarifies that a value of β close to minus one implies no persistence of the current account pattern, as would be the case if the adjustment to a shock is contemporaneous. In contrast,

18. Aizenman and Lee (2007) find that, as predicted by the mercantilist use of reserves, deviations from purchasing power parity (PPP) are statistically significant in explaining the hoarding of international reserves. Nevertheless, the economic importance of deviations from PPP in accounting for reserve hoarding is close to zero and is dwarfed by other variables. Cheung, Chinn, and Fujii (2006) report that "once sampling uncertainty and serial correlation are accounted for, there is little statistical evidence that the RMB is undervalued, even though the point estimates usually indicate economically significant misalignment."

19. See Taylor (2002) for a discussion linking the above estimation to intertemporal long-run budget constraints.

a value of $|\beta|$ closer to zero implies greater persistence of the current account, allowing for a more protracted adjustment to shocks.

I start by fitting the following regression:

$$\Delta\left(\frac{\text{CU}}{\text{GDP}}\right)_{i,t} = \text{Country Effects}_i + \text{Time Effects}_t + \beta_{\text{sample}}\left(\frac{\text{CU}}{\text{GDP}}\right)_{i,t-1} + e_{it}, \quad (17)$$

where (CU/GDP) = ln[1 + (Current Account / Domestic GDP)], and both the current account balance and the domestic GDP are measured in current U.S. dollars. Table 5 shows the coefficient of adjustment and thus a measure of persistence for the current account balance for 1970–2004, subject to data availability, and subsets of the data such as developing countries, developed OECD countries, manufacturing exporters, natural resource exporters, and Latin American and Asian emerging economies. The table also reviews subsamples from 1980–92 and 1993–2004, and it also breaks down indebtedness and income as classified by the World Bank. The table reveals that developing countries are characterized by a faster current account adjustment than OECD countries, Latin American economies adjust faster than Asian emerging economies, and exporters of natural resource adjust faster than manufacturing exporters.

I turn now to a cross-country study testing the impact of international reserves on the speed of adjustment. On average, one would expect that a higher buildup of reserves gives countries a better buffer against shocks, thereby reducing the speed of adjustment of the current account and resulting in a positive association between international reserves and β. I apply a two-step derivation of the relationship between reserves (and other government assets) and current account persistence. In the first step, I derive a measure of current account persistence.

I ran a time-series regression for each available country in the following form:

$$\Delta\left(\frac{\text{CU}}{\text{GDP}}\right)_{t} = \beta\left(\frac{\text{CU}}{\text{GDP}}\right)_{t-1} + \varepsilon_t. \quad (18)$$

This yields one β coefficient per country. The countries, the number of observations used in the autoregressive estimation of β, and the fitted values are listed in Aizenman (2006, tables B1–B4). Table 6 provides the estimates for several Latin American countries.

Table 5. Current Account Persistence across Subgroups[a]

Period and sample	*Lag(CU/ GDP)*	*Standard error*	*No. observations*	R^2
1970–2004				
All countries	–0.437***	0.026	4,053	0.2548
Developing	–0.441***	0.027	3,346	0.2608
OECD	–0.260***	0.036	707	0.2315
Manufacturing exporters	–0.250***	0.056	273	0.3655
Commodity exporters	–0.362***	0.049	391	0.4182
Latin America	–0.432***	0.088	594	0.3082
Asia	–0.217***	0.063	298	0.3812
1980–1992				
All countries	–0.544***	0.041	1,661	0.3316
Developing	–0.546***	0.042	1,394	0.3336
OECD	–0.433***	0.057	267	0.2228
Latin America	–0.523***	0.091	234	0.3395
Asia	–0.248***	0.067	114	0.1626
1993–2004				
All countries	–0.563***	0.046	1,708	0.3421
Developing	–0.568***	0.047	1,445	0.3443
OECD	–0.347***	0.059	263	0.2224
Latin America	–0.507***	0.059	216	0.3963
Asia	–0.315***	0.087	112	0.166
Indebtedness				
Severely indebted (Debt1)	–0.435***	0.047	1,016	0.2737
Moderately indebted (Debt2)	–0.512***	0.040	930	0.3515
Less indebted (Debt3)	–0.412***	0.057	999	0.2449
Income level				
Low (Income1)	–0.413***	0.044	1,137	0.2679
Lower-middle (Income2)	–0.495***	0.056	1,105	0.3302
Upper-middle (Income3)	–0.496***	0.057	844	0.2809
High (Income4)	–0.315***	0.050	961	0.224

Source: Author's estimations.
*** Statistically significant at the 1 percent level.
a. The dependent variable is D(CU/GDP). For a list of the indebtedness ranking of each country and the breakdown by income level, see Aizenman (2006, tables B1–B2, available online at papers.nber.org/papers/w12734).

Table 6. Estimated β for Selected Countries

Country	β	*Standard error*	*No. observations*	R^2
Argentina	–0.396	0.083***	34	0.1896
Brazil	–0.214	0.093**	34	0.0841
Chile	–0.447	0.117***	34	0.2108
Costa Rica	–0.329	0.103***	34	0.1602
Dominican Republic	–0.477	0.232**	34	0.1703
Ecuador	–0.73	0.185***	34	0.3629
El Salvador	–0.917	0.196***	34	0.47
Haiti	–0.282	0.126**	32	0.153
Honduras	–0.586	0.163***	30	0.2968
Mexico	–0.413	0.149***	34	0.2041
Uruguay	–0.494	0.128***	34	0.2462
Venezuela	–0.656	0.129***	34	0.3164

Source: Author's estimations.
** Statistically significant at the 5 percent level. *** Statistically significant at the 1 percent level.

The persistence proxy used in the next step is simply the value of the pure autoregressive process of the current account deflated by GDP:

$$\left(\frac{\text{CU}}{\text{GDP}}\right)_t = \alpha\left(\frac{\text{CU}}{\text{GDP}}\right)_{t-1} + \varepsilon_t, \tag{19}$$

where $\alpha = \beta + 1$. In the second step, I look at the cross-section relationship between the measure of persistence represented by α and a series of structural parameters for these economies, on the one hand, and a measure of the stock of reserves deflated by GDP, on the other. [20]

The univariate regressions reveal that higher reserves, higher GDP growth, and a lower share of commodities are associated with a significant increase in the persistency of the current account for non-OECD countries (see table 7). International reserves are insignificant for a sample that includes the OECD countries. The multivariate regressions

20. Out of 134 countries, ten countries have negative alphas that would represent extreme volatility in the current account. These countries are generally small economies with very sensitive external sectors. To reduce noise in future regressions, I have purged these countries from the data. (See the countries in italics in Aizenman, 2006, table B4; available online at papers.nber.org/papers/w12734).

indicate that for developing countries, higher persistence is positively associated with a higher reserves-GDP ratio, lower inflation, greater exchange rate flexibility (measured as the volatility of the nominal exchange rate), and a higher share of manufacturing (see table 8).

Table 7. Univariate Regressions[a]

Explanatory variable	*All countries*	*Non-OECD countries*
Reserves	0.068 (0.110)	0.183 (0.100)*
Nominal exchange rate volatility	–0.056 (0.247)	0.058 (0.240)
Financial integration	0.142 (0.110)	–0.042 (0.113)
Terms of trade	0.058 (0.083)	0.116 (0.085)
GDP growth	1.701 (0.635)***	2.119 (0.639)***
Percent share of commodities	–0.415 (0.096)***	–0.311 (0.102)***
Inflation	–0.017 (0.044)	0.009 (0.044)

Source: Author's estimations.
* Statistically significant at the 10 percent level. *** Statistically significant at the 1 percent level.
a. The dependent variable is alpha. Robust standard errors are in parentheses.

The results reported above are consistent with the consumption-smoothing role of current account adjustments. To illustrate, consider a benchmark neoclassical economy in which consumption is determined by the permanent income hypothesis (that is, linear marginal utility of consumption); output follows a first-order autoregressive, or AR(1), process defined as $Y_t - \bar{Y} = \rho(Y_{t-1} - \bar{Y}) + \bar{Y}\varepsilon_t$ (where $|\rho| < 1$, with output reverting to the long-run mean, $\bar{Y}$, at a rate determined by $1 - \rho$); and agents can borrow and lend at the real interest, r, which also equals their subjective rate of time preference. Then, around the long-run equilibrium,[21]

21. This follows from the observation that in such an economy, $C_t = rB_t + \bar{Y} + [r/(1 - r - \rho)](Y_t - \bar{Y})$. Hence, $CU_t = rB_t + Y_t - C_t = [(1 - \rho)/(1 + r - \rho)](Y_t - \bar{Y})$. In the vicinity of the long-run equilibrium, $(CU_t/Y) = [(1 - \rho)/(1 + r - \rho)]\{\rho(Y_{t-1} - \bar{Y}) + \bar{Y}\varepsilon_t]/Y_t\} = \rho(CU_{t-1}/Y_{t-1})(Y_{t-1}/Y_t) + (1 - \rho)/(1 + r - \rho)(\bar{Y}/Y_t)\varepsilon_t \simeq \rho(CU_{t-1}/Y_{t-1}) + (1 - \rho)/(1 + r - \rho)\,\varepsilon_t$.

Table 8. Multivariate Regression[a]

Explanatory variable	*All countries*	*Non-OECD countries*
Reserves	0.058	0.192
	(0.089)	(0.082)**
Inflation	–0.101	–0.072
	(0.042)**	(0.043)*
Nominal exchange rate volatility	0.566	0.545
	(0.303)*	(0.294)*
Terms of trade	0.177	0.195
	(0.088)**	(0.098)*
Financial integration	0.298	0.076
	(0.114)**	(0.127)
Manufacturing exports	0.784	0.628
	(0.212)***	(0.225)***
Summary statistic		
No. observations	94	80
R^2	0.2084	0.1618

Source: Author's estimations.
* Statistically significant at the 10 percent level. ** Statistically significant at the 5 percent level. *** Statistically significant at the 1 percent level.
a. The dependent variable is alpha. Robust standard errors are in parentheses.

$$\left(\frac{\mathrm{CU}}{Y}\right)_t \simeq \rho\left(\frac{\mathrm{CU}}{Y}\right)_{t-1} + \frac{1-\rho}{1+r-\rho}\varepsilon_t. \tag{20}$$

Hence, $\alpha \simeq \rho$. Next I modify the above assumptions to add the possibility of sudden stops. Specifically, assume that the probability of a sudden stop, which terminates the ability to borrow externally, is Φ, where $\Phi = \Phi(\mathrm{IR/Y})$ and $\Phi' < 0$. Under these circumstances,

$$\alpha \simeq \rho\,(1 - \Phi). \tag{21}$$

This suggests that a negative association between sudden stops and hoarding reserves may account for the impact of international reserves on the persistency of current account adjustment.

5. On the Limitations of International Reserve Management

I close the paper with a discussion of the limitations of international reserve management. While useful, international reserve management is not a panacea, and it is subject to serious limitations as outlined below.

First, as with any insurance, there is no way to avoid various layers of moral hazard, which can be broken down into macroeconomic and microeconomic hazards. With regard to the former, any deep pot of resources may be the target of opportunistic raiding by policymakers in regimes characterized by political instability and limited monitoring. Central bank independence helps and is desirable, but it is not sufficient to overcome this obstacle.[22] Microeconomic moral hazard, in turn, centers on the likelihood that large stockpiles of reserves may subsidize risk taking, especially if the hoarding is viewed as a signal of a low probability of exchange rate changes.[23]

Second, international reserve management carries fiscal costs, including a direct opportunity cost (that is, the marginal product of investment or the cost of external borrowing) and any marginal costs of sterilization.[24] Hauner (2005) estimates these costs for a hundred countries in 1990–2004; he conlcudes that while most countries made money on their reserves in 1990–2001, most lost money in 2002–04. One should keep in mind, however, the difficulties in tracing the full benefits of hoarding reserves:

> "While assessing the fiscal cost of holding reserves, it would be worthwhile to set off the benefits that the country may have in holding reserves. In any country risk analysis by the rating agencies and other institutions, the level of reserves generally has high weights. Moreover, it is essential to keep in view some hidden benefits which could accrue to a country holding reserves, which may, inter alia, include: maintaining confidence in monetary and exchange rate policies; enhancing the capacity to intervene in foreign exchange markets; limiting external vulnerability so as to absorb

22. See Aizenman and Marion (2004) for empirical results on the adverse effects of political instability on hoarding international reserves.

23. See Levy Yeyati (2008), who advocates a combined scheme of, first, decentralized reserves in the form of liquid asset requirements on individual banks to limit moral hazard and, second, an ex-ante suspension-of-convertibility clause to reduce the self-insurance costs while limiting bank losses in the event of a run.

24. See Calvo (1991) for an early discussion on the quasi-costs of sterilization.

shocks during times of crisis; providing confidence to the markets that external obligations can always be met; and reducing volatility in foreign exchange markets. It is true that beyond a point, when the credit rating reaches appropriate investment grade, addition to reserves may not lead to further improvement in the credit rating. It is necessary to recognize that, as in the case of costs, there are difficulties in computing the benefits too." (Reddy, 2006.)

Third, any government in the process of analyzing its international reserve management program faces coordination issues. While this paper has focused on international reserve management as self-insurance, international reserve management may be part of a fiscal scheme to augment social security and future pensions. This is especially relevant for commodity-exporting countries like Chile, Norway, and so on. The management of these funds is best delegated to two different agencies. One, like the central bank, should undertake international reserve management as part of a prudent macroeconomoic management throughout the business cycle. The second fund is best managed by the treasury or the social security administration, as it deals with long-term intergenerational transfer.[25]

To conclude, this paper outlined several motives for hoarding international reserves in this era of growing financial integration. The message of the report is mixed, and reserve management is not a panacea. The mercantilist case for hoarding international reserves, as an ingredient of an export-led growth strategy, is dubious. Done properly, however, international reserve management reduces downside risk in turbulent times. These benefits are especially important for commodity-exporting countries and countries with limited financial development.

25. For further discussion, see Davis and others (2001).

Appendix A
Data Definitions and Sources

This appendix defines the key variables used in the main paper and outlines the data sources. For the indebtedness ranking, country classification by income level, data availability, and estimated β for each country, see Aizenman (2006, tables B1–B4).[26]

—Manufactures: the average of annual observations of the percentage of economic activity dedicated to the production of manufactures (measured as percentage of GDP). Following the definition given by the United Nations, manufactures include the tabulation category D and divisions 15–37 in the International Standard Industrial Classification of All Economic Activities, Revision 3. Manufactures are defined as the physical or chemical transformation of materials or components into new products, whether the work is performed by power-driven machines or by hand, whether it is done in a factory or in the worker's home, and whether the products are sold wholesale or retail. The definition includes assembly of component parts of manufactured products and the recycling of waste materials.

—Commodities: the average of annual observations of the percentage of economic activity dedicated to the production of agricultural products, mining, hunting, and utilities.

—Reserves: the average of annual observations of the stock of reserves over GDP taken during the sample period. The sample period depends on data availability.

—Nominal exchange rate volatility: the average annual volatility of the nominal exchange rate. Each annual observation corresponds to the percent standard deviation of the monthly nominal rate of the domestic currency against the U.S. dollar,

$$\sqrt{\sum\left(\frac{x-\bar{x}}{\bar{x}}\right)^2 \Big/ (n-1)}.$$

—Financial integration: the average of annual observations of Edward's (2001) measure of financial integration.

—Inflation: the average of annual CPI inflation observations.

—Terms of trade: the average of annual observations of the terms of trade defined as the ratio of the export price index to the corresponding import price index, measured relative to the base year (2000).

26. Available online at www.nber.org/papers/w12734.

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Do Development Considerations Matter for Exchange Rate Policy?

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Chile was one of the world's fastest-growing economies in the 1990s. Its growth rate of 6.8 percent per year from 1990 to 2000 (inclusive) was the seventh highest in the world, and by far the highest in Latin America. Poverty was halved, and while this was overwhelmingly due to growth rather than a reduction in the concentration of income, public services became much more equitably distributed. Inflation fell progressively from over 20 percent at the beginning of the decade to under 4 percent at the end. My own explanation of this success centers on the well-rounded policy measures that were implemented in Chile over the period. The Central Bank was one of the institutions responsible for implementing these successful policies.

In particular, it helped that the Central Bank took a balanced view of its responsibilities. It aimed to reduce inflation, but it took a gradual approach rather than believing that a sudden reduction in inflation would automatically bring all other good things in its wake or that there were no trade-offs. It was also concerned with securing an anticyclical policy that would stabilize the real economy. Furthermore, it took into account the *encaje,* an important instrument in the battle to maintain a competitive exchange rate, and thereby avoided the overvaluation that had such a devastating effect in other Latin American countries.

The questions that I address in this paper are whether considerations of growth and development demand a more competitive exchange rate than might emerge spontaneously. If so, what (if any) instruments should be used to affect the exchange rate?

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1. The Primacy of Inflation

I am as firm an anti-inflationist as a reasonable central banker could ask for. I find the evidence that the inflation tax is regressive to be quite persuasive, at least for Latin America. If governments want to spend more, they should finance their spending honestly, by raising taxes, and not seek to pass the cost on either to the next generation, by borrowing, or to the poor, through inflation. I am not dismissing the Keynesian argument for deficit financing when needed to avoid the waste of idle capacity, but rather expressing a conviction that the case for deficit spending on more than a cyclical basis is only occasionally relevant.

I am also a convert, if not a particularly enthusiastic one, to the cause of inflation targeting. The macroeconomy seems to be adequately described by an open-economy Keynesian model incorporating an inflation-augmented Phillips curve (the sort of model that was popularized by Edmund Phelps, among others). The case for the central bank having a particular concern with inflation, however, rests on political economy rather than economic principles. An agency that commands sufficient policy instruments to stop inflation, while having an explicit mandate to preserve price stability and being independent of the short-run political process, acts as a safeguard against the sort of temptation summarized in the literature on the political business cycle. Views seem to have coalesced around the idea that a low but positive inflation rate, of perhaps 2.0 or at most 2.5 percent a year, provides the best possible balance between the costs of inflation and the danger that a zero floor to the nominal interest rate could lead to the emergence of a real interest rate that is too high for anticyclical policy.

But a particular concern is not the same as an exclusive one. I agree that a central bank's main interest should be controlling inflation, but this does not preclude it addressing other issues. I do not, however, believe that in normal times those other issues need give particular weight to output or unemployment. The way that one stabilizes inflation involves monetary stimulus when unemployment rises, because at such times inflation may decline to a rate below the target. Under abnormal circumstances, like much of the world in the 1930s or Japan in the 1990s, unemployment may become so high and ingrained that it is desirable to target its reduction explicitly. Most of the time, the only monetary policy objective that may merit consideration—other than inflation targeting—is the maintenance of a sufficiently competitive exchange rate to preserve the incentive to invest and, thus, the supply-side growth rate.

2. Exchange Rate Modeling

The overwhelming conventional view in the profession is that it is a mistake to try to manage exchange rates. Maybe not everyone in the foreign exchange market has rational expectations, but enough do to create the expectation that the exchange rate will be equal to the long-run expected exchange rate discounted by the impact of the currently expected disequilibria between now and the long run. If there are some irrational people who do not conform to those expectations, they will be driven out by Friedmanite profitable stabilizing speculation. This is known as the rational expectations, efficient markets (or REEM) model.

The model is aesthetically appealing, but unfortunately it is overwhelmingly rejected by empirical evidence. De Grauwe and Grimaldi (2006) list several problems with this popular model, of which the three most convincing are the following. First, exchange rate changes are not driven mainly by changes in fundamentals, as has been known since Meese and Rogoff (1983). Second, chartist rules are profitable. This shows no sign of being a temporary phenomenon. Milton Friedman's argument that destabilizing speculation must be unprofitable is wrong (Friedman, 1953). Finally, exchange rate changes are not normally distributed, but exhibit fat tails (that is, they display more instances of extreme exchange rate changes than would be consistent with a normal distribution, given mean and standard deviation).

Theories are not supplanted because they prove inconsistent with the facts, but because some more appealing theory becomes available. De Grauwe and Grimaldi offer such an alternative theory, which they label a behavioral model. The essence of their model is the existence of two alternative bases for forecasting exchange rates: fundamentalist and chartist.[1] Fundamentalists believe that, absent special factors, exchange rates will tend to revert to their long-run equilibrium level. They forecast exchange rates on the basis of REEM models. Chartists extrapolate recent exchange rate changes into the longer-term future.

1. Their model has antecedents in a number of other papers, such as Frankel and Froot (1986).

Their actions tend to reinforce recent changes in exchange rates. At any one time, particular actors in the foreign exchange market tend to behave as either fundamentalists or chartists, but they may revise the principle used to forecast exchange rates if they find that the alternative behavior is currently more profitable. They choose between these two rules not because of a conviction that this results in actions that are perfectly rational, but because they are boundedly rational, that is, unable to understand the world in its full complexity and thus forced to resort to imperfect but comprehensible rules of thumb. They are rational in the sense that they discard a rule that is serving them badly.

De Grauwe and Grimaldi are unable to solve their model analytically, so they simulate the model several thousand times to establish its properties. Their main findings are as follows:

—Exchange rate changes are usually disconnected from changes in fundamentals, although the exchange rate is cointegrated with its fundamental value

—The exchange rate is sometimes, but unpredictably, disconnected from its fundamental value and instead involved in bubble-and-crash dynamics;

—If one sticks to one rule at all times, then a chartist rule tends to be more profitable than a fundamentalist rule (it can be better still to switch between these rules); and

—Exchange rate changes have fat tails.

In other words, the model is consistent with the main facts about exchange rate markets that should cause acute embarrassment to those who still adhere to the profession's mainstream model.

In this model, sterilized intervention is not always the exercise in futility suggested by conventional models, although that may be true (depending on unpredictable initial conditions) of the sort of ad hoc seat-of-the-pants intervention currently favored by most of the world's monetary authorities. More systematic intervention, however, can help to limit misalignments. Assuming that it is used in that way (or even that it consistently leans against the wind), and that it is not a vain attempt to defend disequilibrium exchange rates, intervention tends to increase the profitability of fundamentalist trading strategies. By making fundamentalism more profitable, it encourages the private sector to adopt fundamentalist and not chartist strategies. The main impact of intervention has nothing to do with the portfolio changes on which most professional attention has focused.

2.1 Corden's Three Views of Exchange Rate Policy

Corden (2002) distinguishes three alternative views of the objectives of exchange rate policy. Perhaps the most familiar in Latin America is the nominal anchor view of the exchange rate, which holds that the purpose of exchange rate policy should be to provide the economy with a nominal anchor. Fix the exchange rate, and the postulate of zero-degree homogeneity of the system in all absolute prices ensures that all other prices will eventually be pinned down. That is surely true of equilibrium prices, but the theory is silent on the time that it will take to reach equilibrium and the costs of getting there. Experience in countries that have made an exchange rate anchor the center of their stabilization policy, including Chile in 1979–82, shows that those costs can be prohibitively high.

An alternative view is much more prevalent in my own country (Great Britain), where it also has a formidable academic pedigree. This view, which Corden calls the real targets view of the exchange rate, holds that the exchange rate, or maybe the exchange rate regime, should be chosen to facilitate the achievement of simultaneous internal and external balance. The (real) exchange rate has real effects in influencing from where demand is satisfied, and these should be exploited.

Corden calls his third approach the exchange stability view of the exchange rate. This is his own attempt to make some sense of the hostility to exchange flexibility found in many European circles. It holds that exchange rate volatility is capricious and that allowing it free rein can increase the total amount of instability in the system, so that keeping exchange rates fixed has some virtue. According to this view (for which there is some empirical support), suppressing exchange rate flexibility does not shift volatility to the interest rate, as is sometimes perceived, but reduces the total volume of noise.

Although some economists are happy to commit themselves wholeheartedly to one of these three views, it is not necessary to take such a narrow position. One can perfectly well recognize that several views have merit; different policies may be appropriate at different points in time, and one will need to trade these considerations off against one another. Indeed, part of my enthusiasm for the basket, band, and crawl (BBC) regime is stimulated by a belief that it offers a particularly favorable combination of exchange rate flexibility where it serves a serious social purpose and suppresses much of the more frivolous, frothy kind of volatility that serves only to increase the noise in the system.

Corden's taxonomy is thus a useful contribution to our understanding of exchange rate policy. My main criticism is that it is incomplete. It does not recognize the place of thinkers like the late Bela Balassa, who regarded a competitive exchange rate as a central instrument of development policy. My next task is to repair this lacuna.

2.2 The Development Strategy View of the Exchange Rate

The development strategy view of the exchange rate attempts to formalize the view advocated most prominently by Balassa. He held that a competitive exchange rate was a key incentive for outward-oriented development, which had a far better prospect of supporting sustained growth than inward-oriented policies. This helped spark the large literature in search of particular growth virtues in the production of nontraditional exports, exploring whether such exports offer better opportunities for productivity growth, generate greater competition in the economy, allow learning-by-doing, propagate externalities, and so on. The channels at work have never been definitively identified, but the idea that a country is unlikely to get very far with its development if it allows the evisceration of its nontraditional export industries has become a part of conventional wisdom. The contention that a misaligned exchange rate—particularly an overvalued rate, although also a seriously undervalued rate—impedes growth receives strong empirical support in a recent study of Aguirre and Calderon (2006).

The basic idea of the development strategy view (laid out in Williamson, 2003) is to analyze the determinants of a growth-maximizing exchange rate. A more competitive exchange rate increases the profitability of investing in tradables, so it is expected to increase investment in—and, in due course, the output of—tradable goods. It is also likely to have an analogous effect in decreasing the profitability of investment in nontradables, but that will probably leave a net negative impact on investment through a low exchange rate (that is, an overvalued currency), for two reasons.[2] First, part of the demand for nontradables is a derived demand from the tradables

2. In accordance with the Latin American tradition, an exchange rate is measured in this paper as the price of the national currency in terms of the dollar. Hence an appreciation of the national currency results in a lower exchange rate, and vice versa.

sector, since many nontradables are inputs in the production of tradables. Second, the demand for nontradables is limited by the national market, while tradables sell on a world market that is typically many times the size of the national market. It is ultimately an empirical question as to whether a competitive exchange rate stimulates overall investment, and I am not aware of any studies that have addressed this issue. Unless and until empirical evidence indicates the need to drop what seems a natural assumption, I shall assume that a more competitive exchange rate increases the net desire to invest.

Some advocates of what they like to call export-led growth, notably the exponents of Bretton Woods II (Dooley, Folkerts-Landau, and Garber, 2003), stop the analysis at this point. They consider only the demand for investment, implicitly assuming that the resources to effect the desired level of investment are always available. This hyper-Keynesian assumption may have been a reasonable approximation to conditions in China, on which their analysis has principally focused, although I would argue that even in China intertemporal utility would have been increased if the resources that were invested in low-yielding U.S. Treasury bills had instead been used to increase domestic consumption. At any rate, it is an untenable assumption in general. Investment can be constrained by the supply-side—by the resources available for investment—as well as by the demand-side—by a lack of desire to invest.

The resources available for investment are domestic savings plus those that flow in through the current account. It was once generally assumed that growth was always constrained by the amount of investment that a country could undertake, so countries that imported more capital were expected to grow faster. This turns out not to be true (Prasad, Rajan, and Subramanian, 2006), but that is no reason to go to the other extreme of assuming that all that matters is the incentive to invest. The development strategy view of the exchange rate considers both sides of the equation. It asserts that the growth-maximizing value of the exchange rate is characterized by the increased incentive to invest induced by a real depreciation being equal at the margin to the increased ability to invest allowed by a real appreciation.

In practice, the serious danger appears to be that open capital imports in good times will lead to overvaluation and a consequent danger of robust growth being undermined by Dutch disease. Prasad, Rajan, and Subramanian (2006) conclude (like Aguirre and Calderon, 2006) that the empirical evidence indicates that this harms growth in developing economies, although (contrary to Aguirre and Calderon) they find no evidence that the same is true in developed countries. Razin and Collins (1999) also find empirical evidence that serious overvaluation hurts growth in developing countries. The main casual support for the importance of a competitive exchange rate in preserving the incentive to invest comes from East Asia, where exchange rate policy is customarily considered one of the reasons for the region's success. Perhaps the most conspicuous instance of defying balance-of-payments need and devaluing to sustain growth despite having ample reserves was provided by Indonesia in 1978. The contrast between the squandering of Nigeria's oil wealth and the productive use to which the Suharto regime put (most of) Indonesia's similar windfall is well known (see, for example, Little and others, 1993). A crucial element of the latter was the decision to devalue "unnecessarily."

3. Implications of the Development Strategy Approach

Assume first that both the growth-maximizing exchange rate and the equilibrium exchange rate are known to the government, and that they are the same. Standard theory says that optimal policy is to float freely, which will achieve the equilibrium rate (and thus the growth-maximizing rate). The behavioral view, in contrast, argues that the government can expect to reduce misalignments by a policy of intervention. The question is how those interventions should be structured: whether they should be ad hoc or systematic and, if the latter, how the system should be designed.

For many years, I argued in favor of a basket, band, and crawl (BBC) regime as the answer to this problem. It seems clear, however, that many governments value the freedom of not being constrained by exchange rate obligations, and they increasingly prefer to use inflation targeting rather than the exchange rate as their nominal anchor. These judgments seem sensible, and they are probably irreversible, so there is no point in trying to reverse them. The question is whether one could achieve some of the same advantages with a less constraining system than the BBC. I have argued that this could be accomplished with a reference rate system (Williamson, 2007), which offers a way of structuring intervention.

Specifically, a reference rate is an exchange rate that the authorities commit themselves not to push their exchange rate away from. It is in that sense an officially endorsed estimate of where the equilibrium rate lies. It carries no obligation to hold or even push the rate toward that level, but simply prohibits attempts to push the rate away from it. The obligation should extend to all policies designed specifically to influence the exchange rate: not just intervention in the foreign exchange market, but also jawboning (or so-called oral intervention, including declarations of faith in a strong currency), changing interest rates other than for reasons of domestic monetary management, changing capital controls, and so on.

A reference rate can be surrounded by a monitoring zone for the exchange rate, defined as a zone within which intervention is prohibited. As long as the exchange rate remains in that zone, it floats freely. When it deviates more than 5 or 10 percent in effective terms (depending on the size of the monitoring zone) from the reference rate (which should also be defined in effective terms), then countries have the right—but not an obligation—to enter the market so as to try to limit further deviations. This provides a set of rules that both constrains governments from actions perceived to be against the international interest and informs the private market of what can be expected. If the behavioral model is basically right in that both market and oral intervention are effective tools, this could be expected to limit deviations of the effective rate from the reference rate.

Assume next that, although the authorities know both the growth-maximizing rate and the effective rate, the two are not equal. Specifically, consider the case that has often troubled people in Chile, where the growth-maximizing rate is higher (more depreciated) than the equilibrium rate. In this case, central bank operations can at best provide a breathing space for nonmonetary actions, because the equilibrium rate in the behavioral model is completely determined by fundamental factors, just as in the traditional model. Hence, it is only something that affects those fundamentals that can bring the long-run equilibrium rate into line with the growth-maximizing rate. Five candidates come to mind as falling in that category:

—Tighten fiscal policy (although I pity the finance minister who has to explain to the prime minister or president that they need to raise taxes or cut expenditures because the country is so prosperous and the foreigners are so anxious to lend money);

—Impose controls to impede the entry or increase the cost of foreign capital (which Chile did when it imposed the *encaje* in the 1990s, but that eminently sensible instrument has now been abolished[3]);

—Accumulate foreign assets (as a number of countries are currently doing, including many East Asian countries, led by China; a number of oil exporters, with a few like Kuwait and Norway adopting it as a conscious act of long-term policy; and Singapore and Switzerland, which face low rates of return on investment at home and therefore see foreign asset accumulation as part of a strategy of optimal asset accumulation);

—Alter the currency composition of foreign borrowing (since a country's currency will tend to be stronger if it borrows in foreign currency, as most Latin American countries traditionally have done, than if they issue more domestic-currency denominated debt and sell some of it to foreigners, who will hold more domestic debt only if it is available more cheaply); and

—Impose export taxes on traditional exports (which Argentina is currently doing, and succeeding in maintaining a highly undervalued currency).

All of these actions are liable to impose costs of some sort, which presumably tend to increase progressively if the policy is pushed to more extreme levels. Restrictive fiscal policies involve higher taxes or lower expenditures (or both), which will be welcomed by neither taxpayers nor economists transfixed by distortions. Their most enthusiastic supporters are unlikely to deny that capital controls create distortions. Large reserves cost the taxpayers money whenever the rate of return on those reserves (including the likely future change in the exchange rate) is less than the opportunity cost of investing an equivalent sum in the domestic economy. So long as it commands less

3. There is an extensive Chilean literature examining the effect of the encaje, which I once surveyed (Williamson, 2000, pp. 37–45). I was not persuaded by the many papers purporting to prove that the encaje had no effect on the level of capital inflow or the exchange rate. (Almost all papers agreed that the encaje altered the composition of borrowing, in the direction of increasing the maturity of the foreign debt.) To begin with, I could not understand why the encaje continued to evoke so much hostility if it were as ineffective as claimed: investment bankers laugh at ineffective instruments; they do not foam at the mouth. Nor could I understand why a tax yielding so much revenue should not be applauded if it had no effect on resource allocation; distortion-free taxes are the economist's ideal, not something to be dismissed as useless. I argued that the reason empirical work had often failed to uncover a relation between the encaje and capital inflows or exchange rates was that a given level of encaje could influence either one or the other (or some combination of them), but that which of the two would be influenced would depend on policy and would not (as the econometricians had all assumed) be the same in all situations.

confidence, domestic-currency debt will require a higher yield in order to attract foreign buyers. Yet another set of distortions is created by taxing some exports at a different rate than others. Hence, a country that seeks to resist an excessively low (uncompetitive) exchange rate will usually find it advantageous to apply a mix of policies, rather than relying on any single policy to prevent overvaluation.

What is clearly not tenable is the view that the exchange rate given by the market has to be accepted stoically as a fact of life. It may not be worthwhile to try to avoid an uncompetitive rate, but one would expect that a country in which growth matters would be willing to pay some price to limit overvaluation. Much more persuasive is the view that the tools needed to devalue the long-run equilibrium exchange rate are not those of the central bank, but even this has to be qualified. For example, prudential regulations on the banking system will have some of the same effects as capital controls. It is sensible to limit the open position that banks can take. If they are allowed to extend foreign currency loans to the nontradable sector at all, they should be required to recognize that this practice involves risks and to insure those risks (see Rojas-Suarez, 2003). Again, the mix of reserves and domestic credit used to achieve a given expansion of the money supply will have some effect on the equilibrium exchange rate, and this is within the control of the central bank. The effect of both factors is likely to be minor, but it is not true that all the instruments wielded by central banks are, in principle, unable to influence the equilibrium exchange rate.

Do I believe that it is still important to maintain a competitive exchange rate in Chile? Yes, though I doubt it is as important as it was in the 1990s. Chile still has many poor people to absorb into the modern economy, and as long as this remains true, the finding that a competitive exchange rate lacks explanatory power for the growth of a developed country cannot be used to dismiss concern over the exchange rate.[4]

3.1 Ignorance

So far the analysis has been conducted on the supposition that the authorities know both the growth-maximizing exchange rate and the long-run equilibrium rate. What are the implications of a more realistic recognition of their limited clairvoyance?

Total ignorance is inconceivable. There is always some sense of what exchange rate is inappropriate. The crucial question would seem to be whether the authorities or the market have a better sense of what the

4. And even this finding is disputed, as noted above.

growth-maximizing and equilibrium rates are. If the authorities know less than the market (which is probably believed by some advocates of floating), then presumably they should do nothing. Similarly, if prompt action by the authorities is constrained by foolish institutional constraints (like those of Bretton Woods, which obliged the authorities to defend an inherited parity until it was clear to the market that it was indefensible), it is preferable for them to cease to be active.

It is more intellectually interesting and perhaps more realistic to consider the other case, in which the authorities have a better idea of the long-run equilibrium exchange rate than the market. The authorities have both the resources and the incentive to undertake research on the question, whereas it is unclear that any individual market trader does. Traders rarely command the resources to undertake a major research effort, and their primary interest is in where the exchange rate is likely to jump in the next few minutes, rather than what it is likely to average over the next few years. Furthermore, the relevant question is whether the authorities are less prone to being driven to extreme positions than market operators, not whether they are more accurate on average. Under these conditions, it seems that a reference rate system would again be totally appropriate.

Estimating the growth-maximizing exchange rate is a far less familiar practice than estimating the long-run equilibrium exchange rate (on which there is now a vast academic literature). This theoretical construct brings out two points. First, it reinforces the proposition that it is a policy mistake to let the market exchange rate fall substantially below the equilibrium exchange rate for a considerable period. Second, it emphasizes that it may be necessary to contemplate nonmonetary measures to increase the exchange rate. It would be good to know a lot more, and Aguirre and Calderon (2006) begin to take matters forward. They find that the growth-maximizing exchange rate is typically somewhat more competitive than the equilibrium exchange rate. Their estimate is that a moderate undervaluation, of up to about 12 percent, is likely to lead to a faster growth rate than the equilibrium exchange rate would generate, so presumably their implicit estimate of the growth-maximizing exchange rate is about 6 percent higher than the equilibrium rate. They are pessimistic about the feasibility of finding policy actions that will sustain an undervaluation of that size, but that is another issue.[5]

5. My own candidate would be the imposition of additional taxation on interest earnings by a foreign resident.

4. Conclusions

This paper has made several points. First, the current fashion in the profession for clean (that is, unmanaged) floating exchange rates rests on an empirically erroneous model. A behavioral model in better accord with the stylized facts suggests that a systematic policy of sterilized intervention can limit the misalignments to which floating rates are subject. Second, the maintenance of a sufficiently competitive exchange rate to ensure the continued growth of nontraditional exports is vital to the long-run growth rate; this accentuates the importance of preventing misalignments involving a very low exchange rate. However, changing the equilibrium exchange rate to bring it more into line with the growth-maximizing rate in the event of a discrepancy is likely to require non-monetary tools like restrictive fiscal policy, controls on capital imports, accumulation of foreign assets, altering the currency composition of foreign borrowing, and the imposition of taxes on traditional exports or additional taxes on interest earned by foreign residents. Finally, good measures of the growth-maximizing exchange rate are not yet available, and very few studies explore the policy measures that might be able to influence the equilibrium rate if it diverges from the growth-maximizing rate. One possibility that deserves examination is a tax surcharge on interest income earned by foreign residents.

Although the central bank does not command instruments adequate to avoid overvaluation, it should not be indifferent to a major misalignment. The central bank has an important role in deciding the range of policies that a country adopts, and intervention provides a crucial tool until other instruments are brought into play. Central banks need to concern themselves about misalignments and especially overvaluation.

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Current Account Deficits: The Australian Debate

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Large and persistent current account deficits are frequently raised as a cause for concern for a number of reasons. Perhaps the key concern is that countries in this situation could be on a path to insolvency, building up excessive net foreign debt, raising the prospects of default or a sharp reversal in capital flows, which might force an abrupt and costly adjustment.[1] Large deficits and rising indebtedness could also leave countries more vulnerable to adverse external shocks, including a change in sentiment on the part of foreign creditors. Some argue that policymakers should take steps to ensure that countries move toward a sustainable position in which the current account deficit is not so large that it will lead to an excessive build-up in foreign indebtedness.

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1. Milesi-Ferretti and Razin (1996) provide a thorough discussion of solvency (when the intertemporal budget constraint is satisfied) and sustainability (whereby the current account deficit is small enough that net foreign liabilities do not rise as a share of GDP). Optimality, by definition, will satisfy solvency, but it will not necessarily satisfy sustainability.

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At the other extreme is the argument that as long as markets are efficient, current account deficits reflect the optimal decisions of borrowers and lenders. Therefore, policy intervention to reduce deficits is not only unwarranted, but could reduce welfare. Moreover, policies that attempt to rein in deficits may be ineffective, while policies to improve market efficiency and enhance welfare could lead to higher current account deficits.

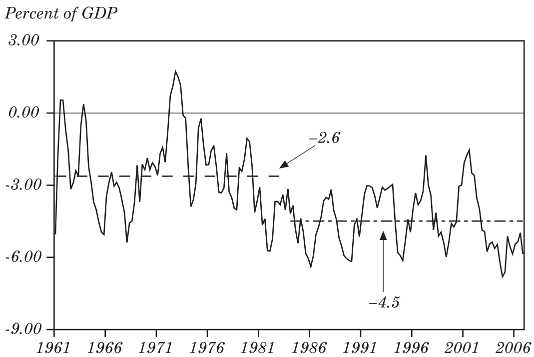
Because Australia has a long history of sizeable current account deficits, it makes an interesting case study of these issues. This paper documents the clear change in the general view in Australia over the past three decades concerning the current account balance as a policy objective, highlighting issues related to solvency, sustainability, optimality, and vulnerability. This period is also interesting because it spans the transition from a fixed exchange rate regime with stringent capital controls and a heavily regulated financial system, to a flexible exchange rate regime with an open capital account and liberalized financial markets.

Figure 1 shows Australia's current account balance and some related macroeconomic developments since the 1960s. A shift to larger sustained current account deficits is noticeable around the early 1980s, with the average increasing from 2.6 percent to 4.5 percent of gross domestic product (GDP). Most of this rise can be accounted for by a drop in the saving rate, rather than a rise in investment. This change was sustained in the face of a sizeable turnaround in the fiscal position (public sector debt reached a little over 30 percent of GDP in the early 1990s and has declined to around zero currently) and a large depreciation of the real exchange rate (of around 30 percent between the mid-1970s and mid-1980s). Net foreign debt rose rapidly from around 6 percent of GDP at the beginning of the 1980s to over 30 percent by the mid-1980s (which partly reflects the effect of the depreciation on foreign-currency-denominated debt); it has since risen to about 52 percent. The profile of total net foreign liabilities is not quite as steep, with net foreign equity liabilities flat for much of the period and lower since the late 1990s.[2]

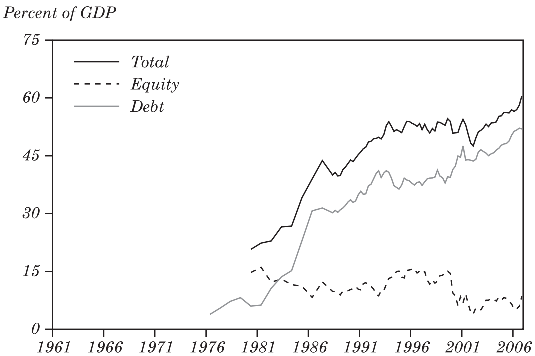
2. Gruen (2005) discusses the evolution of the current account deficit in Australia and compares the case with selected economies. Data compiled by Lane and Milesi-Ferretti (2006) show that Australia is one of five OECD countries with an annual average current account deficit of greater than 4.0 percent (relative to GDP) since the late 1980s, along with Greece, Iceland, New Zealand, and Portugal. These and other OECD countries experienced peak deficits on an annual basis of around 9.0 percent or higher, compared with a peak of 6.2 percent for Australia in 2004. These countries also have higher net foreign liabilities (relative to GDP) than Australia.

Figure 1. The Current Account Balance, Debt, and Other Indicators[a]

A. Current account balance



B. Net foreign liabilities



C. Saving and investment

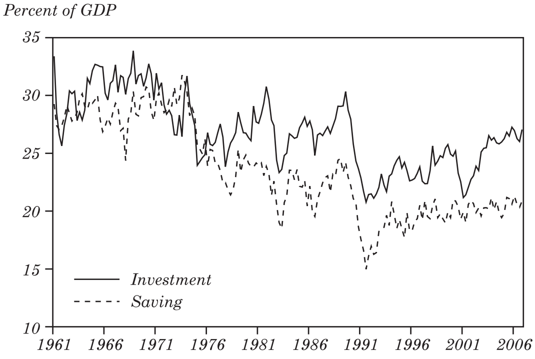
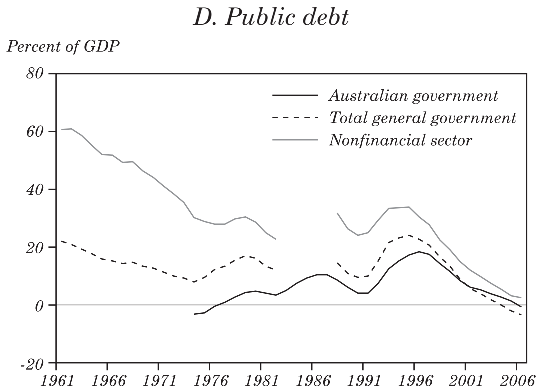
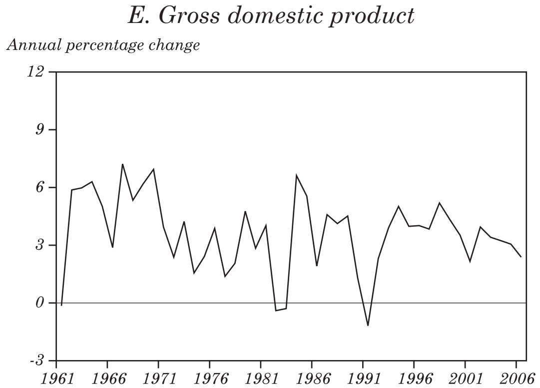
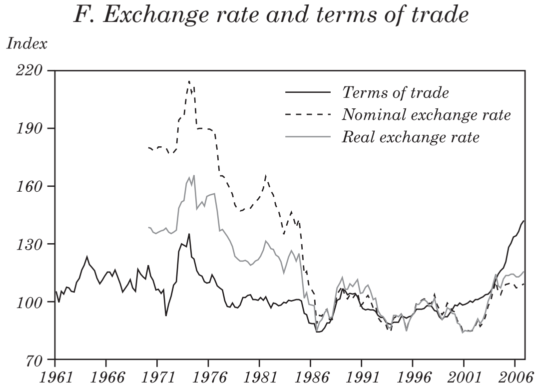


Figure 1. (continued)







Source: See appendix B.
a. Current account averages are shown for 1960 to 1983 and for 1984 to June 2006. The terms of trade and exchange rate are indices with a postfloat average of 100 (the latter are on a trade-weighted basis). Annual GDP is in calendar years.

From the early 1970s to December 1983, when Australia had a fixed (and later managed) exchange rate regime, current account deficits were a cause of policy concern to the extent that they were not matched by capital inflows and hence needed to be funded out of foreign exchange reserves. The more general and growing concern, however, was the problem of managing a partially fixed exchange rate while pursuing monetary policy goals with an increasingly open capital account. These pressures contributed to the complete opening of the capital account and floating of the exchange rate in December 1983. (Debelle and Plumb, 2006).

The view that policy could and should do something to address large current account deficits and the build-up of external liabilities persisted after the move to the flexible exchange rate. Indeed, the rapid build-up of external liabilities in the mid-1980s heightened concerns about excessive and persistent deficits, in part reflecting the fact that policymakers could no longer rely on capital controls to rein in the current account. The key strategy to address this was fiscal consolidation, together with a number of other structural policies aimed at improving international competitiveness. While such policies had the stated objective of lowering the current account deficit, such pronouncements may have also played a useful rhetorical role in support of fiscal and market reforms. Of course, the usefulness of these warnings would have waned with the realization that despite determined attempts, the trend current account deficit had recorded no reduction.

Monetary policy, it was hoped, could also play a role through its influence as a short-term demand management device. Under the checklist approach to monetary policy in place from the mid-1980s, the balance of payments was listed explicitly as an important factor to guide policy decisions, and there were frequent references to the need to rein in sizeable current account deficits.

By the end of the 1980s, several Australian academics were arguing that policy should not attempt to influence what they perceived to be the outcome of optimal decisions by private agents. Within the Reserve Bank of Australia, a debate took place regarding the value of having the current account deficit as an explicit objective, as evidenced in various published statements. Even so, large current account deficits in the late 1980s were seen to be a symptom of excess domestic demand pressures, and, at least in that sense, they were something to which monetary policy could usefully respond.

The so-called consenting adults view was gradually taken up by policymakers in public statements from the late 1980s onward.[3]

It is now widely argued that the current account balance need not, and cannot, be an objective for macroeconomic policies. Nor is it seen by itself as a reliable indicator of vulnerabilities. Australia's experience is particularly relevant in this regard, given its experience with large fluctuations in the exchange rate and sizeable foreign debt, much of it intermediated through the banking system. The floating exchange rate has been an important means of adjusting to external shocks, and it provides a mechanism by which Australia's external position is subject to continual reassessment by the markets. The fact that Australia has managed to sustain investors' confidence is evident in the maintenance of the current account deficit at an average of 4.5 percent of GDP over two decades, combined with a real exchange rate that shows no discernable trend over the same period.

The remainder of the paper is structured as follows. Section 1 provides a brief history of Australia's current account and incidence of capital reversals going back as far as the 1850s. Section 2 steps through the various stages of the debate about the role for policy in stemming large current account deficits in Australia. Section 3 briefly discusses some empirical evidence relevant to the optimality and sustainability of the current account in Australia. In Section 4, we discuss the issue of external vulnerabilities in the context of a range of structural features of the Australian economy. Section 5 concludes.

1. The History of Australia's Current Account

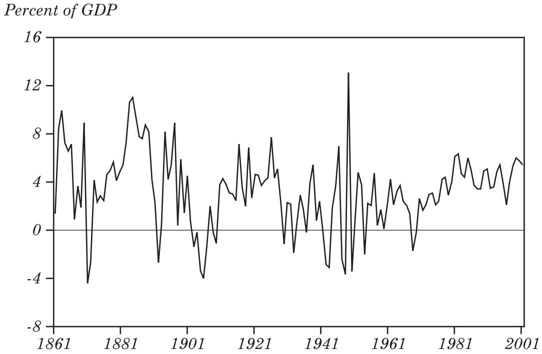
Australia has recorded sizeable current account deficits in almost every decade for at least 150 years (see figure 2). One of the chief concerns associated with large and persistent current account deficits is that they might increase the prospects of a sharp reversal in capital flows, requiring costly adjustments to domestic economic activity.4 Sharp reversals in capital flows have not been a regular—and certainly not a recent—feature of the Australian experience, however, and there have been no instances of default on Australian public debt.

3. This view is also known as the Pitchford thesis in Australia, though had an earlier origin with Corden (1977). It is termed the Lawson doctrine in the United Kingdom, where it can be traced back to Congdon (1982).

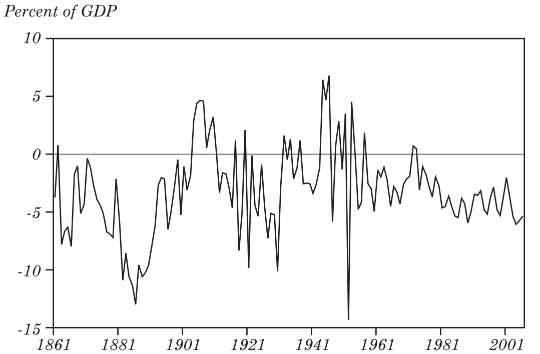
4. For evidence on this issue, see Edwards (2004) and Bordo and Eichengreen (1999).

Figure 2. Australia's Capital and Current Account Balances[a]

A. Capital account balance



B. Current account balance



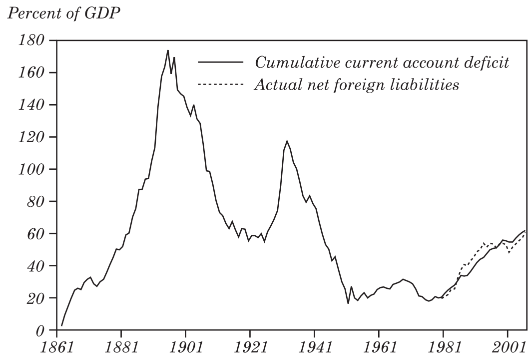
Source: ABS; Foster (1996); Vamplew (1987).
a. Annual data.

Nevertheless, the economy has undergone two episodes of rapid and unsustained rises in net foreign liabilities, the unwinding of which were associated with depressions in the 1890s and 1930s.[5]

5. The 1871 reversal appears to have reflected a decline in overseas investors' confidence, associated with the collapse of prices of gold mining shares. Confidence was restored fairly quickly, however, with these mining companies paying hefty dividends in the few years immediately following (Blainey, 1963). During the few years either side of 1910, Australians had difficulty raising funds offshore. Foreign investors had lost confidence in Australia's economic prospects, since Australia experienced a drought and a decline in its terms of trade at a time when the distress of the 1890s was still a fresh memory. The reversal in net capital inflows in 1951 was not due to a withdrawal of capital, but reflected a sizeable temporary increase in export earnings associated with a spike in prices received for exports of wool (and to a lesser extent metals) at the onset of the Korean War.

These episodes are illustrated quite starkly in figure 3, which shows the cumulated current account deficit (as a share of GDP). This measure can provide a reasonable approximation to net foreign liabilities to the extent that valuation effects are small and real GDP growth tends to reduce any past discrepancies over time. This appears to be the case in Australia given that after 120 years, the cumulative measure matches the first available direct estimate of net foreign liabilities very closely.

Figure 3. Cumulative Current Account Deficits[a]



Source: ABS; Foster (1996); Vamplew (1987); authors' calculations.
a. Annual data.

Large capital inflows in the 1870s and 1880s pushed up net foreign liabilities to very high levels (over 150 percent of GDP). These inflows helped to fuel substantial growth in lending by financial institutions, much of which found its way into the property market (Fisher and Kent, 1999). The collapse of property prices in the early 1890s coincided with more than half of the trading banks of note issue suspending payments (with around 60 percent of these eventually closing their doors permanently) and a large number of nonbank financial institutions failing. Deposits in many of these trading banks were effectively frozen for years while the government enforced reconstruction of these institutions. Most deposits were repaid between 1893 and 1901, but in some cases deposits were not repaid until as late as 1918. Not surprisingly, overseas investors took flight during the 1890s, and their full confidence was not restored until the 1910s. The aggregate data imply that large capital inflows were restored by the second half of the 1890s, but this appears to reflect large direct flows to fund mining ventures and related investments associated with the 1890s gold rush in Western Australia (Merrett, 1997).

The availability of foreign capital in the 1890s was also affected by turmoil in global financial markets. Barings, the large London discount house, suffered a liquidity crisis in the 1890s, in part owing to its financial exposures in South America. This generated concern about all offshore exposures, and it became difficult for Australians to raise funds in London at this time. London remained the main source of offshore funds even into the 1920s. Australia was virtually cut off from long-term borrowings in London from the late 1920s onward, as money flowed into the New York stock exchange instead (Royal Commission on Monetary and Banking Systems in Australia, 1937, paragraph 114).

Fisher and Kent (1999) argue that for Australia the 1930s depression was somewhat different from the depression of the 1890s. The banking sector was relatively healthy in the run-up to the 1930s depression, having taken a more conservative approach to lending in the boom years of the 1920s. Net foreign liabilities (relative to GDP) peaked at a much lower level than in the 1890s (according to the indirect estimate presented in figure 3). Only three financial institutions had cause to stop payments in the 1930s depression, and none of these were trading banks. Foreign capital dried up after the 1929 stock market crash, but the capital flight seen in the 1890s episode was not repeated. Even so, concerns about economic weakness, combined with a reduction in foreign exchange reserves, underpinned a devaluation of the exchange rate in late 1930—despite initial resistance by the trading banks, which kept interest rates high earlier in the year. Thereafter, the current account returned to rough balance, reflecting a combination of factors including the decline in activity, the exchange rate devaluation, and an increase in trade protection.

A key development of the 1930s episode was the lengths to which the Australian government went to avoid default, especially on debt held by foreigners (Caballero, Cowan, and Kearns, 2004). From April to June 1931, the government of the largest state, New South Wales, did not fully meet interest due on foreign debt. The Australian government and the Commonwealth Bank made good on these payments, however, to protect the ratings of Australian governments (with compensating reductions in revenue payments made to New South Wales by the Commonwealth). More generally, the Australian and state governments cut expenditure, raised taxes, and cut bank interest rates and interest paid to domestic holders of debt to ensure adequate funds for the payment of foreign debts. Australia thus maintained an unblemished record with regard to foreign holders of debt.

Foreign capital inflows were largely curtailed during World War II and were tightly controlled thereafter by a comprehensive system of controls introduced as emergency measures during the war.

Debelle and Plumb (2006) document a number of episodes of capital flight in the 1970s and early 1980s. These tended to be short-lived events based on the speculation of devaluations in the context of the fixed and, later, crawling peg exchange rate regimes.[6] However, the overarching pressure over this period was the tendency for sizeable capital inflows (with an increasingly open capital account), which made it difficult to achieve the goal of internal balance. This tension eventually led to the floating of the Australian dollar in December 1983 and a complete liberalization of the capital account.

A significant feature of the years following the floating of the exchange rate was a sustained widening in the current account deficit and the consequent rapid accumulation of foreign debt, which more than doubled between 1984 and 1989. As early as 1984, the Secretary to the Treasury, John Stone, expressed concern that a default elsewhere in the world would harm Australia as international financial markets took flight to quality (Stone, 1984, p 8). Argentina came close to default a number of times in 1984, and Stone suggested that lessons could be drawn from the 1890s experience, when poor returns from offshore investments in South America, particularly Argentina, spilled over into foreign investor concern about investing in Australia.[7]

The rise in the current account deficit from 1985 to 1986 partly reflected a fall in the terms of trade and the associated depreciation of the exchange rate (of around 50 percent in nominal effective

6. Heavy outflows occurred in the week leading up to the federal election in March 1983. After the election, the exchange rate was devalued by 10 percent, contributing to the perception that speculators could precipitate significant exchange rate adjustments. Speculative inflows also occurred in anticipation of revaluations, particularly toward the end of 1983.

7. Other pieces written in the 1980s are less alarmist (Jonson and Stevens, 1983; Johnston, 1987), acknowledging both similarities and differences between the 1980s and the 1930s. In terms of overseas borrowings, foreign debt as a percent of GDP was higher in the 1930s than the 1980s, as was the burden of servicing this debt as a share of export receipts. While capital inflow dried up in the 1930s, the 1980s recorded significant capital inflow.

terms over this period).[8] Combined with the rise in foreign debt, this led the Treasurer at the time, Paul Keating, to warn of the risk of Australia becoming a banana republic and underpinned continued reform efforts. The banking sector underwent further deregulation, a process that had started in the late 1970s. Controls on lending to businesses and households were largely removed, and access to international capital markets was facilitated. Industrial reforms were also implemented in an effort to make Australian industry more internationally competitive. A key aspect of this process was the Prices and Incomes Accord (an agreement between the government and trade unions), which had the dual aims of containing domestic inflation and improving international competitiveness (Chapman and Gruen, 1990). A further reduction in tariffs on imports and other barriers to trade (following an across-the-board cut in tariffs of 25 percent in 1973) was another important change.

The large depreciation that followed the floating of the exchange rate helped improve the competitiveness of domestic firms and insulated them from the reduction in trade barriers. However, the depreciation did not generate inflation to the extent that might have been expected under the old fixed exchange rate regime (in part owing to the impact of the Prices and Incomes Accord), and it proved to be stimulatory in the face of the declining terms of trade (Debelle and Plumb, 2006).

Australia also provides evidence of the potential for changes in the supply of capital to influence the current account. The removal of capital controls with the floating of the exchange rate allowed foreigners desiring to invest in Australia to bring in capital, and to some extent the economy and the current account adjusted to absorb this inflow of capital. An episode in the late 1990s also illustrates this general point. At the height of the global technology boom, Australia was apparently viewed as an "old economy" which contributed to a sizeable depreciation of the exchange rate that was not matched by a change in the terms of trade (Macfarlane, 2000). The trade balance moved from a deficit of about 2.5 percent of GDP in 1999 to a surplus of 0.5 percent by 2001, with a commensurate turnaround in the current account deficit.[9]

8. Because the depreciation raised the Australian-dollar values of debt denominated in foreign currency, it generated a widening of the net income deficit, which accounted for roughly three-quarters of the widening seen in the current account deficit at this time.

9. Dvornak, Kohler, and Menzies (2003) provide estimates regarding the relationship between the current account deficit and the exchange rate in Australia.

The question of resiliency in the face of large external shocks and exchange rate volatility is taken up again in section 4 of the paper. In the next section, we focus on the evolution of the debate about the need for monetary and fiscal policies to respond to large current account deficits.

2. The Australian Policy Debate

The policy debate in Australia occurred against a backdrop of changing views about the macroeconomic framework, particularly in an open economy context. There were three broad aspects to this. First, there was a general realization that demand management should be directed toward the control of inflation over the medium term and that this was the best way to support employment, which would be determined in the longer run according to a vertical Phillips curve. Second, in a world of internationally mobile capital and flexible exchange rates, there was no longer a balance-of-payments problem per se, but concerns about vulnerability to external shocks and long-run solvency remained. Third, Mundell-Fleming models (and later, more sophisticated variants) highlighted that monetary policy is well suited to controlling inflation in an environment of flexible exchange rates (via its affect on aggregate demand), though fiscal policy was relevant to questions of international solvency.[10]

2.1 An Evolving Policy Framework: The Late 1980s

Through the mid-1980s, under the fixed exchange rate, current account deficits were a cause of concern for policymakers to the extent that large deficits made it difficult to achieve the goals of internal and external balance. These deficits needed to be financed out of net capital flows and foreign currency reserves, while large swings in net capital inflow could hamper policymakers' efforts to contain growth in domestic liquidity. These particular difficulties were largely removed with the float of the Australian dollar, not the least because policymakers regained control over the setting of domestic interest rates. By the

10. Discussions of these and related issues include Grenville (1997), Gruen and Stevens (2000), Horne (2001), Gruen and Sayegh (2005), and Macfarlane (1999, 2006b). In an early case for flexible exchange rates, Friedman (1953) suggests that monetary policy should be directed away from external balance and that an exchange rate depreciation need not produce inflation.

mid-1980s, large current account deficits were becoming the norm, and the Australian-dollar value of foreign debt was growing rapidly. At this stage, there was less concern regarding the implications of the deficit for the implementation of policy, and the current account deficit became an objective of policy in its own right.

At the heart of this concern was the widespread sense that the pace of foreign borrowing was unsustainable. Policymakers feared that it could ultimately impose a constraint on economic growth, and in the meantime, the domestic economy would become more susceptible to the vagaries of international investors while debtors would face higher borrowing costs. This view gained further credibility when the credit rating agencies downgraded Australian Commonwealth debt (Gruen and Stevens, 2000). It was at this time, in 1986, that the Australian Treasurer, Paul Keating, made his famous banana republic remark. The reaction in the markets to this comment was probably greater than the reaction to the downgrades themselves.

The current account deficit was clearly not the only problem facing the Australian economy. Inflation, which had risen at the time of the first oil price shock, persisted at a relatively high rate into the 1980s. Improving Australia's international competitiveness through tariff reduction and the dismantling of other protectionist measures was also deemed necessary. Notwithstanding efforts to reduce tariffs in the 1970s, Australia's legacy of protectionist policies was being blamed in part for the emergence of the balance-of-payments problem.

In the 1980s, the fiscal authorities took a lead role in setting policies relevant to the current account. In line with the twin deficits argument, a key strategy was fiscal consolidation aimed at reducing the call on foreign funds by the public sector.[11] Restrictive fiscal policy was also expected to ultimately allow an easing in domestic interest rates. Reforms to improve international competitiveness were introduced, including the phased reduction in trade barriers and the continuation of the Prices and Incomes Accord to restrain wage growth. As already mentioned, the prominence given to the current account throughout this period may have partly reflected its usefulness as an argument to pursue other worthwhile reforms (Edwards, 1996). The value of such a strategy eventually weakened, however, as it became increasingly apparent that policy was ineffective at reducing the trend in the current account deficit.

11. See Gruen and Sayegh (2005) for a discussion of Australian fiscal policy since the 1980s.

As the more flexible tool, monetary policy was to be directed to general demand management, such as containing cost and price pressures and ensuring stability in financial markets, until other policies had time to take effect. It was also hoped that restrictive monetary policy would reduce the demand for imports, thereby contributing to a rise in the trade balance (Commonwealth of Australia, 1988, pp. 43, 53). The rest of this section outlines monetary policy's role in the response to the current account deficit.

The role carved out for monetary policy in the second half of the 1980s was highly ambitious. The belief that monetary policy should be guided by a single quantity was called into question toward the end of the monetary targeting period of 1976–85, particularly after financial deregulation when the already tenuous relationship between monetary aggregates and inflation broke down (Johnston, 1985, p. 811). In its place, the Reserve Bank of Australia instituted a checklist approach, which included "all major economic and financial factors—present and prospective" (Johnston, 1985, p. 812). Among other things, the balance of payments was listed as an explicit factor and was given a high weight in monetary policy settings (see the Reserve Bank of Australia's annual reports in the second half of the 1980s).

With the floating exchange rate, policy needed to be mindful of the effects that the exchange rate could have on inflation and Australia's international competitiveness, as well as the potential feedback from interest rate settings to exchange rates (Grenville, 1997; Macfarlane, 1991). These factors, along with more general concerns about stability in financial (and exchange rate) markets, variously influenced policy. Nonetheless, the Reserve Bank believed it could operate policy as a "potent demand management tool" (Reserve Bank of Australia, 1989, p 7), with inflation and current account deficits being symptoms of excess demand.

Over this period, however, there was a growing sense of dissatisfaction by the authorities with what monetary policy could achieve. While it was thought that higher interest rates could reduce import demand and therefore the current account deficit in the long run, the short-term effects were less clear and could even operate in the opposite direction if higher interest rates produced an exchange rate appreciation. It was always believed that the other arms of government policy—namely, fiscal restraint and microeconomic reforms—were more effective tools for bringing about a lasting reduction in the deficit, and the Reserve Bank came to question whether monetary policy was able to contribute to the adjustment process at all.

Toward the end of the 1980s, persistent high inflation increasingly became the Reserve Bank's main focus, though the current account deficit still rated a mention in policy discussions.12 This shift in focus also reflected evolving views within the Bank about the appropriate policy framework. The emerging view was that the single instrument of monetary policy could only be effectively directed to a single target, namely, inflation (Macfarlane and Stevens, 1989, p. 8; Phillips, 1989). It was believed that "monetary policy can best contribute to a sustainable external position in the same way that it can best contribute to overall growth, namely, by providing an environment of low inflation" (Reserve Bank of Australia, 1991, p. 4). By early 1993, the Reserve Bank had adopted a flexible inflation-targeting framework and shifted the policy time horizon from relatively short-term demand management to a medium-term objective of containing inflation (Stevens, 1999).

By the end of the 1980s, it was apparent that no permanent reduction in the current account deficit had been achieved despite the concerted efforts of policymakers. The current account deficit was back to 6 percent, roughly around the level that sparked concern in the first place. This was despite an impressive turnaround in the Australian government's annual budget position of around 5 percentage points of GDP between 1983/84 and 1988/89 (reflecting both fiscal restraint and strong growth) and significant microeconomic reform. The fact that these policies had had no (persistent) effect on the current account lent weight to the emerging view of academia.

2.2 The Challenge from Academia

In the second half of the 1980s, Australian academics began to debate whether the current account deficit was an appropriate target of macroeconomic policies and whether the view that the deficit was unsustainable was correct. This debate was led by John Pitchford, although the so-called Pitchford thesis—or consenting adults view, as it is commonly known in Australia—can be traced back to Max Corden, (Corden, 1977).[13]

The Pitchford thesis rests on the understanding that the current account balance is the net result of investment and saving decisions

12. Treasurer Paul Keating reflects this sentiment in his 1988–89 budget speech: "while the balance of payments deficit is Australia's number one economic problem, inflation remains Australia's number one economic disease" (Keating, 1988, p. 4).

13. Makin (1988) also made an early contribution to the debate.

made by agents within the economy (Pitchford, 1989a, 1989b, 1990). If these decisions are made optimally, then any resulting current account deficit (or surplus) cannot be considered a cause for concern. After all, a deficit merely represents households deciding to consume now rather than later and firms deciding to take advantage of profitable investment opportunities in Australia. These decisions are optimal and therefore welfare maximizing. The households and firms have made these decisions with every expectation that they will have the capacity to repay, and the foreign investors lending the money are obviously of the same mind. The deficit, therefore, is the result of decisions between consenting adults. At the time these arguments were being aired, the Australian government was running a budget surplus and the public sector borrowing requirement was low, so the current account deficit could largely be considered the outcome of private decisions.

The Pitchford thesis fundamentally countered established thinking on the current account deficit—that is, the notion that large current account deficits are always unsustainable or can ultimately impose a constraint on growth. Rather than imposing a constraint on growth, a current account deficit represents a means of taking advantage of profitable investment opportunities, thereby raising potential growth. Capital flows into Australia are presumably the result of foreign investors seeking high returns, benefiting both the borrowers and lenders in the process.

The key message from Pitchford and others was that macroeconomic policies had no role in responding to current account deficits and that current policies aimed at reducing the current account deficit might be severely misplaced. If the government had any role at all in addressing the current account deficit, it would be to remove distortions and externalities adversely affecting the decisions of private agents. Even then, the first-best solution would be to use microeconomic-based policies to remove the identified problems at their source.[14]

The rationale behind existing policy strategies was also challenged. The twin deficits argument—on which the fiscal consolidation strategy was seemingly based—was convincingly refuted, as it assumes that private behavior will not change in response to changes

14. While the government undertook a lot of microeconomic reforms in the 1980s, Pitchford (1989b, p. 2) claims that the relevant microeconomic policies were largely not being considered.

in government behavior (see, for example, Argy, 1990). This does not imply that fiscal consolidation is inappropriate, but rather that it would not necessarily reduce the current account. The argument that microeconomic reforms would necessarily lead to a reduction in the current account deficit was also disputed. Such reforms might make markets operate more efficiently, but does that mean agents would invest more or less? Save more or less? This ambiguity led to the view that microeconomic reform, while worthwhile for its own sake, should not be pursued in order to influence the current account. Otherwise, policymakers might not undertake reforms that are likely to lead to an increase in the current account deficit but are otherwise beneficial (Pitchford, 1989c, p. 11).

2.3 The Response

Not all academics and policymakers sided with Pitchford in his thinking, particularly with regard to the hands-off approach. Some questioned the new framework and viewed it as untested, instead suggesting that policy should be based on the more established way of thinking (see, for example, Nguyen, 1990). Most arguments, however, did not question the framework, but rather emphasized practical considerations (see, for example, Corden, 1991). First, private agents are not always able to make optimal decisions. Distortions and externalities interfere with incentives and provide a rationale for policy intervention. Moore (1989) argued that history provided plenty of examples of excessive borrowing by nations that had ended in a debt crisis. Second, an agent's decision that leads to an increase in external debt may impose costs on other borrowers in the form of higher interest rates stemming from the imposition of a risk premium applying to the country as a whole. Third, the economy was at risk of an adverse swing in sentiment of foreign investors, possibly resulting in a sharp and severe adjustment process. In this case, it would be preferable to undertake some adjustment preemptively through appropriate restrictive policy settings (Argy, 1990).[15]

While these counter arguments have valid elements, they often are not concerned with the current account deficit per se, but see it as a symptom of another underlying problem. The appropriate

15. Argy (1990, p. 79), who at the time was the director of the Economic Planning Advisory Council, suggested that this view was shared "by many of us in Canberra."

policy response, then, is to address the underlying problem, be that overspending or the distortions and externalities themselves.[16]

Policymakers started to acknowledge the intellectual weight of the Pitchford thesis in the late 1980s. In September 1989 and again in June 1990, the Deputy Governor of the Reserve Bank of Australia, John Phillips, gave credence to the Pitchford argument, stating that the balance of payments was a reflection of the "community's attitudes to savings, consumption, investment and debt" (Phillips, 1989, 1990), and the current account deficit was therefore not an appropriate target of monetary policy. Instead, the appropriate role for monetary policy was controlling inflation, and the Reserve Bank's stated concern that the current account deficit was unsustainable started to wane. A few years later, the government also expressed the view that monetary policy should not be used to target the current account (see, for example, Commonwealth of Australia, 1991, p. 2.33).

The Australian government acknowledged the broader implications of the Pitchford thesis in the early 1990s, but it had reservations about how well it would apply in practice, in line with many of the arguments outlined above (see, in particular, Commonwealth of Australia, 1991, p 2.36).[17] While strategies such as microeconomic reform and fiscal consolidation were important in their own right (and for broader goals such as raising national saving), they were continually framed as strategies to address the current account deficit problem.[18]

Likewise, the Reserve Bank at this time did not entirely accept the view that the current account deficit should not be a concern at all. It was deemed to be "a medium-term problem," at which horizon deficits of around 5–6 percent probably were not sustainable (Fraser, 1994, 1996). Since 1996, the current account deficit has no longer featured as part of the monetary policy debate. In 2004, the Deputy Governor, Glenn Stevens, restated the Reserve Bank of Australia's view as follows: "whether the current account deficit should be a target of any policy is not obvious—it would need to be argued. But

16. Responses to other arguments can be found in the many papers that constitute this debate (see, for example, Corden, 1991; Pitchford, 1989a).

17. The broader community feeling was that the deficit should be regarded as a concern, and this led the government to initiate a formal enquiry in October 1991 into the causes and consequences of Australia's current account deficit and overseas debt (Langmore, 1991).

18. Many of these issues were also raised in the government-commissioned Fitzgerald (1993) report, which outlines a strategy for improving national saving, in part to help reduce Australia's current account deficit.

whatever one's view on that question, the current account is not, and should not, be an objective of monetary policy" (Stevens, 2004, emphasis in the original).

The dissenting voices to the Pitchford view—in both academia and policy institutions—have now largely disappeared from within Australia. If concerns are raised, they generally herald from international organizations, such as the Organization for Economic Cooperation and Development (OECD) or the International Monetary Fund (IMF), in their assessments of the external vulnerabilities facing Australia.

2.4 External Recommendations

The IMF and the OECD have made regular assessments of the Australian economy since at least the early 1980s. Reports from the IMF, however, have only been publicly available since the mid-1990s. The OECD in the 1980s concurred with Australian authorities that the country's current account deficit and external debt position were unsustainable and that such concerns needed to be the overriding priority of policy (OECD, 1987). The organization recommended reducing public sector debt and improving Australia's international competitiveness (see, for example, OECD, 1984, pp. 50–51; also see various issues of OECD Economic Surveys for Australia for the 1980s and 1990s). With regard to the latter recommendation, the OECD pointed in particular to a need for real wage moderation and reduced trade protection. In the areas of fiscal policy, the OECD acknowledged that the Australian government had made substantial progress in reducing its deficit, but pressed for greater efforts by state and local governments.

OECD concern regarding Australia's current account deficit moderated in the 1990s. The OECD describes the current account deficit as sustainable in view of current government policies (OECD, 1994), but the OECD raised concerns throughout the 1990s about the potential for high external debt to affect credit ratings and increase external risks. The latest OECD report, however, presents a more sanguine view (OECD, 2006). The IMF reports from 1995 onward describe Australia's net external debt position as sustainable and the external risks as manageable, but recommend that Australia's external debt position requires continued careful monitoring. These IMF reports often attribute weight to either the narrowing or widening that had been recently observed in the current account deficit, without always appreciating that most of these movements are part of a standard cyclical pattern around a longer-term average.

Since the Asian crisis, IMF staff have stressed the potential risk from a shift in market sentiment, particularly considering that around one-half of Australia's foreign debt has a relatively short maturity. The IMF has a standard set of external vulnerability indicators that they use for a variety of countries in assessing external risks. Over time, the IMF has acknowledged that the one-size-fits-all approach fails to recognize some special factors relevant to the Australian situation, such as the fact that the external debt is denominated in Australian dollars or hedged, that private balance sheets are in a strong position, and that the Australian economy has proven to be relatively resilient to large adverse domestic and external shocks, including through the operation of the flexible exchange rate regime.

3. Optimality and Sustainability: An Empirical Assessment

The intertemporal approach to the current account forms the foundation of Pitchford's view of the current account (Pitchford, 1989a, 1989b, 1990). Several studies use the methodology developed by Campbell (1987) and Campbell and Shiller (1987) to test whether Australian current account data support the intertemporal model, with mixed results. Milbourne and Otto (1992), reject the intertemporal model using quarterly data, while Cashin and McDermott (1998) and Otto (2003), who use annual data, and McDermott (1999), who uses quarterly data, find supportive evidence, but only after 1975, 1980, and 1991, respectively. Bergin and Sheffrin (2000) extend the intertemporal model to account for external shocks by allowing the interest rate and exchange rate to vary. They find that this improves the fit of the model by better capturing volatility, thereby providing support for the intertemporal model.

Following these studies, this section of the paper examines optimality through the lens of the intertemporal approach to the current account balance, with two innovations. First, in accounting for the effect of the capital market opening and financial market deregulation, we take advantage of a longer sample of data postdating these changes. Prior to these changes, net foreign debt may have been less than optimal (because consumption or investment were too low), and credit constraints may have prevented optimal consumption smoothing in the face of shocks to income. Second, we account for the fact that shocks to the Australian net cash flow (that is, output minus investment and government expenditure) may be correlated with shocks in the rest of the world and thus have a limited effect on the current account (Glick and Rogoff, 1995). That is, global shocks should lead to changes in the world interest rate, rather than in current account balances.

The full details of the model and estimation approach, along with detailed results, are reported in appendix A. In summary, we find tentative evidence in support of the intertemporal model. The current account balance appears to adjust in a way that is consistent with consumption smoothing in the face of temporary shocks to output, government expenditure, and investment. This is true, however, only in the period after financial liberalization in the early 1980s, in line with the removal of capital controls and the easing of credit constraints. We also find evidence of consumption tilting, whereby Australian residents appear more impatient than the world as a whole. This has contributed to a persistent current account deficit on the order of 4.5 percent of GDP since the mid-1980s.

It is worth considering what might justify a persistent degree of impatience and the resulting long history of current account deficits. In the case of Australia, building up the capital stock (both private and public) while maintaining a relatively high level of consumption would seem a natural outcome for a relatively undeveloped, "new" country with considerable natural wealth. This is particularly true in the case of an economy that benefits from a relatively steady flow of immigrants and institutional features conducive to sustaining a relatively prosperous and stable lifestyle.

While the estimates presented in appendix A suggest that the extent of this impatience appears relatively modest, it is not possible to test the solvency condition—that is, whether the intertemporal budget constraint has been satisfied. Indeed, as Milesi-Ferretti and Razin (1996) note, it is difficult in practice to determine whether a country running persistently large current account deficits is solvent at any given time. The more feasible test is to examine the sustainability of the situation—that is, to determine the level of trade surplus, and hence also the current account balance, required to stabilize the level of net foreign liabilities (relative to GDP) given plausible assumptions about output growth and the costs of servicing net foreign liabilities. A number of studies have undertaken this type of exercise for Australia. For example, Gruen and Sayegh (2005) find that an average goods and services trade surplus of around 0.50 to 0.75 percent of GDP can sustain foreign liabilities at a ratio of 60 percent, whereas Australia has actually run a deficit on the trade account of 1.5 percent of GDP, on average, since 1980. Alternatively, if the trend current account balance (of about 4.5 percent of GDP since 1984) were to be sustained, net foreign liabilities would eventually stabilize around 86 percent of GDP (assuming average growth of nominal GDP of 5.5 percent per year).

Such calculations, however, do not consider what sort of changes would be needed to bring about the turnaround in the trade balance and the associated reduction in the current account, or exactly when these changes need to occur. Again, this reflects the difference between solvency and sustainability: the latter is an assessment of what constitutes a stable equilibrium, while the former allows for the possibility that even higher, and potentially sustainable, levels of foreign indebtedness could be welfare enhancing.

4. Current Account Deficits and External Vulnerability

Instead of focusing on questions of sustainability, it may make more sense to consider the potential costs of large current account deficits and the associated build-up of foreign liabilities in terms of an economy's vulnerability to external shocks. This approach essentially falls somewhere in between the position that markets are always efficient and all current account deficits are therefore optimal, and admonitions that countries with large foreign debts should (gradually) reduce their dependence on foreign funds so as to avoid potentially costly adjustments in the future.

In the wake of the Mexican and Asian financial crises of the 1990s, a number of studies sought to develop models that might provide an early warning of external crises, which, by definition, imply a costly adjustment (in the form of either a deep recession associated with higher borrowing costs or a cessation or reversal of capital flows).[19] By examining time-series data across a wide range of countries, this literature attempts to find indicators that can reliably point to an increasing likelihood of an external crisis. These studies have contributed to a perceived association between large net external

19. For example, see Kaminsky and Reinhart (1999).

debt positions and external risks. Australia is a clear outlier in this context, with relatively large net external debt and persistent current account deficits, but no crises.

This approach is generally restricted to a limited set of potential indicators, and it tends to encourage a one-size-fits-all approach to assessing vulnerability, which leads analysts to treat large current account deficits and external debt as sufficient statistics for vulnerability. However, economists increasingly acknowledge the value of recognizing the role of institutional differences among countries (see, for example, Daseking, 2002). In this regard, Australia has a number of features that tend to make it relatively resilient in the face of considerable external shocks. Indeed, these features underpin the stability that encourages sizeable capital inflows in the first place. This suggests that a high debt level may not signal vulnerability, but rather reflects resilience that permits high debt to be sustained.

One feature, in particular, helps Australia to be resilient in the face of large external shocks, in spite of relatively high foreign indebtedness. Namely, foreigners are willing to participate in markets that allow Australian residents to hedge their foreign exchange exposures at reasonable cost; for instance, foreigners are willing to hold Australian debt denominated in Australian dollars. This allows the balance sheets and trading activities of domestic corporations and households (which are net foreign debtors) to withstand large, sharp nominal exchange rate fluctuations. Such markets can only evolve fully under a flexible exchange rate regime, in which frequent and often large fluctuations in the nominal exchange rate are the norm. The flexible exchange rate regime also has the advantage of providing a timely and automatic mechanism for adjusting to external shocks. It can act as a buffer, allowing shocks to dissipate rapidly across the domestic economy with a more modest impact on inflation than was the case under the fixed exchange rate regime.[20]

The development of this resilience of the Australian economy to external shocks is well documented (Caballero, Cowan, and Kearns, 2004; Becker and Fabbro, 2006; Debelle and Plumb, 2006;

20. The Reserve Bank of Australia believes occasional intervention in foreign exchange markets is desirable. The Asian crisis is one such example where intervention was used to limit downward pressure on the exchange rate, but only after the exchange rate had moved a long way, consistent with the view that depreciation was a desirable and necessary part of adjustment (Stevens, 2006).

Macfarlane, 2006a; McCauley, 2006). These studies emphasize the value of maintaining investor confidence in the face of sizeable external shocks via the following mechanisms: a robust financial system, with deep, liquid, and stable financial markets and strong financial institutions; credible and stabilizing macroeconomic policies; and low net foreign currency exposure.[21] Arguably, an element of luck and perseverance in the early stages of floating helped these markets and policies to develop. This section of the paper summarizes this literature by briefly tracing through these key features. The exercise illustrates that while many of these features have come about through a conscious effort on the part of policymakers seeking to generate resilience, others have arisen as a by-product of other pursuits or the result of learning-by-doing.

4.1 The Record on Inflation

A record of, and commitment to, low and stable inflation is necessary to keep down the cost of issuing debt. It reassures holders of debt denominated in domestic currency that the value of this will not be eroded to the benefit of issuers. In Australia, the adoption of inflation targeting by the Reserve Bank in 1993 achieved the goal of keeping year-ended inflation between 2 and 3 percent, on average, over the cycle. Caballero, Cowan, and Kearns (2004) argue that, notwithstanding higher inflation in the 1970s and 1980s, Australia has established a reputation over the past hundred years of being willing and able to maintain modest and stable inflation.

4.2 The Government Debt Market

A key factor behind foreigners' confidence in the market for Australian government debt is the fact that foreign holders have never suffered from any defaults on the debt, as discussed above. In addition, a number of changes in the early 1980s strengthened the market for government debt in Australia, apparently contributing to the take-up by foreigners of Australian-dollar-denominated debt. McCray (2000) highlights the role of financial deregulation in reducing the extent to which domestic financial institutions acted

21. Caballero, Cowan, and Kearns (2004) argue that this confidence reflects what they term currency trust and country trust. Closely related to currency trust is what McCauley (2006) describes as the internationalization of the Australian dollar.

as a captive market, thereby contributing to a rise in yields. He also points to a range of important operational changes that were made as the market moved from a highly regulated environment, with tap issuance (whereby authorities set the price) and a buy-and-hold mentality, to one of open price discovery (through auctions) and an active secondary market.[22]

As a result, more than half of Australian government debt—almost all of which is issued domestically in Australian dollars—is held offshore.[23] Foreign investors also hold debt issued by Australian state and local governments and corporations. Indeed, more than 70 percent of corporate debt is held by offshore investors, with the corporate bond market around eight times larger than the Australian government bond market. Foreign investors' interest in Australian corporate bonds has been facilitated by a liquid cross-currency interest rate swaps market, which has allowed foreign investors to accept currency risk while insulating themselves from the credit risk associated with lending to Australian firms (McCauley, 2006).

4.3 Financial Markets

Caballero, Cowan, and Kearns (2004) emphasize the importance of deep, efficient financial markets for helping to ensure that domestic residents are able to hedge foreign exposures at a reasonable cost. International comparisons suggest that these markets are relatively deep in Australia. For example, Australia's share of world output is relatively small at around 1.5 percent (making it the fifteenth largest economy), but turnover in the Australian dollar spot and derivatives markets (against the U.S. dollar) is the fourth largest in the world (BIS, 2005). The average daily turnover of the Australian dollar swaps market is A$45 billion (US$34 billion). This market is deep enough that the net derivatives position of the banking sector could be turned over more than three times a month (Becker and Fabbro, 2006).[24]

This was not the case during the era of capital controls and regulated financial institutions. Debelle and Plumb (2006) discuss the early stages of development of these markets as these controls

22. See also McCauley (2006).

23. As of June 2006, the Australian government had A$65 billion of bonds on issue, of which A$33 billion, or 52 percent, was held by offshore investors.

24. The average daily turnover of Australian dollar swaps between domestic and overseas banks is around A$25 billion (US$19 billion), or 2.8 percent of GDP, over the year to March 2005.

were eased. Australian borrowers learned about the dangers of unhedged foreign-currency borrowing early on in the postfloat period (see also Becker and Fabbro, 2006). In the mid-1980s, some borrowers took out unhedged Swiss franc loans to avoid paying much higher domestic interest rates. These borrowers made substantial losses when the Australian dollar depreciated by more than 50 percent against the Swiss franc between January 1985 and August 1986. The scale of the borrowing was relatively small, so the losses did not disrupt the economy or the banking system overall. They did, however, generate enough publicity to provide a salutary lesson to both businesses and households.

The bulk of Australia's nongovernment foreign debt is currently raised by the banking sector. These institutions are not only able to raise funds at a relatively low cost (given that they tend to be highly rated), but they are also in a good position to hedge exchange rate risks arising from these borrowings. It is thus advantageous for these financial institutions to act as intermediaries for business and household sectors, given that they can provide Australian borrowers with relatively low cost and fully hedged access to foreign funds.

As in the United States, Australian residents have a net long position in foreign currency (before accounting for hedging activities); that is, gross foreign-currency-denominated assets exceed gross foreign-currency-denominated liabilities (Becker and Fabbro, 2006). Of Australia's net external debt, around 40 percent is denominated in Australian dollars. According to a recent survey by the ABS (2005), most of the remaining net exposure is hedged, with just over one-tenth of net external debt being in unhedged foreign currency (Becker and Fabbro, 2006), which is not to say that it may not be covered by some natural hedge. Much of the hedging activity appears to have nonresidents as counterparties, thereby insulating domestic residents as a whole against unfavorable exchange rate fluctuations.

Given that currency risk does not appear to present much of an issue for Australia, attention has instead focused on refinancing risk, particularly of short-dated debt (see, for example, IMF, 2006). Much of Australia's offshore debt is issued by financial institutions, with foreign liabilities accounting for about 27 percent of Australian banks' total liabilities, compared with around 15 percent a decade ago. While debt securities make up the majority of banks' foreign liabilities, more than two-thirds of these have been issued with a term to maturity of greater than one year, with an average maturity of around four years; Australian corporations borrowing offshore tend to issue longer-dated debt. It is beyond the scope of this paper to make more than three brief remarks on refinancing risk. First, rolling over debt has not been an issue for Australia, even during periods of adverse shocks, such as the Asian crisis. Second, Australian banks have tended to issue offshore debt in a range of different markets and in a range of different currency denominations, providing some diversification against shocks that may adversely affect any one market (Reserve Bank of Australia, 2006). Third, in the event of an adverse shock, much of the adjustment would likely occur through a depreciation of the exchange rate.

4.4 Institutional Framework

Stable government with credible and sustainable monetary and fiscal policies is necessary for a country to maintain the confidence of both foreign and domestic investors. Other critical institutional features include a sound financial system based on efficient regulation and supervision, effective legal and accounting frameworks, and transparent and open markets for both factors of production and outputs. In the extreme, these reduce the likelihood of some type of expropriation of wealth or income (to the advantage of particular domestic residents), either by direct or indirect means. More generally, however, they allow countries to better withstand adverse external shocks that might otherwise harm foreign investors' interests.[25] Australia appears to rank highly on a range of indicators in this regard. For example, in 2006 Australia ranked ninth (out of 161 countries) in the *Economic Freedom of the World Index*, which attempts to systematically compare countries across the types of institutional features mentioned above.

One episode that points to the resilience of the Australian economy is the Asian economic crisis of 1997 and 1998, when demand from many of Australia's major trading partners in the region declined significantly. The nominal exchange rate depreciated in effective terms by about 20 percent from mid-1997 to early 2001, but the inflationary impact of this was relatively modest. Unlike a number of countries

25. Kent, Smith, and Holloway (2005) present evidence that structural reforms leading to stricter monetary policy regimes, greater labor market flexibility, and increased product market competition have played a role in reducing the volatility of output across a range of developed economies.

with substantial commodity exports to the region, the Reserve Bank of Australia did not tighten policy in response to the depreciation. Instead, the depreciation was viewed as a necessary part of the adjustment to an adverse shock of this type. A widening in the current account deficit—of more than 4 percentage points of GDP over the two years to mid-1999—was also an important mechanism dampening the impact of the shock on the domestic economy. Caballero, Cowan, and Kearns (2004) note that the stimulatory impact of the depreciation (including by facilitating a diversion of exports to the United States and Europe) contrasted with the experience of less-developed economies, for which the depreciation adversely affected the balance sheets of corporations with sizeable exposures to unhedged foreign-currency-denominated debts.

5. Conclusion

Australia has a long history of large and persistent current account deficits. Even so, the deficit rose considerably in the mid-1980s following the floating of the Australian dollar and the opening of the capital account. It has since been sustained around an average of 4.5 percent of GDP, with no discernable trend in the real exchange rate. This shift in the 1980s contributed to a rapid rise in net foreign debt, and the current account deficit became a key object of policymakers in its own right. The chief concern was that such deficits raised the prospects of default or a sharp reversal in capital flows (or both). In other words, policymakers feared that the deficits were not sustainable, implying potentially disruptive adjustments in the future, and that they left the country more vulnerable to adverse external shocks (including a change in sentiment by foreign creditors). Hence, it was argued that all arms of policy, in both macroeconomic and microeconomic spheres, should and could attempt to reduce the current account deficit.

This view was challenged by those who argued that the current account merely reflected the optimal decisions of private agents and that for this reason, concerns about sustainability were misplaced, and macroeconomic policy certainly had no role to intervene. This did not mean that efforts at fiscal and other reforms were unwarranted, but that they should not be directed at influencing the current account balance, and indeed may not have had the desired effect in any case. Policymakers ultimately accepted many elements of this view, perhaps because they realized that the current account deficit remained stable in trend terms despite widespread reforms (including a substantial fiscal consolidation leading ultimately to no net public debt).

This so-called consenting adults view of current account deficits has become widely accepted in Australia among academics and policymakers. This paper presented empirical evidence providing some support to the idea that, following capital market opening in 1983, cycles in the current account deficit in Australia have been consistent with optimal consumption-smoothing behavior. Sustainability calculations imply that if the recent trend level of the current account deficit continues, foreign liabilities will eventually stabilize at around 86 percent of GDP, compared with around 60 percent in 2006. This says nothing about the more important question of solvency, which, under a flexible exchange rate regime, is subject to the ongoing assessment provided by open and transparent capital markets.

It is generally acknowledged that large deficits and foreign indebtedness can imply some degree of vulnerability for a small open economy subject to large external shocks, including swings in investor sentiment. Australia is an interesting case study in this regard, as it has a number of institutional features that ameliorate its vulnerability to external shocks. Stable government, credible and sustainable monetary and fiscal policies, a sound financial system based on efficient regulation and supervision, effective legal and accounting frameworks, and transparent and open markets for both factors of production and outputs are critical features for maintaining the confidence of foreign and domestic investors. Of particular note is the fact that foreigners are willing to participate in markets that allow Australian residents to hedge their foreign exchange exposures at reasonable cost. This allows the balance sheets and trading activities of domestic corporations and households (which are net foreign debtors) to withstand large nominal exchange rate fluctuations. Since floating, Australia has certainly demonstrated considerable resilience in the face of a number of large adverse external shocks.

Indeed, the features that underpin this resilience may have encouraged sizeable capital inflows in the first place. In other words, Australia's high debt level may be less a signal of vulnerability than a reflection of the resilience that attracts foreign capital and keeps it in place.

Appendix A
Testing the Intertemporal Model

The model describes a representative agent in a small open economy who chooses a path of consumption and investment to maximize lifetime utility (equation A1) subject to a budget constraint (equation A2) and a production function:

$$U_t = \sum_{s=t}^{\infty} \beta^{s-t} \frac{C_s^{1-1/\sigma} - 1}{1 - 1/\sigma} \text{ and} \tag{A1}$$

$$CA_t \equiv B_{t+1} - B_t = rB_t + Y_t - C_t - G_t - I_t, \tag{A2}$$

where C_t is consumption at time t, β is the agent's discount rate, and $1/\sigma$ is the agent's intertemporal elasticity of substitution.[26] The return on an asset is equal to the fixed world interest rate, r. The stock of assets held from time $t - 1$ is B_t, Y_t is output, G_t is exogenous government spending, and I_t is investment.[27] The budget constraint (equation A2) defines the current account balance (or change in net foreign liabilities) as being equal to the net cash flow ($Z_t = Y_t - G_t - I_t$) less private consumption and foreign interest payments.

The optimal consumption profile is then given by the Euler equation:

$$C_{t+1} = C_t \, \beta^{\sigma} \, (1 + r)^{\sigma}. \tag{A3}$$

Optimal consumption can be shown to be proportional to wealth:

$$C_t^* = \left(\frac{r + \upsilon}{1 + r}\right) W_t, \tag{A4}$$

26. We use an isoelastic utility function and assume no uncertainty, rather than the more commonly used quadratic utility function, which implies a strict upper bound on the level of consumption and does not rule out negative consumption levels. In any case, the empirical approach is very similar.

27. Labor is supplied inelastically, output is produced according to the production function, $Y = AF(K)$, and the optimal capital stock (assuming no depreciation) is such that $r = AF'(K)$. Total factor productivity, A, is exogenous.

where $\upsilon \equiv 1 - \beta\sigma(1+r)^{\sigma}$ and where wealth, W_t, is defined as the sum of current period value of assets and the net present value of current and future net cash flow,

$$W_t \equiv (1+r)B_t + \sum_{s=t}^{\infty}\left(\frac{1}{1+r}\right)^{s-t}(Z_s). \tag{A5}$$

If $\upsilon = 0$, it is optimal for agents to consume the annuity value of wealth, leaving consumption constant over time. Otherwise, the consumption path will tilt upward if $\upsilon < 0$ and downward if $\upsilon > 0$.

Finally, the optimal current account is obtained by substituting equations (A4) and (A5) into the budget constraint:

$$CA_t^* = (Z_t - \tilde{Z}_t) - \frac{\upsilon}{r+\upsilon}W_t, \tag{A6}$$

where $\tilde{Z}_t$ is the permanent (or annuity) level of the net cash flow. The term in parentheses in equation (A6) implies that output below its permanent level leads to a current account deficit, and investment or government spending above their permanent levels lead to a current account deficit. Thus, the net foreign assets adjust to smooth consumption in the face of temporary disturbances to the net cash flow.[28] The second right-hand-side term captures consumption tilting that occurs when the rate of time preference, which equals $(1-\beta)/\beta$, is different from the world interest rate (that is, when $\upsilon \neq 0$). A country that is more impatient than the rest of the world will thus be running current account deficits in proportion to their level of wealth.

Since consumption is proportional to wealth, equation (A6) effectively decomposes the optimal current account into its consumption-smoothing and consumption-tilting components:

$$CA_t^S = Z_t - \tilde{Z}_t = -\sum_{s=t+1}^{\infty}\left(\frac{1}{1+r}\right)^{s-t}\Delta Z_s \text{ and} \tag{A7}$$

$$CA_t^T \equiv -\frac{\upsilon}{r+\upsilon}W_t = \lambda C_t, \tag{A8}$$

28. This term also captures the potential for income growth (that is, through productivity growth) to influence the level of the current account balance. For a more detailed discussion of this possibility, see Engel (2005).

where $\lambda \equiv -[\upsilon(1 + r)/(r + \upsilon)^2]$. Equation (A7) shows that the consumption-smoothing component of the current account will be in deficit when the net present value of future changes in the net cash flow is positive. Furthermore, the consumption-smoothing hypothesis embodied in equation (A7) implies that the current account is a sufficient predictor of future changes in net cash flows.

A.1 Estimation

The estimation of this model proceeds by decomposing the current account into these two components. First, we remove the trend behavior of the current account by estimating the extent of any consumption tilting ($\lambda \neq 0$). Specifically, if CA_t^S and C_t are I(1) and cointegrated, the residuals will be stationary. In this case, the residuals will provide an estimate of the current-account-smoothing component (CA_t^S), which can be tested for evidence of consumption smoothing.

To test the consumption-smoothing hypothesis explicit in equation A7, we derive the net present value of future changes in the net cash flow by estimating a vector auto regression (VAR), which provides the basis for estimating future changes in net cash flow:[29]

$$\begin{bmatrix} \Delta Z_t \\ CA_t^S \end{bmatrix} = \begin{bmatrix} \psi_{11} & \psi_{12} \\ \psi_{21} & \psi_{22} \end{bmatrix} \begin{bmatrix} \Delta Z_{t-1} \\ CA_{t-1}^S \end{bmatrix} + \begin{bmatrix} \varepsilon_{1t} \\ \varepsilon_{2t} \end{bmatrix} \tag{A9}$$

A weak test of the consumption-smoothing hypothesis is to determine whether the current account Granger causes changes in the net cash flow, as implied by equation (A7). The VAR provides a convenient way of performing this test.

An estimate of future expected changes in the net cash flow can then be constructed from the VAR estimate, as follows:

$$E_t \Delta Z_s = \begin{bmatrix} 1 & 0 \end{bmatrix} \begin{bmatrix} \psi_{11} & \psi_{12} \\ \psi_{21} & \psi_{22} \end{bmatrix}^{s-t} \begin{bmatrix} \Delta Z_t \\ CA_t^S \end{bmatrix} \tag{A10}$$

29. The estimation procedure is justified by asserting that both CA_t^S and ΔZ_t are subject to measurement error. This model is easily generalized to incorporate higher-order VARs.

Let $\mathbf{\Psi}$ be the matrix $[\Psi_{ij}]$ and $\mathbf{I}$ be a two-by-two identity matrix. The optimal consumption-smoothing current account can be estimated by substituting equation (A10) into equation (A7).[30] The result is

$$\hat{CA}_t^S = -\begin{bmatrix}1 & 0\end{bmatrix}\left(\frac{1}{1+r}\Psi\right)\left(\mathbf{I}-\frac{1}{1+r}\Psi\right)^{-1}\begin{bmatrix}\Delta Z_t \\ CA_t^S\end{bmatrix} \equiv \begin{bmatrix}\Phi_{\Delta Z} & \Phi_{CA}\end{bmatrix}\begin{bmatrix}\Delta Z_t \\ CA_t^S\end{bmatrix} \quad \text{(A11)}$$

From equation (A11), a stronger test of the intertemporal model is the joint test of $\Phi_{\Delta Z} = 0$ and $\Phi_{CA} = 1$.[31]

A.2 Empirical Results

The data used are annual from 1949 to 2005 (see appendix B for sources and details). To be consistent with the theoretical model, all series are converted into per capita terms, and nominal series (including the current account) are converted into real terms by using the GDP deflator.[32]

The level of the current account has an obvious downward trend over the second half of the sample period, which suggests the existence of consumption tilting. We checked the series for the presence of a unit root using the augmented Dickey-Fuller (ADF) test. The results (not reported) confirm that the current account, consumption, and net cash flow are all nonstationary variables, but the change in net cash flow is stationary.

An estimate of the consumption-tilting coefficient, λ, is obtained in equation (A7) using dynamic ordinary least squares (DOLS):

$$CA_t = \lambda C_t + \delta(D_t C_t) + \sum_{i=-1}^{1} \gamma_i \Delta C_{t-i} + u_t, \quad \text{(A12)}$$

30. Both CA_t^S and ΔZ_t need to be stationary in order for equation (A11) to be well defined.

31. Obstfeld and Rogoff (1996) use a stochastic framework but with quadratic utility, which implies certainty equivalence and, therefore, yields the same test of the intertemporal model.

32. There are two problems with the current account data. First, the current account should preferably incorporate changes in net foreign assets stemming from capital gains and losses. Second, the net income deficit is based on nominal, rather than real, interest flows. This overstates Australia's real current account deficit, which ran a net income deficit over this entire period. This bias will be increasing over time, since net foreign debt has been steadily increasing, although it will be offset somewhat by the fall in world inflation rates since the mid-1980s.

where D_t is a dummy variable that takes the value of one from 1984 onward and zero otherwise. We expect λ to be negative given the obvious negative trend in the current account (that is, Australia's rate of time preference appears to be above the world interest rate). The inclusion of the second term allows for a break in the trend at 1984, consistent with the capital market opening and financial deregulation. Before this, consumers probably were not able to borrow as much as they desired. In this case, the degree of consumption tilting will have increased after 1983; that is, δ will be negative.

The current account balance and consumption are clearly cointegrated. The ADF for the residuals is –5.61.[33] The estimate of λ is less than zero, at –0.035 (with a t statistic of –4.65).[34] Furthermore, δ is significantly less than zero at –0.029 (with a t statistic of –5.16), which confirms that the degree of consumption tilting increased after financial liberalization in 1983. This is evidence in support of the existence of binding credit constraints in the period prior to 1983 (so long as the reasonable assumption of unchanged consumer preferences is maintained).

Figure A1 separates the actual current account into its stationary and nonstationary components.[35] Using estimates of the sum of λ and δ, we can obtain a rough estimate of the Australian rate of time preference, $(1 - \beta)/\beta$. Deaton (1992) provides a summary of estimates of the intertemporal elasticity of substitution ($1/\sigma$) that range from 0.35 to 0.75. Using an interest rate of 4 percent implies that the rate of time preference is between 0.04004 and 0.04008.36 That is, the consumption-tilting behavior implies rates of time preference only marginally above the world interest rate.

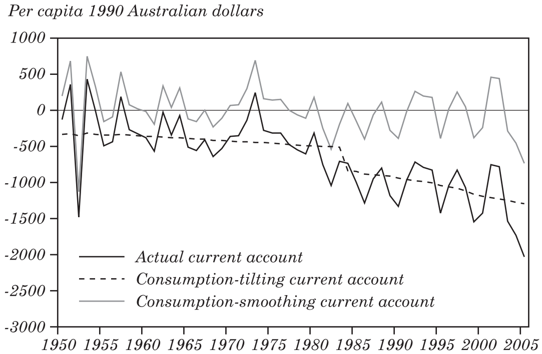
33. Critical values for the ADF statistic are from Fuller (1976). The null hypothesis of no cointegration is rejected at the 5 percent significance level.

34. Reported t statistics have been adjusted as follows, so that the standard t tables are applicable. The OLS t statistics were multiplied by the factor (s^2/η^2) ; $s^2 = (T-5)^{-1}\sum_{t=1}^{T}\hat{u}_t^2$; and $\eta = \hat{\sigma}/(1-\hat{\phi}_1-\hat{\phi}_2)$, where $\hat{\sigma}$ is a consistent estimate of the standard deviation of residuals from an AR(2) regression of $\hat{u}$ with AR coefficients ϕ_1 and ϕ_2 . Consistent with theory, no constant term was included in the regression. Furthermore, a constant was insignificant when included and had a negligible effect on the slope coefficient estimates.

35. The stationary component of the current account is obtained as the estimated residuals $CA_t - \hat{\lambda}C_t - \hat{\delta}D_tC_t = \mu + \varepsilon_t$. The left-hand side of this expression has a nonzero mean because of the inclusion of leads and lags of consumption changes in the right-hand side of equation A12. The nonstationary consumption-tilting component of the current account is simply $\hat{\lambda}C_t + \hat{\delta}D_tC_t - \hat{\mu}$.

36. For an interest rate of 2 percent, the estimate is between 0.02001 and 0.02002. For an interest rate of 6 percent, the estimate is between 0.06008 and 0.06017.

Figure A1. Current Account Tilting and Smoothing Components



Source: ABS; authors' calculations.

Before we can estimate the VAR shown in equation (A9), we need to control for common world shocks. Theory predicts that these will have a much smaller effect on the current account than on investment (interest rates adjust to ensure that world savings equal world investment). Glick and Rogoff (1995) show that this is true for the G7 countries.

The idiosyncratic changes in the Australian net cash flow, ΔZ_t^I, are constructed as the estimated residuals from the following regression:

$$\Delta Z_t = \alpha + \delta \Delta Z_t^W + \varepsilon_t, \tag{A13}$$

where ΔZ_t and ΔZ_t^W are changes in the Australian and world net cash flows, respectively. Obstfeld and Rogoff (1995) show that under certain conditions, ΔZ_t can be replaced by ΔZ_t^I in equation A7.[37] We estimated a VAR(1), VAR(2), and VAR(3); the results are presented in table A1. The results of the Granger causality test and the transformed coefficient vector, $\mathbf{\Phi}$, are shown in tables A2 and A3, respectively.

37. These conditions include a zero net foreign asset position. Otherwise, changes in the world interest rate will have a differential income effect on net debtors and net creditors, thereby leading to some adjustment of these countries' current accounts. Glick and Rogoff (1995) demonstrate that this effect is small for the set of G7 countries. In the case of Australia, this effect is likely to be more significant only in the latter part of the sample, following the more rapid accumulation of net foreign debt after 1983.

For the VAR(1) and VAR(2), the current account Granger causes the change in the net cash flow, but not vice versa, providing weak evidence of consumption smoothing. This is not the case for the VAR(3), which appears to be a consequence of the loss of the influential observation of 1952. However, the estimates of the vector **Φ** imply a failure of the strict test of the intertemporal model—that is, the element applying to CA_t^S should be one, with all other elements being zero.[38]

Table A1. VAR Estimates: Using Idiosyncratic Component of Net Cash Flow, 1951–2005[a]

Explanatory variable	*VAR(1)*		*VAR(2)*		*VAR(3)*	
	ΔZ_t^I	CA_t^S	ΔZ_t^I	CA_t^S	ΔZ_t^I	CA_t^S
ΔZ_{t-1}^I	0.08 (0.14)	−0.03 (0.17)	−0.09 (0.14)	−0.22 (0.17)	−0.08 (0.15)	−0.07 (0.16)
ΔZ_{t-2}^I			0.11 (0.13)	−0.11 (0.15)	0.10 (0.15)	−0.02 (0.15)
ΔZ_{t-3}^I					0.05 (0.14)	0.14 (0.14)
CA_{t-1}^S	−0.35*** (0.13)	−0.03 (0.15)	−0.19 (0.12)	0.18 (0.14)	−0.16 (0.14)	0.39*** (0.14)
CA_{t-2}^S			−0.20 (0.13)	−0.13 (0.15)	−0.21 (0.13)	−0.25* (0.14)
CA_{t-3}^S					−0.06 (0.13)	−0.05 (0.14)
Summary statistic						
Durbin-Watson statistic	1.96	1.46	1.95	1.28	2.01	1.70
No. observations	54	54	53	53	52	52

Source: Author's estimations.
* Statistically significant at the 10 percent level. *** Statistically significant at the 1 percent level.
a. Standard errors are in parentheses.

38. The estimates shown are based on a real interest rate of 4 percent. Results are robust to using either a 2 or a 6 percent real interest rate.

Table A2. Granger Causality Tests, 1951–2005
F statistics

	VAR(1)		*VAR(2)*		*VAR(3)*	
Explanatory variable	ΔZ_t^I	CA_t^S	ΔZ_t^I	CA_t^S	ΔZ_t^I	CA_t^S
$CA_{t-i}^S \ \forall i \geq 1$	7.72***		2.68*		1.58	
$\Delta Z_{t-i}^I \ \forall i \geq 1$		0.04		1.19		0.34

Source: Author's estimations.
* Statistically significant at the 10 percent level. *** Statistically significant at the 1 percent level

Table A3. Test of the Nonlinear Consumption-Smoothing Restriction, 1951–2005[a]

Parameter	*VAR(1)*	*VAR(2)*	*VAR(3)*
$\Phi_{1\Delta Z}$	−0.10 (0.15)	−0.16 (0.22)[b]	−0.05 (0.22)
$\Phi_{2\Delta Z}$		−0.17 (0.17)[b]	−0.10 (0.19)
$\Phi_{3\Delta Z}$			−0.01 (0.13)
Φ_{1CA}	0.36 (0.14)	0.45 (0.24)[b]	0.47 (0.24)
Φ_{2CA}		0.16 (0.13)[b]	0.13 (0.13)
Φ_{3CA}			0.03 (0.12)
Summary statistic			
Wald statistic	47.65***	49.84***	19.60***

Source: Author's estimations.
*** Rejection of the joint null hypothesis at a 1 percent significance level.
a. The null hypothesis is $\Phi_i = 0$ for all i except $\Phi_{1CA} = 1$.
b. Standard errors adjusted using White's correction for heteroskedasticity.

This rejection of the intertemporal model could be due to the existence of credit constraints prior to 1983. To account for this, we reestimated the model for the two periods, 1951–1983 and 1984–2005. The Granger causality and transformed VAR(1) estimates are shown in tables A4 and A5. In the later sample, the current account Granger causes changes in the net cash flow, but not vice versa. Furthermore, the stricter test of the null hypothesis of consumption smoothing (that is, the restriction on the vector Φ) is rejected for the earlier subsample, but not for the later subsample, although the standard errors are large. For the VAR(2) and VAR(3), however, which are not presented here, consumption smoothing is rejected at the 5 percent significance level but not at the 1 percent level for the postfloat sample.

Table A4. Granger Causality Tests, 1951–1983 and 1984–2005
F statistics

	1951–1983		*1984–2005*	
Explanatory variable	ΔZ_t^I	CA_t^S	ΔZ_t^I	CA_t^S
CA_{t-1}^S	2.70		5.24**	
ΔZ_{t-1}^I		0.03		0.03

Source: Author's estimations.
** Statistically significant at the 5 percent level.

Table A5. Test of the Nonlinear Consumption-Smoothing Restriction, 1951–1983 and 1984–2005[a]

Parameter	*1951–1983*	*1984–2005*
$\Phi_{1\Delta Z}$	−0.00 (0.17)	−0.16 (0.24)
Φ_{1CA}	0.23 (0.14)	0.81 (0.41)
Summary statistic		
Wald statistic	59.91***	1.55

Source: Author's estimations.
*** Rejection of the joint null hypothesis at a 1 percent significance level.
a. The null hypothesis is $\Phi\Delta_Z = 0$ and $\Phi_{CA} = 1$.

Appendix B
Data

—Current account: 1861–1949 data from Vamplew (1987), tables ITFC 1–8 and ITFC 84–100; 1950–59 data from Foster (1996), table 1.1; and data from 1960 onward are from ABS, catalog no. 5302.0.

—Capital account: 1861–1900, indirect estimate of long-term capital inflows from Butlin (1962), table 250; 1901–49, apparent capital inflows from Vamplew (1987), tables ITFC 101–106 and ITFC 200–210; 1950–59 data are from Foster (1996), table 1.15; and data from 1960 onward are from ABS, catalog no. 5302.0.

GDP: 1861–1900 is in market prices from Butlin (1962), table 1, column 2; from 1900–01 to 1949–50, data are from Vamplew (1987), table ANA 119–129; for 1950–59, data are from Foster (1996), table 5.1a; and for 1960 onward nominal and real GDP are from ABS, catalog no. 5206.0.

—Net foreign liabilities: ABS, catalog no. 5302.0.

—Saving, investment, terms of trade, consumption, government, and investment expenditures: ABS, catalog no. 5206.0, tables 2, 9, and 32. A statistical discrepancy, averaging 2.3 percent and –0.2 percent of GDP from 1960–75 and 1976–2006, respectively, reconciles the saving-investment balance to the current account.

—Public sector debt: Australian government debt is from Treasury Budget Paper 1, table A3; 1960–82 total general government and public sector debt are from Vamplew (1987), table GF1–33; and from 1988 onward they are from Treasury Budget Paper 1, table A4. Some data were not available for 1983–87.

—Trade-weighted indices (of the exchange rate): Reserve Bank of Australia Bulletin, table F.11. CPI data for Australia's trade partners, from Datastream, are used to calculate real trade-weighted indices.

—Population: ABS, catalog no. 3105.0.

—World net cash flow: based on net cash flow (NCF) for Canada, China, France, Germany, Italy, Japan, the United Kingdom, and the United States. Data are from the IMF, International Financial Statistics. Percentage changes in net cash flow for each country are weighted by nominal GDP. Countries with missing data were not included in that year's net cash flow.

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Experiences with Current Account Deficits in Southeast Asia

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In the 1990s, Southeast Asia experienced very rapid growth associated with large and persistent current account deficits.[1] The episode lasted from 1990 to around 1996, ending with the outbreak of the Asian crisis in 1997–98. Current account deficits peaked at around 10 percent of gross domestic product (GDP) in Malaysia in 1995 and at 8 percent of GDP in Thailand in 1996 (compared with 7 percent in Mexico around the time of the peso crisis in 1994). Deficits were also large in the Philippines and Indonesia, at around 4 percent of GDP. During the crisis years of 1997–98, deficits became surpluses that persisted for years (in the Philippines this occurred much later). Malaysia's surpluses rose to around 15 percent of GDP after its crisis, whereas they declined in Thailand (turning to a small deficit for a time) and Indonesia. The current account reversals to surpluses were associated with a sudden stop in capital inflows, which significantly exceeded current account deficits in the first half of the 1990s, but which had not recovered their previous levels by 2006. The reversal was largest in Thailand, where net capital flows switched from an annual average inflow of $21 billion in 1995–96

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1. I draw on the experiences of the four countries in Southeast Asia where current account sustainability was an issue in the first half of the 1990s, namely, Indonesia, Malaysia, the Philippines, and Thailand. For reference, I include data on Singapore, which consistently maintained large surpluses during this period.

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to an outflow of $13 billion in 1997–98 (a reversal of $34 billion). Indonesia saw its capital flows swing from an $11 billion inflow to a $5 billion outflow. The reversals were smaller in Malaysia and the Philippines (from $9 billion to 0 and from $8 billion to $3 billion, respectively). By way of comparison, Singapore also experienced an increase in capital outflows of $11 billion over the period, but it had a current account surplus of around 15 percent of GDP.

The sudden stop episode was associated with sharp contractions in output that were unprecedented in Asia over the sample period. The 1998 absolute drop in output was largest in Indonesia and Thailand, although the swing in output in Malaysia was second only to Indonesia. In the Philippines, the drop in output was comparatively modest. Singapore experienced a more severe drop in output, in part reflecting the country's economic links to neighbors with sharply declining outputs, such as Indonesia. These declines in output were followed by relatively quick recoveries but permanently lower growth.

This paper argues that the drive for economic growth contributed to current account deficits and influenced policy responses. It is organized as follows. The first section describes current account developments in Southeast Asian economies from the saving-investment and trade perspectives. The second section focuses on the experience with current account deficits in the period leading up to the sudden current account reversals of 1997–98. I review arguments made at the time (some of which are still made today) suggesting that current account deficits were sustainable. The third section discusses fiscal and monetary policy responses with open capital accounts. I also address the use of capital controls prior to the crisis and the impact they may have had on current account balances or sustainability. The final section offers some concluding observations on current account experiences in Southeast Asia.

1. Current Accounts in Southeast Asia: Stylized facts

To provide some perspective on current accounts in Southeast Asia, table 1 reports the balance of payments for the five countries in the sample, while figure 1 illustrates the evolution of national saving and investment and the current account in five Southeast Asian economies. The first point to emerge from the figure is that until the Asian crisis, saving ratios were high in Malaysia (peaking at nearly 40 percent of GDP in 1998), Thailand (averaging around

35 percent of GDP in 1991–94), and—for a time—Indonesia (with a maximum of 38 percent in 1997), whereas the Philippines posted somewhat lower rates (with a peak of 25 percent in 1997). Saving rates fell significantly in all regions after the late 1990s. Thus the period of current account deficits was associated with higher saving rates than the more recent period of current account surpluses.

Figure 1. Current Account Balances as a Percentage of GDP

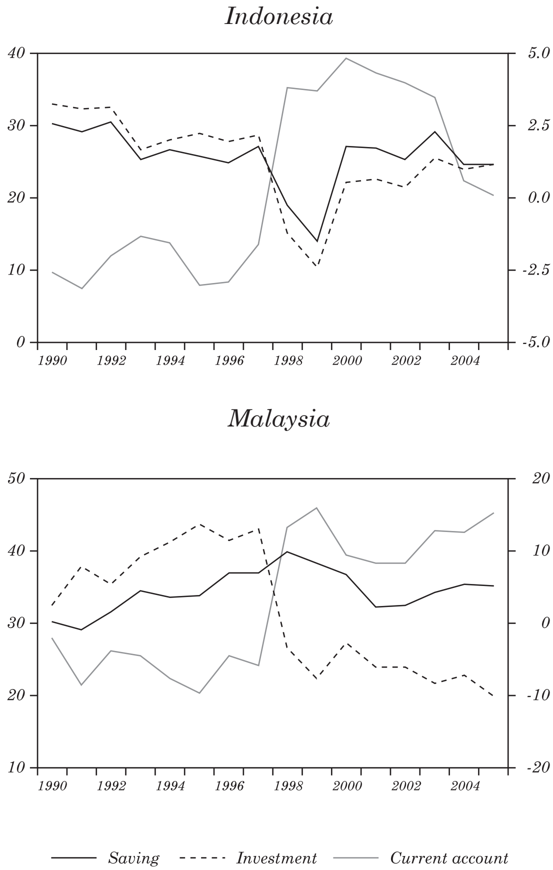
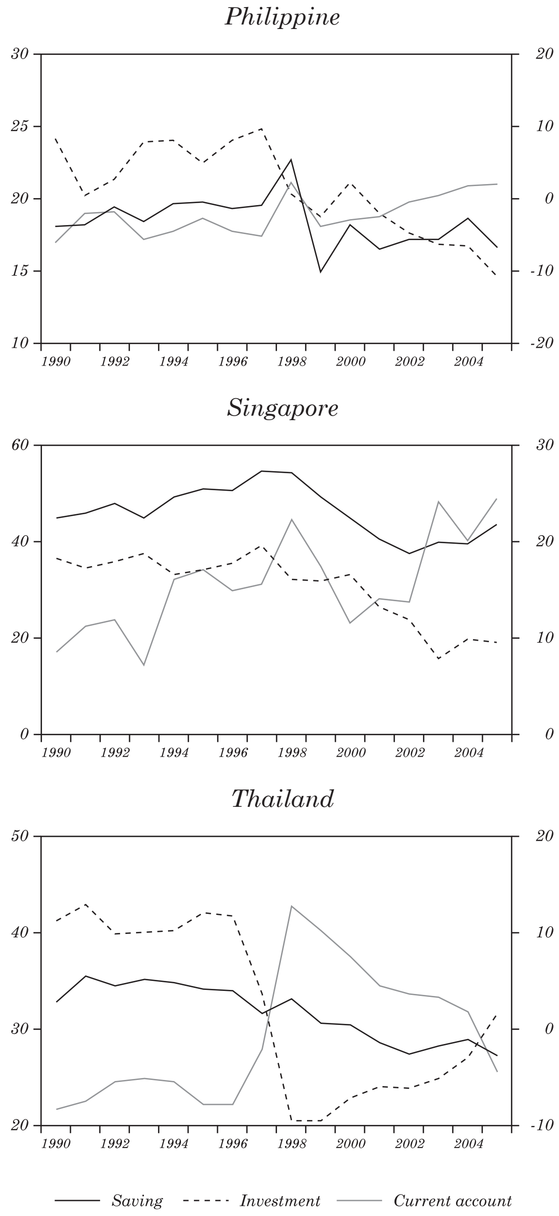


Figure 1. (continued)



Source: IMF.

Table 1. Balance of Payments in Asia[a]
Billions of US dollars

	Current account balance				*Net capital inflows*[b]				*Reserves*				
									Increase				*Stock*
Country	*1990–94*	*1995–96*	*1997–98*	*2000–05*	*1990–94*	*1995–96*	*1997–98*	*2000–05*	*1990–94*	*1995–96*	*1997–98*	*2000–05*	*Sep 2006*
Indonesia	–3	–7	–0	6	5	11	–5	–3	1	3	–1	2	40
Malaysia	–3	–7	2	12	6	9	–0	–4	4	0	3	7	75
Philippines	–2	–3	–1	0	3	8	3	0	1	2	–0	–0	22
Singapore	6	14	17	22	–0	–4	–15	–14	6	8	6	6	129
Thailand	–7	–14	6	6	11	21	–13	–3	4	5	–4	3	60

Source: International Monetary Fund (IMF), *Balance-of-Payments Statistics*; IMF, *World Economic Outlook*.
a. Annual average for the period.
b. Financial account balance.

Second, fluctuations in the current account tend to mirror movements in investment rather than saving. The switch in current accounts from large deficits to large surpluses around 1998 largely reflects first surging investment and then its collapse below national saving in most countries in the sample. In particular, the emergence of current account surpluses in 1998 was associated with relatively stable saving ratios in Malaysia and Thailand and a fall in saving in Indonesia and the Philippines. On an annual basis, deviations in investment from trend are also more closely correlated with fluctuations in the current account than are deviations in saving (table 2). The drivers of investment spending in Southeast Asia, and its perceived sustainability and efficiency, are thus of particular interest for understanding fluctuations in the current account. To provide perspective, a comparison with Singapore reveals striking contrasts. Singapore maintained large and growing current account surpluses in this period, and saving rather than investment was more closely correlated with the current account. Indeed, investment spending was stable and national saving increased, although output growth reached double digits in the first half of the 1990s (see table A1 in the appendix).

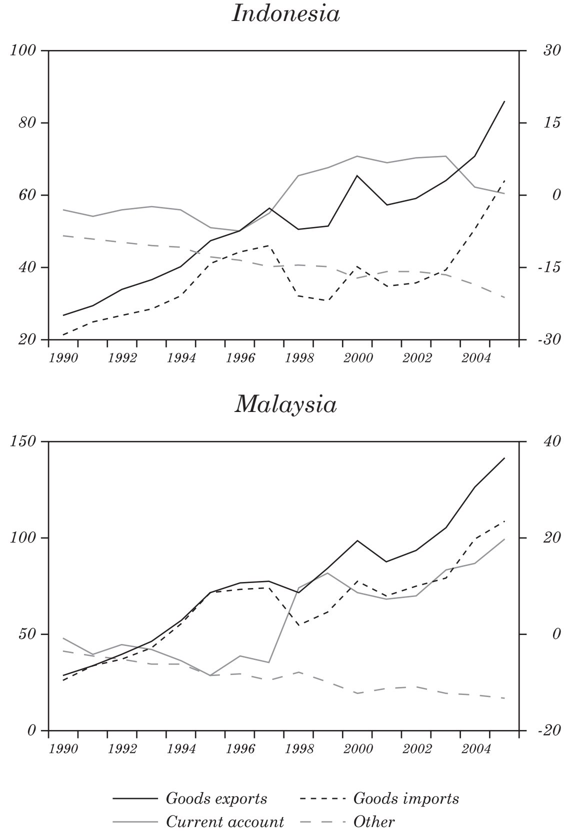
Table 2. Correlation of Saving or Investment with Current Account Balance[a]

	Correlation with saving		*Correlation with investment*	
Country	*1985–2005*	*1985–2005 (excl. crisis[b])*	*1985–2005*	*1985–2005 (excl. crisis[b])*
Indonesia	–0.08	0.10	–0.50	–0.36
Malaysia	0.48	0.48	–0.93	–0.93
Philippines	0.20	–0.04	–0.80	–0.86
Singapore	0.69	0.72	–0.34	–0.47
Thailand	–0.37	–0.58	–0.97	–0.97

Source: IMF; Bank for International Settlements (BIS) calculations.
a. As applied to detrended annual series as a percentage of GDP. Trend series are estimated using the Hodrick-Prescott filter.
b. More specifically, excluding values from 1997–98.

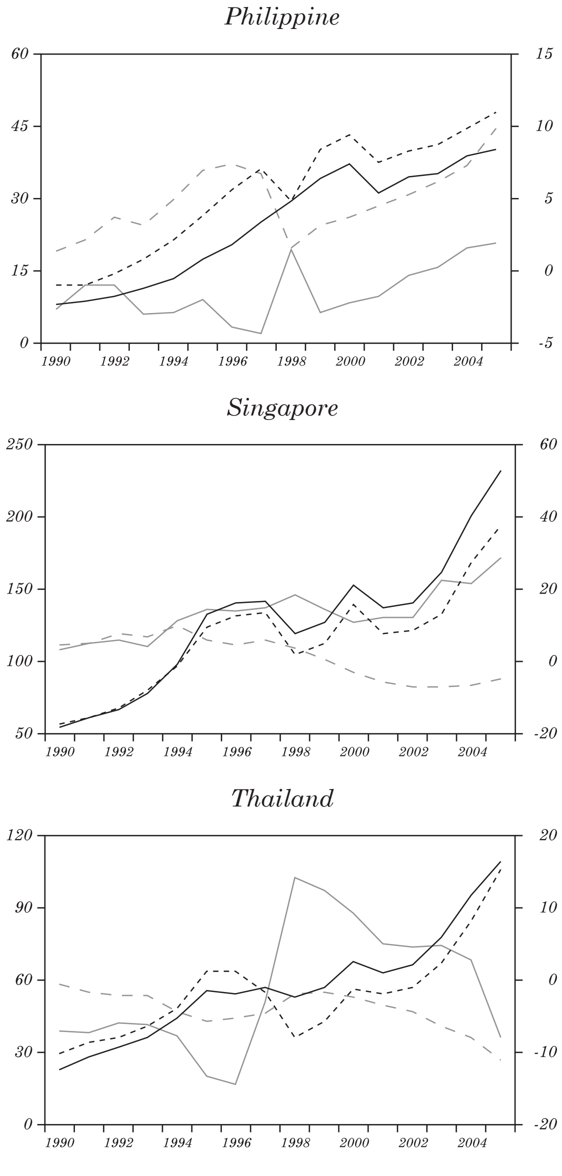
Figure 2 illustrates trends from the perspective of merchandise imports and exports in U.S. dollars. In Indonesia and Malaysia, merchandise trade was in surplus or nearly balanced throughout the period; deficits were explained by other components of the current account. Merchandise export and import revenues both grew rapidly during the period of current account deficits in the first half of the 1990s, although import growth exceeded export growth over certain periods in the first half of the 1990s in Indonesia, Malaysia, the Philippines, and Thailand.[2] The large increase in trade surpluses after 1997 in a number of cases reflected a sharp drop in imports and a failure to keep pace with export growth thereafter. This is broadly in line with the view that imports were closely related to investment spending, which also declined sharply (see below).

Figure 2. Current Account Balances in Billions of U.S. Dollars[a]



2. The trend in Singapore is not all that different, except that exports begin to visibly exceed imports starting in 1995.

Figure 2. (continued)



Source: IMF.

a. Other includes services, income, and transfers balance.

The conventional wisdom is that the Asian current account surpluses observed in recent years reflect rapid export growth, or what might be described as Bretton Woods II.[3] Export growth has indeed remained a key driver of growth in Southeast Asia, and it contributed to recovery from the 1997–98 crisis.[4] However, export revenues grew more rapidly and steadily during the period of current account deficits (and more stable exchange rates) than they did after 1996. The reversals of current account deficits to large surpluses around 1998 did not reflect strong or booming exports. On the contrary, in spite of steep currency depreciations, export revenues in U.S. dollars contracted in 1998 in all countries in the sample but the Philippines (where export revenue growth fell to 17 percent from 23 percent a year earlier). Imports fell by more, however, resulting in the current account reversals. Outside the crisis period, between 1990–95 and 1999–2005, average annual merchandise export revenue growth in U.S. dollars fell in Indonesia (from nearly 13 percent to 9 percent), Malaysia (20 percent to 10 percent), the Philippines (15 percent to 5 percent), and Thailand (19 percent to 11 percent).

Other components of the current account have also been relevant. The tourism industry is a significant contributor to current account surpluses in Thailand: the service account represented about a third of dollar inflows on exports, services income, and transfers in the 1990s and somewhat less than a quarter in the 2000s. In the Philippines, trade in goods and services comprised the bulk of the current account until 2001, when overseas workers remittances began to play a major role in turning the current account consistently to surplus (figure 2). In 2005 remittances totaled $10.7 billion, corresponding to about half the sum of services income and transfers in the current account versus $40 billion for merchandise exports). In Malaysia, trade surpluses have been offset by significant deficits on the nonmerchandise trade components of the current account.

1.2 The Importance of the Exchange Rate in the Current Account

The exchange rate's influence on the behavior of the current account is an important issue in small open economies like those in Southeast Asia. Calderón, Chong, and Loayza (2002) study the determinants of the current account using a panel data set of forty-four

3. See Dooley, Folkerts-Landau, and Garber (2004).
4. See Guidotti, Sturzenegger, and Villar (2004).

developing countries, with annual data for 1966–94. They find that current account deficits are modestly persistent and rise with a real exchange rate appreciation, although this last effect is small. They also rise with an increase rise in domestic output growth and an increase in the terms of trade, but fall with faster growth of industrialized economies or higher interest rates.

Turning to Southeast Asia, some insights on the role of the exchange rate can be gained from a study on Thailand's current account by economists at the Bank of Thailand (Chayawadee and Jantarangs, 2004). The authors first estimate a single equation model of Thailand's current account with the lagged current account, the real effective exchange rate, trading partner output, domestic output, terms of trade, and a crisis dummy. They find that the impact of the real effective exchange rate is small: a 1 percent increase in the real exchange rate lowers their current account proxy (namely, the exports-to-imports ratio) by a quarter of a percent. The impact of a 1 percent change in trading partner output on the current account is much larger, at nearly two-thirds of a percent. The impact of domestic output is smaller than foreign output, but it is still significant and higher than the effect of the real exchange rate. A vector autoregression (VAR) model (comprising the current account, the real exchange rate, the repurchase rate, and the production index) reinforces the impression of a weak impact of the exchange rate on the current account in Thailand.[5]

Bayoumi (1996) provides evidence on the strength of exchange rate effects in the five Southeast Asian countries in the sample based on estimates of long-run trade elasticities (see table 3). These estimates suggest that changes in growth (particularly foreign) have a substantial impact on trade balances. Long-run income elasticities in the sample of Southeast Asian countries (including Singapore) average 1.8 for exports and nearly 1.4 for imports, with Thailand having far higher income elasticities than its neighbors. Bayoumi also directly measures

5. Impulse responses indicate that an unexpected (one-standard-deviation) depreciation in the baht has a large impact on the current account (of 0.2 percent of GDP), but the impact subsides thereafter. Introducing exports and imports separately in the model reveals that the real exchange rate has a weak effect on these two variables. In line with this, much of the variance of the forecast error of the current account is due to its own innovations, particularly in the first year. After twenty quarters, own innovations still account for about half of the variance of the forecast error. (In their single equation model, the coefficient on the lagged current account is about 0.6.) Using the Bank of Thailand's larger macroeconomic model, Chayawadee and Jantarangs (2004) find a much larger response of the current account to a real exchange rate depreciation than they do in their own model, but the effect also dissipates over time.

the effect of changes in the real exchange rate on exports and imports; he finds that most of the coefficients are small and statistically insignificant, with the exception of Indonesian imports.[6]

Table 3. Southeast Asia: Long-Run Trade Elasticities[a]

	Income		*Price (real exchange rate)*	
Country	*Exports*	*Imports*	*Exports*	*Imports*
Indonesia	1.27	1.66	–0.32	0.68
Malaysia	1.86	1.47	–0.53	0.01
Philippines	1.34	1.65	0.10	–0.75
Singapore	1.77	1.05	–0.21	0
Thailand	2.73	1.03	–0.99	0.75
Memo				
Japan	2.10	0.79	–0.69	0.55
United States	1.47	2.46	–0.86	0.26
Panel	1.96	1.46	–0.80	0.28

Source: Bayoumi (1996, tables 3-3 and 3-4).
a. Unless otherwise indicated, the output coefficients are significant at the 1 percent level. The real exchange rate elasticities for exports for Asia are not significant except for Japan (1 percent), while for imports they are only significant in Indonesia (1 percent). Sample period is 1974–93.

Some features of trade in Southeast Asia may explain why exchange rate effects on the current account could be weak. First, exports have a high import content, which generally reflects the importance of manufactured exports in Southeast Asia.[7] A high correlation between

6. The perception that price effects are low and income effects are high in Southeast Asia was not limited to Bayoumi. Goldman Sachs (1997) reaches the same conclusion. In contrast, the finding that price effects are weak in Southeast Asian trade is contradicted by Marquez (2002). The combination of strong income elasticities and weak price elasticities may explain why Philippine exports sometimes rose while the real exchange rate was appreciating and fell while the real exchange rate was depreciating.

7. For example, according to input-output tables, the import content of exports in Thailand in 1995 ranged from 44 percent for computer and parts to 65 percent for electrical appliances and integrated circuits. In this setting, a depreciation of the currency that boosts exports could simultaneously be associated with an increase in imported inputs. This is also related to the high share of machinery or production inputs in imports and the presence of regional production networks. Indeed, Chayawadee and Jantarangs (2004, pp. 30–31) note that in one version of their VAR model separating Thai exports and imports, both increase in response to a depreciation of the baht. García-Herrero and Koivu (2007) also find that exports and imports (from Asia) in China move in the same direction in response to exchange rate changes. China similarly forms part of a production network in which a significant proportion of imports are used in exports.

merchandise exports and imports is apparent in Indonesia, Malaysia, and Thailand (as well as Singapore), particularly in the first half of the 1990s (see figure 2).

Second, East Asian production networks determine imports and exports in a specific location (Ando and Kimura, 2003), which can dampen the impact of exchange rate fluctuations. A sectoral analysis by Chayawadee and Jantarangs (2004) similarly indicates that real exchange rate changes in Thailand have a relatively small effect on manufacturing trade, but a significant effect on agricultural products. They argue that in the case of Thailand's integrated circuit industry, dominated by multinational firms, the volume of imports is primarily determined by parent company headquarters, rather than changes in the exchange rate.

Third, as noted earlier, Southeast Asian current accounts have significant nonmerchandise trade components, which are price insensitive. The real exchange rate's impact on the current account may thus be weakened further by the small effects on these nonmerchandise components.[8]

One final relevant aspect of the relationship between the exchange rate and the current account in Southeast Asia is that apart from having price effects, the exchange rate had offsetting income effects on the current account through its impact on capital flows. An exchange rate depreciation (or efforts to stem appreciation) that was perceived as unsustainable could worsen the current account balance by increasing capital inflows and, therefore, domestic investment spending.[9] Pegging influenced capital flows in Southeast Asia, in particular, by exposing these countries to fluctuations of the yen against the U.S. dollar. Research suggests that in periods of yen appreciation, Southeast Asian economies (whose currencies tended to be stable or depreciating against the U.S. dollar) became more attractive destinations for Japanese foreign direct investment (FDI) inflows, while imports in these economies also increased (Goldberg and Klein, 1998). This implies that, at the time, an effective trade-weighted depreciation

8. For example, Chayawadee and Jantarangs (2004) report that real exchange rate fluctuations have little effect on the services account in Thailand. Overseas worker remittances in the Philippines may also be insensitive to exchange rate fluctuations: Vargas-Silva and Huang (2006) find that remittances are more influenced by conditions in the host rather than home country; in particular, exchange rates against the dollar do not help explain remittances in a set of emerging market recipients.

9. Greene (2002) finds that inflows supported domestic investment spending prior to the crisis.

of Southeast Asian currencies could be associated with more capital inflows and larger current account deficits.[10]

2. Why Pre-Crisis Current Account Deficits Were Not Sustainable

Large current account deficits were observed up to about 1997 and then reversed sharply. This current account cycle appears to reflect abrupt changes in the availability of capital flows. Starting in the late 1980s, falling U.S. interest rates and recessions in industrial countries stimulated capital flows to Southeast Asia and other emerging market regions, as investors sought higher returns. Exchange rate policies in the Southeast Asian countries also helped attract capital. Capital flows were also supported by favorable domestic macroeconomic conditions, such as sound fiscal policies, rapid growth in output and exports, and relatively stable inflation that was not excessive by emerging market standards (see table A1). All these factors had a positive influence on market sentiment and capital flows.[11]

The large current account deficits did raise concerns, but a number of arguments were presented to dispel them. These arguments, some of which are still brought up today, are generally founded on three basic issues. First, current account deficits reflected an excess of investment over (high) saving rates, as opposed to high consumption. Second, current account deficits were financed, in some cases, by non-debt-generating inflows, including foreign direct investment.[12] Finally, indicators of external debt sustainability appeared to be favorable. I discuss each of these points in turn.

10. In private correspondence, economists at the Central Bank of the Philippines pointed out a counterintuitive relationship between the exchange rate and export volumes. While the real trade-weighted peso appreciated in 1992, 1996, and 1999, export volume nonetheless grew during the same years. By the same token, real exchange rate depreciation in 1991, 1998, 2001, and 2003–04, was not associated with more rapid export growth. Bautista (2002) suggests that the Philippines' international competitiveness is affected not only by movements in its real exchange rate, but also by trade policies and incentive structures. More generally, the uncertain relationship between real exchange rates and the trade and current accounts in Southeast Asia highlights the importance of a general equilibrium analysis that explicitly takes into account the effects of demand, supply, capital flows, and other factors that might have an important bearing on trade outcomes.

11. In a retrospective study of crises in the 1990s and the IMF's role, Ghosh and others (2002) emphasize the importance of shifts in market sentiment in influencing external balance, in contrast to traditional IMF programs in which macroeconomic imbalances resulted in a gradual deterioration on the external side.

12. Banque Paribas (1995).

The first argument—that current account deficits reflected excess investment rather than high consumption—was often presented in contrast to Mexico, where external deficits were associated with high rates of consumption prior to the 1994 peso crisis, and cases in which current account deficits reflected public deficits. It was widely believed at the time that the association with high investment rates implied that the current account deficits were sustainable. Ostry (1997), using an intertemporal approach, found no evidence of excessive private consumption in Southeast Asian current account deficits, except to a small degree in Indonesia and Malaysia. The absence of excess consumption suggested that the fast-growing Asian economies were not necessarily experiencing the temporary and unsustainable spending booms that characterized the Latin American stabilization programs that lacked policy credibility (see Calvo and Végh, 1999).

A 1995 private sector report refers to the "value-adding" nature of Thailand's current account deficit as supporting the external valuation of the baht (Union Bank of Switzerland, 1995c). The Monetary Authority of Singapore (1997) draws on Singapore's own experience to assess the current account deficits in Southeast Asia before the crisis. The study notes that the high investment rates in Southeast Asia were largely attributable to the private sector, which accounted for 76 percent of total investment in Indonesia, 66 percent in Malaysia, and 81 percent in Thailand. These investments had a high import content (resulting in higher import-to-GDP ratios and current account deficits), and estimates indicated that they were highly productive. For example, U.S. multinational investments in three Southeast Asian economies were estimated to have yielded higher rates of return (in US$) than they did in the European Community, Japan, or the newly -industrialized economies (that is, Korea, Hong Kong, Singapore, and Taiwan).[13] One indicator that imports were used for investment is the high share of machinery in imports. Ando and Kimura (2003, table 1) estimate that the shares of machinery imports in 1996 were 42 percent in Indonesia, 63 percent in Malaysia, 54 percent in the Philippines, and 50 percent in Thailand.[14] The

13. The Monetary Authority of Singapore (1997) also argued that such imports would eventually increase exports.

14. The shares have since fallen in Indonesia and Thailand, remained stable in the Philippines, and risen in Malaysia. The Monetary Authority of Singapore (1997, table 4) confirms the high share of imports used in production. The shares of intermediate and capital goods in total imports were estimated to have risen sharply between 1975–77 and 1990–94 in Malaysia, Thailand, and Indonesia.

share was also high in Singapore, at 63 percent.[15]

The second argument—that current account deficits were financed by non-debt-generating inflows—was supported by studies such as Sachs, Tornell, and Velasco (1996), who, in searching for lessons from Mexico, suggest that this type of financing reduced vulnerability to crises. Frankel and Rose (1996) present similar results. More recently, Levchenko and Mauro (2006) conclude that FDI helps protect countries from sudden stops in capital flows.

This argument was also used to highlight differences between Southeast Asia and Mexico in the aftermath of the 1994 collapse of the Mexican peso.[16] In 1991–97, FDI inflows averaged about 120 percent of current account deficits in Malaysia, 70 percent in Indonesia, 50 percent in the Philippines, and 30 percent in Thailand. The Monetary Authority of Singapore (1997) noted that a high share of FDI financing was one factor that helped sustain Singapore's own large current account deficits, which persisted from 1972 to 1984. FDI accounted for 83 percent of Singapore's current account deficits in that period. It was argued that such financing was an indication that these current account deficits were efficient market outcomes, reflecting the flow of international capital to countries with the highest returns.

A third argument was that indicators of external debt sustainability appeared to be favorable. The ratios to exports of external debt and debt service payments were generally low or seemingly manageable. Until 1995, export growth in a number of countries appeared to be more than adequate to cover existing current account deficits, so that the debt-to-exports ratios would converge to a level that could be serviced (not exceeding two digits).[17] Ratings upgrades in 1995 typically cited rapid growth, as well as growth-boosting structural reforms (for example, the Moody's upgrades for Malaysia and the Philippines).[18]

2.1 Shocks and Vulnerabilities

In this setting, a number of shocks starting in late 1994 led to a progressive deterioration in market sentiment, while uncovered

15. The perspective of the Monetary Authority of Singapore (1997) is of interest because it highlights some of the rationale for policies followed by Southeast Asian economies. A fuller exposition (and defense) of the Asian approach to development is provided by Stiglitz (1996). Corsetti, Pesenti, and Roubini (1999) offer a critical view.

16. For example, see N. Sopiee, "We Are Not Going down Mexico Way," *New Straits Times* (Malaysia), 14 March 1995.

17. Dadush and Brahmbhatt (1995).

18. For a discussion of how the Philippines was perceived, see T. Shale, "Has the Philippines Found Its Feet?" *Euromoney*, September 1995.

vulnerabilities triggered currency collapse and a massive capital flow reversal in the region. Three shocks were prominent in the press and analysts' commentary: the Mexican peso crisis; the slowdown in exports and the drop in the terms of trade; and the collapse of the Thai baht.

The collapse of the Mexican peso in December 1994 led to market volatility and a debate on the extent to which Southeast Asian economies might (or might not) be as vulnerable as Mexico, which also had large current account deficits prior to its currency crisis. For example, an analysis by a U.S. investment advisor suggested that four of the seven countries whose currencies were most vulnerable to devaluation after the Mexican peso collapse were in Southeast Asia (namely, Indonesia, the Philippines, Malaysia, and Thailand).[19] Although sentiment stabilized after a period of market volatility, there were lasting effects on interest rates in some countries.[20]

The sharp slowdown in export growth in 1996 affected Thailand most severely. After growing nearly 25 percent in 1995, Thailand's export revenues in dollars fell 1.3 percent in 1996. This partly reflected a significant drop in the terms of trade (see table A1). Export growth also fell sharply in Malaysia (26 percent to 5.8 percent) and the Philippines (32 percent to 17 percent) and more moderately in Indonesia (13.4 percent to 9.7 percent). The reasons cited for this slowdown included a significant decline in manufacturing export prices, most notably for semiconductors and other electronics products, and an appreciation of the dollar against the yen, which caused Southeast Asian effective exchange rates to appreciate (see Goldman Sachs, 1997). In Thailand, the slowdown in economic activity was associated with a significant shift in market sentiment starting in early 1996, as reflected in declining stock prices that did not hit other countries until later. Property markets were also adversely affected, which severely impaired the financial position of certain financial institutions. Press reports suggest that news of the drop in export growth in 1996 raised significant concerns about the sustainability of exchange rates and current account deficits.

19. A *Fortune* article triggered rebuttals from Malaysian commentators; see L. Smith, "After Mexico, Who's Next?" *Fortune*, 6 March 1995. The three other countries listed as vulnerable were in Latin America (namely, Argentina, Brazil, and Chile).

20. For alternative views on who was vulnerable and who was not, see Union Bank of Switzerland (1995a), Sachs, Tornell, and Velasco (1996), and "No, Manila Is Not Mexico," *The Economist*, 11 March 1995.

Finally, the shocks cited above triggered sporadic episodes of speculative pressure, particularly against the Thai baht from 1995 onward. The eventual collapse of the baht in July 1997 triggered depreciations in the exchange rates of Indonesia, the Philippines, and Malaysia. Current account deficits switched sharply into surpluses around this time, reflecting the sudden withdrawal of external financing.

The fact that current account deficits reflected high investment rather than consumption, together with the large share of FDI in financing, did not prevent a sudden stop and costly current account reversal. A number of factors made economies vulnerable to adverse shifts in market sentiment: (a) growing overinvestment; (b) financial fragility; (c) low foreign reserve cover for short-term external debt, accentuated by the fact that short-term debt was underestimated; and (d) currency mismatches.[21]

2.1.1 Overinvestment

Despite the positive factors identified by the Monetary Authority of Singapore (1997) and Stiglitz (1996), rapid capital accumulation resulted in overinvestment and an inefficient use of resources in Southeast Asia up to about 1997.Corsetti, Pesenti, and Roubini (1999), who acknowledge the high marginal efficiency of investment in East Asia, find that incremental capital output ratios rose in Asian economies prior to the crisis, suggesting a deterioration in efficiency. Even before the crisis, the governor of Bank Indonesia expressed concern about economic inefficiency, as reflected in high incremental capital output ratios.[22] In the case of Thailand, the first half of the 1990s was characterized by reductions in the marginal productivity of capital, declining total factor productivity growth, low returns on assets, and falling capacity utilization (Roong, Thaicharoen, and Rodpengsangkaha, 2003, pp. 17–19 and 23–24).[23]

21. An alternative view is that the Asian crisis was largely an unanticipated panic and economies were vulnerable regardless of their fundamentals (Sachs and Radelet, 1998). However, the broader discussion and empirical evidence suggests that there was ongoing debate as to the vulnerability of Asian economies after the collapse of the Mexican peso and that fundamentals did play a role in vulnerability to crises. The clearest example of this is provided by Singapore, which experienced a massive real sector shock but no financial or currency crisis.

22. "Soedradjad Bemoans Economic Inefficiency," *Jakarta Post*, 19 December 1996.

23. See Sarel (1997) for graphs illustrating declines in the marginal product of capital in Southeast Asian countries between 1990 and 1996.

2.1.2 Financial fragility

The Southeast Asian economies showed signs of rapid growth in risky lending.[24] Domestic credit to the private sector picked up sharply in the first half of the 1990s, triggering booms in equity and property markets. The ratio of credit to GDP rose from around 70 percent in 1990 to over 150 percent in 1997 in both Malaysia and Thailand (see figure 3). Over the same period, it rose to 50 percent in both Indonesia and the Philippines, although more sharply in the latter. These increases were partly the result of desirable financial deepening, but examination of banks' asset quality suggests that a considerable proportion of the lending posed significant risks. In the case of Thailand, Moody's expressed concern in early 1995 that credit continued to grow rapidly despite signs of overdevelopment, including the existence of more than 350 golf courses and high property vacancy rates.[25] Nevertheless, Moody's said it was not considering downgrading the credit ratings of Thai banks. Most of the large banks reportedly met Basel I capital adequacy requirements and maintained reserves equal to the size of their doubtful loans. Financial sector weaknesses were also recognized in other countries in the region. For example, at a press conference in November 1996, the governor of Bank Indonesia expressed concern for the growing concentration of bank credit in the property sector (over 18 percent of total credit), which had increased 26 percent from January to September 1996. In 1996, a study by the Central Bank of the Philippines found that property prices in three business districts in Manila had risen between 150 and 230 percent since 1994; the central bank's governor at the time indicated that limits on credit to the property sector were being considered as a result.[26] Certain prudential measures adopted in Malaysia also indicate concerns about developments in property markets. The central bank set a maximum loan-to-value ratio of 60 percent on loans to the real estate

24. For a discussion of varying sets of macroeconomic and financial indicators and what they implied for Asian economies, see Milesi-Ferretti and Razin (1996) and Glick (1999).

25. See P. Montagnon, "Moody's Warns of Thailand Bubble." *Financial Times*, 9 February 1995. A rapid increase in commercial bank lending to the private sector in the years before the 1994 peso crisis is one of the key vulnerabilities highlighted by Sachs, Tornell, and Velasco (1996).

26. See "Indonesia Property Sector Credit Volume up 26 pct," *Asia Pulse*, 12 November 1996; see also J. Marozzi, "Manila Ponders Lending Limits," *Financial Times*, 11 December 1996.

Figure 3. Domestic Bank Credit to the Private Sectora
Percent of GDP

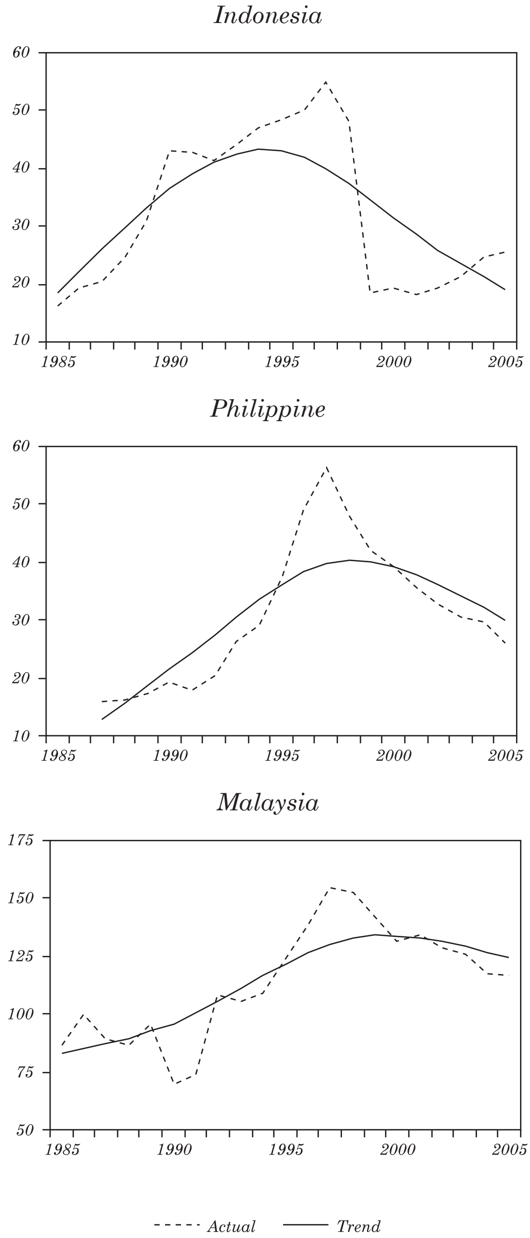
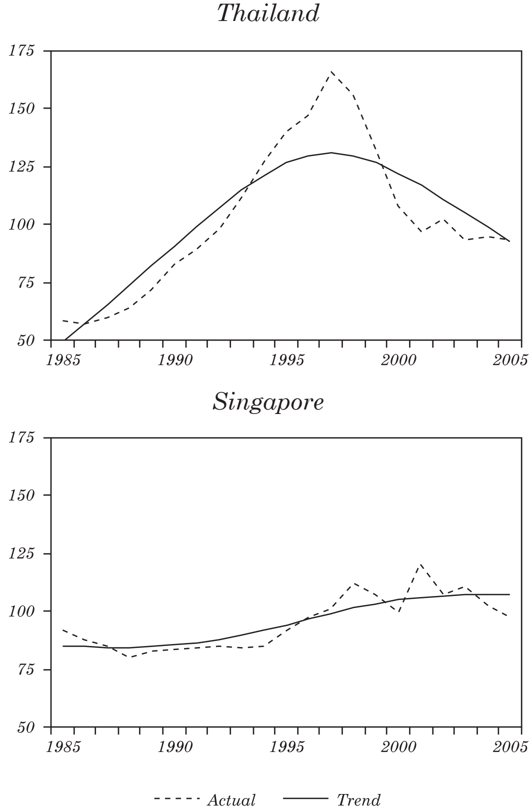


Figure 3. (continued)



Sources: IMF; BIS calculations.
a. Trend series are estimated using a Hodrick-Prescott filter applied to annual data.

sector. It also raised reserve requirements to limit the rapid credit growth for consumption, which was seen as unproductive. Efforts were also made to cut the link between capital flows and domestic liquidity creation.

A number of explanations have been offered for Asia's growing financial fragility. First, the economies suffered from a series of credit market imperfections. Koh and others (2005) provide empirical evidence suggesting that financial intermediaries in Indonesia, Malaysia, and Thailand underpriced lending (specifically, the implicit option to default by borrowers) in property markets, leading to a boom and bust in property prices. The underpricing may have stemmed from lender optimism or disaster myopia in the boom period, from incentives that distort lending decisions, such as implicit guarantees by authorities, or from agency conflicts (for example, between banks and their borrowers or among shareholders).

Incentives or implicit guarantees by authorities could be particularly important in Southeast Asia, where the banking sector supported an economic strategy oriented toward rapid economic growth. With regard to agency conflicts, Johnson and others (2000) report that weaknesses in corporate governance in Asia created a situation in which majority shareholders could step up their expropriation of the claims of minority shareholders during periods of investor uncertainty, leading to capital inflow reversals, falling stock prices, and currency depreciation. They find that weaknesses in corporate governance were a better predictor of currency depreciation than more widely used macroeconomic indicators. Relationship lending is another relevant market imperfection. Rajan and Zingales (1998) hold that Asia's traditional relationship-based system of credit extension contributed to resource misallocation in the presence of large capital inflows by suppressing price signals. Moreover, because suppliers of external capital have few rights in a relationship system, they limited their risks by lending short term, which made the economies more vulnerable to sudden reversals in capital flows.[27] In particular, the withdrawal of short-term funds could create liquidity problems for banks, leading them to recall their loans and forcing borrowers to cancel projects. This mechanism appears to have contributed to the severe economic downturns observed during the Asian crisis.

Second, there were weaknesses in the prudential policies in place. Bongini, Claesens, and Ferri (2001) analyze a sample of 283 financial institutions in Southeast Asia and Korea during the Asian financial crisis. One hundred and twenty of these experienced distress and 38 were eventually closed. The authors identify two predictors of distress: (a) variables that are typically monitored by banking supervisors using the CAMEL supervisory approach; and (b) connections with industrial groups or influential families, which the authors interpret as implying forbearance. These predictors suggest that difficulties in prudential supervision might have played a role in increasing financial vulnerability.

Apart from playing a role in predicting financial distress, financial fragility appears to have directly contributed to market perceptions

27. An alternative explanation for the emphasis on short-term lending by foreign creditors is lack of familiarity with domestic conditions.

of the sustainability of exchange rate regimes in Southeast Asia and the eventual interruption in external financing. For example, early in 1997 an investment bank raised its assessment of the probability of a baht devaluation, partly because financial sector problems associated with a sharp downturn in property markets would make it very costly for the Bank of Thailand to raise interest rates to defend the currency.[28] Press reports suggest that the analysis triggered a bout of speculation against the baht shortly after it was published. The speculation continued intermittently until the collapse of the currency in July 1997. While interest rates in Thailand did rise over the period as liquidity vanished from financial markets, the desire to dampen any interest rate hikes may explain why the Bank of Thailand depleted its foreign reserves significantly during this period to defend the peg.[29]

2.1.3 Low foreign reserve cover

Recent research on early warning systems by Bussière and Fratzscher (2006) confirms that low foreign reserve cover of short-term debt is a predictor of crises. The foreign reserve cover of short-term debt in 1996 was below the (now) conventional threshold of one in Indonesia and Thailand (see table 4). If the need to cover current account deficits (measured ex post) in the following year is also taken into account, then the foreign reserve cover exceeded one only in Malaysia (1.4 in 1996). Moody's widely publicized downgrading of Thailand's sovereign debt in September 1996 was motivated by the rapid and recent accumulation of short-term external debt, which by some estimates slightly exceeded foreign reserves. In contrast, Malaysia's rating remained high for an extended period partly because of its high foreign reserve cover of short-term debt. Standard and Poor's downgraded Malaysia's sovereign rating in 1998, but the rating remained comparatively high in part because liquid international reserves were estimated at 170 percent of short-term external debt.[30] An important

28. See S. Kim, "Baht under Pressure," *Goldman Sachs Asian Weekly Analyst*, 5 February 1997. The analysis was related to Kaminsky and Reinhart's (1999) research linking banking crises and currency crises, which first appeared in 1996 as a working paper.

29. For a general discussion of this episode, see Moreno (1997).

30. "Malaysia's Ratings Cut By S&P; Outlook Now Negative," *Standard and Poor's CreditWire*, 24 July 1998 (available at findarticles.com/p/articles/mi_m0EIN/is_1998_July_24/ai_50195223). Malaysia's high foreign reserve cover was deliberate. Cheong (2002) points out that Malaysia implemented a policy of maintaining a foreign reserve cover of at least one well before it was suggested by Greenspan.

factor is that while FDI was indeed important in financing current account deficits, debt exposures were apparently underestimated in a number of countries. For example, the International Monetary Fund's Independent Evaluation Office (2003, pages 12 and 26) states that Indonesia's debt exposure was underestimated, particularly its short-term debt. Furthermore, market commentary indicates that officials could not closely monitor private lending flows (Union Bank of Switzerland, 1995b).[31] Finally, apart from the debt burden being higher than was thought at the time, the share of short-term debt was sufficiently high to pose illiquidity risks.

Table 4. Foreign Exchange Reserves / Short-Term External Debt Ratio[a]

Region or country	*1996*	*1997*	*1998*	*1999*	*2000*	*2001*	*2002*	*2003*	*2004*	*2005*
Southeast Asia[b]	1.2	0.7	1.3	2.2	2.3	2.3	2.8	3.0	2.9	2.5
Indonesia	0.5	0.4	0.9	1.3	1.3	1.6	2.3	2.6	2.1	1.9
Malaysia	2.3	1.3	2.5	3.7	3.6	3.3	3.4	4.1	3.8	3.2
Philippines	1.2	0.8	1.1	1.7	1.8	1.7	2.0	2.1	2.1	2.0
Thailand	0.8	0.7	1.1	2.2	2.5	2.7	3.9	4.0	4.4	3.7

Source: IMF; national data; BIS.
a. Short-term external debt defined as short-term liabilities to BIS reporting banks: consolidated cross-border claims to all BIS reporting banks on countries outside the reporting area with a maturity up to and including one year plus international debt securities outstanding with a maturity up to one year; based on outstanding year-end positions
b. Unweighted averages of the countries shown.

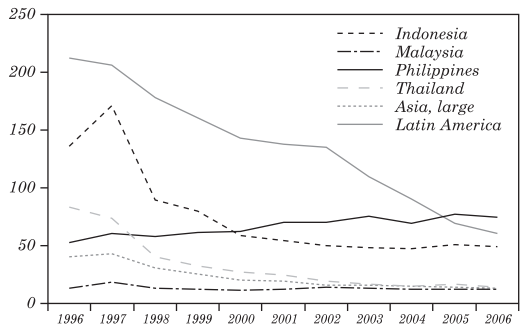
2.1.4 Currency mismatches

A significant amount of foreign currency borrowing in Southeast Asia was either unhedged or not effectively hedged. Such mismatches partly explain why the Asian currency crises of 1997–98 were associated with sudden stops in capital flows and sharp contractions in

31. The estimated external-debt-to-exports ratios for 1995 in table A1—which are based on revised data that use BIS creditor statistics to supplement reports by the debtor countries—are much higher than estimates provided by one investment bank at the time. The investment bank estimated Thailand's debt-to-exports ratio at 103 percent, versus a revised estimate in table A1 of 177 percent; for the Philippines, the two figures are 135 percent versus 225 percent, and for Indonesia, 184 percent versus 274 percent. The two estimates are similar only in the case of Malaysia (43 percent according to the investment bank versus 46 percent in the table). Another investment bank (Union Bank of Switzerland, 1996) used BIS statistics to obtain an estimate of external borrowing in Indonesia.

output while other currency crises were not. As a currency comes under depreciation pressure, the balance sheets of borrowers who have not hedged their foreign currency positions deteriorate sharply, as do those of their domestic bank lenders. This can lead to sharp reductions in expected returns and output, triggering sharp withdrawals in external financing as occurred in Asia in 1997–98. The precise dimensions of the problem were apparently not well understood at the time. For example, an Independent Evaluation Office (2003, page 26) report indicates that there was insufficient exploration of balance sheet risks, including those arising from currency (or maturity) mismatches in Indonesia. The difficulties of dealing with currency mismatches are illustrated by Allayanis, Brown, and Klapper (2000), who find that firms in East Asia tended to use foreign earnings as a substitute for hedging with derivatives. They also find, however, that firms that hedged with derivatives did no better during the Asian crisis than firms that did not hedge. One possible explanation is that the derivatives markets could not handle the sudden stops associated with the Asian crisis. The primary source of cover for meeting foreign currency obligations or managing foreign currency risks in this situation would either be the foreign reserves of the central bank (discussed above) or export revenues. To provide some perspective on the latter, figure 4 illustrates the foreign currency share of total debt divided by the ratio of exports to GDP, which serves as an indicator of the extent to which

Figure 4. Indicators of Currency Mismatch[a]
Percent



Sources: IMF; national data; BIS.
a. Foreign currency share of total debt divided by the ratio of exports to GDP, in percent. Asia is the weighted average of China, India, Korea, and Taiwan (China). Latin America is the weighted average of Argentina, Brazil, Chile, Colombia, Mexico, Peru, and Venezuela.

foreign currency borrowing is not naturally hedged by exports.[32] In 1997, this ratio was highest in Indonesia and then Thailand, the two countries most severely affected by the crisis. The ratio was rising in the Philippines, and it was remarkably low in Malaysia.

3. Policy Responses

Current account deficits in Southeast Asia were an ongoing concern for policymakers throughout the first half of the 1990s.[33] Nevertheless, this concern appears to have been outweighed by the goal of maintaining rapid growth rates to achieve developed-country status. Early in the 1990s, when growth in major developed economies was sluggish, the Bank of Thailand (1992, p. 9) stated that the current account deficit reflected a shortfall in national saving that constrained long-run growth opportunities. Starting around 1994, when growth had picked up, commentators began to describe current account deficits as a sign of overheating and as an apparent proxy for the output gap.[34] After the December 1994 collapse of the Mexican peso, press reports and market commentary indicate growing awareness by people concerned with economic issues that such deficits could pose risks to economic stability, and that there could be a need to tighten fiscal or monetary policy, not only to curb inflation but also to reduce the high current account deficits. For example, in discussing the effects of monetary policy tightening, the governor of Bank Indonesia highlighted the impact on imports and sought to alleviate concerns about the large current account deficits.[35] The governor of the Bank of Thailand announced that monetary policy would proceed in "a cautious mode with the aim of reducing the current account deficit" and cited the central bank's intention to keep inflation below five percent and the current account deficit below eight percent of GDP.[36]

32. This indicator is also used by Goldstein and Turner (2004).

33. The discussion in this section refers to policy responses that have a bearing on the current account, dating to the early 1990s. For a general discussion of policy responses to capital inflows, which were a key consideration during that period, see Corbo and Hernández (1996). For more details on responses from 1995 onward, see, for example, Corsetti, Pesenti, and Roubini (1999).

34. For example, see various issues of Morgan Guaranty's *World Financial Markets* of the period.

35. Cited by Riyadi, "Govt. Vows to Cool Down Economy," *Jakarta Post*, 26 December 1996.

36. "Central Bank to Restrict Use of Monetary Policy in 1997," Agence France Presse, 26 December 1996.

The IMF's advice in this period has not been fully disclosed, but the organization's traditional model and publicly available information indicate that reducing current account deficits was a priority. For example, in addition to boosting growth, the IMF's 1994 program for the Philippines sought to lower inflation, thereby enhancing competitiveness with a stable exchange rate, and reduce the current account deficit to a sustainable level of about 2.5 percent of gross national product (GNP) by 1997, from about 6 percent in 1993.[37] In 1995, the IMF representative to the Philippines suggested that the country was less vulnerable than Mexico because it had a smaller and falling current account deficit, as well as a lower debt service ratio, a lower share of short-term debt, and more flexible exchange rates.[38] The Independent Evaluation Office (2003, p. 62) discussion of the Article IV consultation missions to Indonesia notes that the 1996 mission advice was "that the authorities should follow tight fiscal and monetary policies." In 1997 it also called for "greater exchange rate flexibility and accelerated structural and banking reforms to maintain progress in reducing inflation, contain current account deficits, and minimize external risks." The viewpoint that current accounts should be reduced influenced the policy inferences that were drawn from IMF research. For example, notwithstanding his conclusion that current account deficits in Southeast Asia did not reflect excess consumption, Ostry (1997) argues that risks from other factors (such as the level and composition of external liabilities, flexibility of macroeconomic policies, and the health of banking systems) would justify reducing current account deficits.

To reduce current account deficits, policymakers could seek to increase private or public saving or lower investment spending. Although investment spending was a major driver of the current account cycle, the authorities were reluctant to curb it because it was a centerpiece of these countries' development strategies. It was argued that investment could increase production capacity and lower cost pressures and future current account deficits.[39] In Thailand, reducing government investment spending would have affected infrastructure projects needed to ease severe bottlenecks impeding growth. Indeed,

37. For a discussion, see "Philippines: Manila Transformed," *The Banker*, 1 September 1994.

38. "No, Manila Is Not Mexico," *The Economist*, 11 March 1995.

39. For an example of reasoning along these lines, see the Bank of Thailand's *Annual Economic Report, 1995*, as well as the Monetary Authority of Singapore (1997). The focus on the supply effects of investment, as opposed to its impact on the external balance via aggregate demand, is still apparent in discussions of China today, where there is concern that investment in some sectors might lead to excess capacity.

government spending in these areas was seen as lagging throughout the first half of the 1990s and was not considered the proximate cause of current account deficits. Investment was also a key element of Malaysia's efforts to achieve developed country status by 2020. Bank Indonesia similarly cites the dilemma of pursuing both the goals of macroeconomic stability and the benefits of high investment: its annual report (1992/3, p 3) cites efforts to dampen domestic demand since 1990, but expresses concern about the slowdown in investment activity in 1992/93, which authorities believed could have an adverse impact on economic growth and exports in coming years.

Policymakers instead sought to encourage private saving, in particular through the development of saving vehicles for households.[40] For example, the Bank of Thailand consistently highlighted the need to develop provident funds for employees. Such efforts to raise household saving in Thailand were not very successful, however. National saving was very high, but the household saving rate fell by over half between 1989 and 1996, to around 7 percent (Pootrakul, Ariyapruchya, and Sodsrichai, 2005, chart 2.6, p. 9). An important medium-term factor accounting for this decline appears to have been a consumption boom. At the same time, it is not clear that efforts to increase private saving would have reduced current account deficits. In their study of a larger set of developing countries, Calderón, Chong, and Loayza (2002) find that private saving and investment are tightly linked, while public saving and investment are not. The empirical evidence available today thus suggests that increasing private savings would not necessarily have helped reduce current account deficits, whereas increasing public savings might have.[41]

Increasing public saving was, in fact, considered, although in some ways, this had already occurred. Budgets in many cases were in surplus or were deemed sound or improving. The ratio of public debt to GDP was generally low: in 1996 it was estimated at 3.8 percent in Thailand, 15 percent in Indonesia, and 35 percent in Malaysia. The Philippines had a considerably higher ratio than its neighbors, at 56 percent, but the Philippine budget recorded surpluses in 1994–96 after a period of persistent deficits (see table A1). Measurement issues arose here, too. Fiscal positions were arguably not as sound as they appeared because they did not reflect possible contingent liabilities

40. See, for example, the discussions in the Bank of Thailand's and Bank Negara Malaysia's annual reports.

41. Further research is needed to determine the applicability of these results to Southeast Asian economies.

arising from fragile financial sectors (which today would be assessed through macroeconomic stress testing).

Market sentiment changed around the mid-1990s, generating calls for fiscal policy to support current account deficit reduction. For example in 1996, the Indonesian finance minister promised to maintain fiscal surpluses in an effort to cool down the economy.[42] In its *Annual Economic Report 1996* (p. 8), the Bank of Thailand called on the government to reduce expenditures; this contrasts with earlier reports, which cited expenditure shortfalls. The report also called on the government to expand the tax base, particularly through consumption taxes, so as to increase public and private saving.

In this setting, much of the burden of dealing with overheating and current account deficits arguably fell on monetary policy. However, the scope for an independent monetary policy in the first half of the 1990s was limited by efforts to stabilize exchange rates against the U.S. dollar.[43] As illustrated in figure 5 the baht was very stable against the dollar, as was the Philippine peso after late 1995. The Malaysian ringgit was more volatile, but it was largely trendless against the dollar until the collapse of the Thai baht in July 1997. Indonesia maintained a crawling depreciating band against the US dollar of around 4–5 percent a year.

In the first half of the 1990s, central bank intervention to prevent the exchange rate from appreciating was reflected in significant foreign reserve accumulation (table 1). This increased liquidity and contributed to the boom in credit and investment and the growing financial fragility cited earlier. Monetary authorities responded by applying a variety of tools to drain liquidity. First, they increased reserve requirements. Malaysia increased its reserve requirements eight times between 1990 and 1997, while Indonesia did so twice for rupiah deposits (Van 't Dack, 1999, table 7). Second, government or provident fund deposits with the central bank were increased (for example, Malaysia). Finally, the authorities undertook standard sterilization operations involving short-term borrowing from the money market, which in some cases (such as Indonesia, Malaysia, and Thailand) required the issuance

42. Riyadi, "Govt. Vows to Cool Down Economy," *Jakarta Post*, 26 December 1996.

43. Frankel and Wei (1994) show that East Asian currencies behaved like basket pegs with a high weight assigned to the U.S. dollar; the Monetary Authority of Singapore (2000) updates this study and shows that the role of the yen increased after the Asian crisis. Hernández and Montiel (2003) show that exchange rate volatilities in Asian currencies were low prior to the crises and rose significantly afterward, but less than pure floaters. Stabilizing the exchange rate was arguably also part of a high-growth strategy; see Dooley, Folkerts-Landau, and Garber (2004).

Figure 5. Exchange Rates[a]

1990–2005 = 100

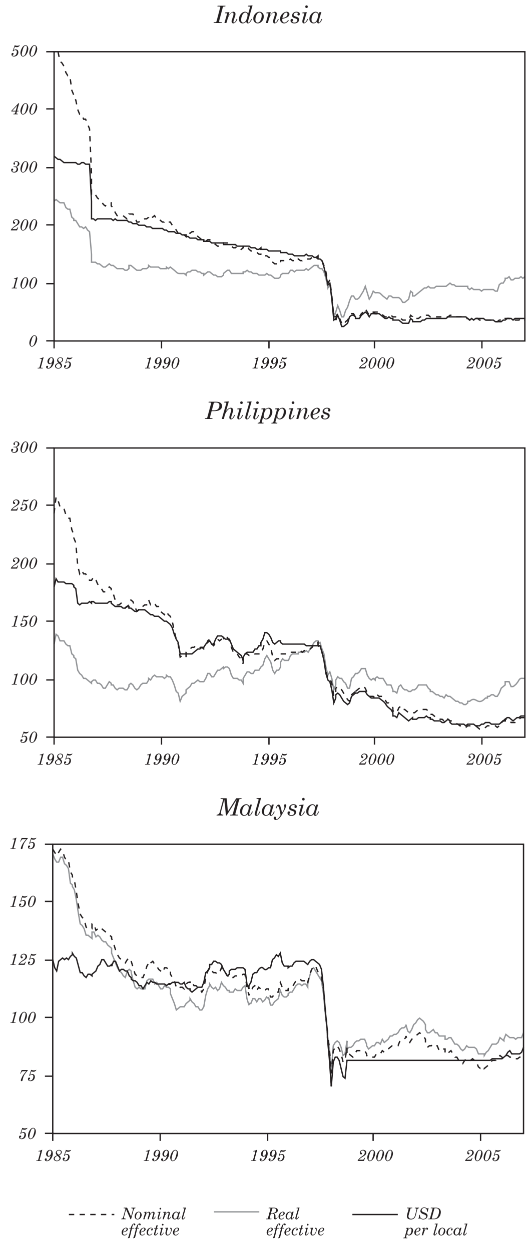
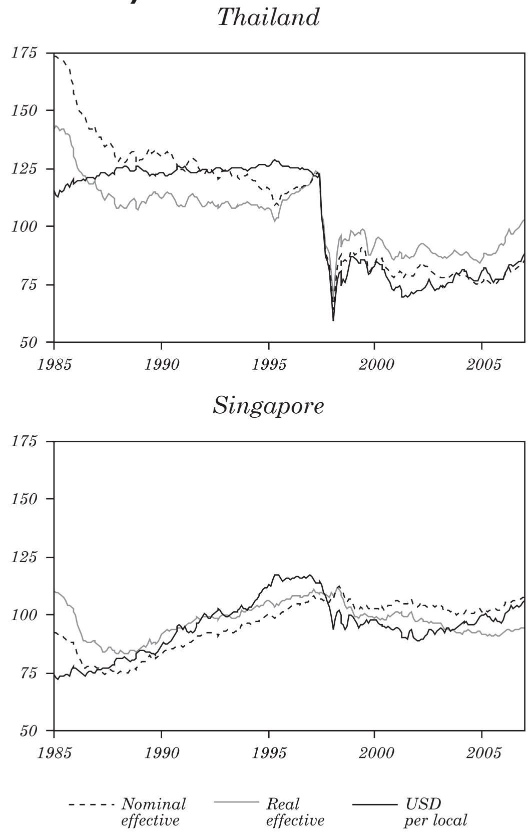


Figure 5. (continued)



Sources: IMF; Bloomberg; Datastream; national data; BIS.
a. Monthly averages. An increase indicates an appreciation. The real effective rate is in terms of relative consumer prices.

of central bank instruments, owing to the lack of government paper. Given efforts to stabilize the exchange rate, these attempts to mop up liquidity attracted more capital inflows, which complicated monetary control.[44] This is an implication of the Mundell-Fleming model and a feature of discussions of the so-called impossible trinity.

The outcomes for exchange rates are illustrated in figures 5 and 6. Domestic monetary policies were significantly influenced by external conditions. Although occasionally disguised by high volatility,

44. For a discussion of the problems of dealing with surging capital inflows, see Bank Negara Malaysia (1993, 1999), Cheong (2002), and Glick and Moreno (1994, 1995).

movements in short-term interest rates in Southeast Asia appear to have mirrored swings in the U.S. Federal funds rate, sometimes with a lag (with the exception of the Philippines). Interest rates thus tended to fall between 1990 and 1993, when the Federal funds rate was falling, and subsequently rise, when the Federal funds rate began to rise. In some cases (such as Thailand), rates would rise significantly more than the Federal funds rate, at least temporarily, reflecting adverse shifts in market sentiment following the Mexican peso collapse. Movements in the nominal effective exchange rate also reflected external influences, in particular fluctuations in the dollar against the yen. Thus, nominal effective rates tended to depreciate until about 1995, paralleling the weakness of the dollar against the yen, and to appreciate thereafter as the dollar rebounded sharply.

Figure 6. Short-Term Rates[a]
Percent

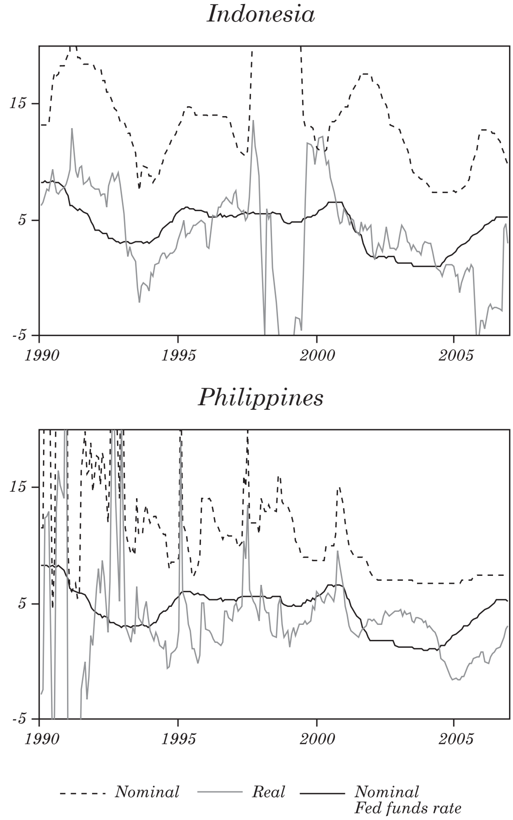
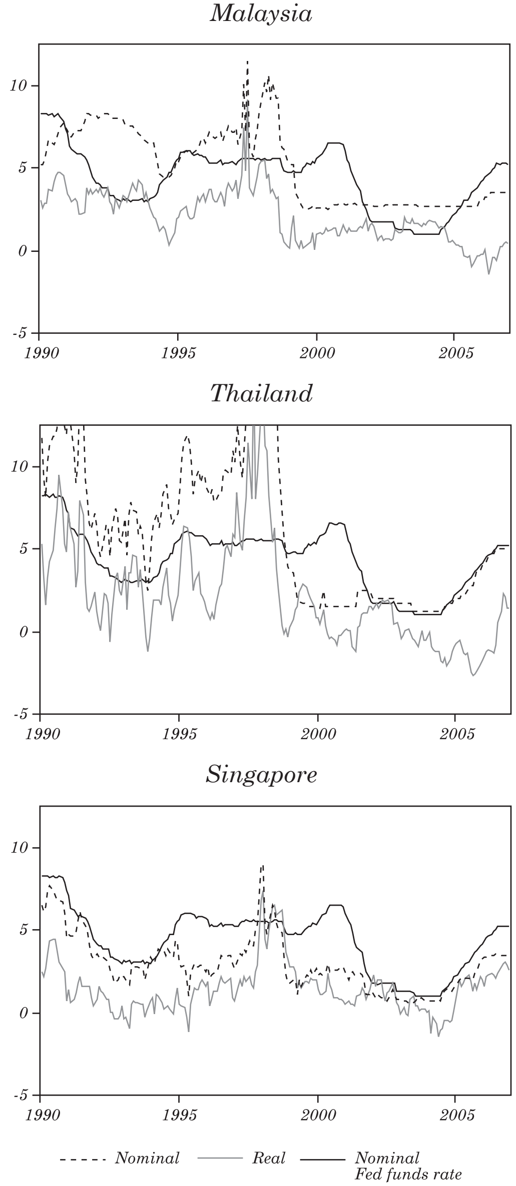


Figure 6. (continued)



Sources: IMF; Bloomberg; Datastream; national data; BIS.
a. Monthly averages. One-month SBI rate for Indonesia, overnight rate for Malaysia, overnight reverse repo for the Philippines, three-month interbank rate for Singapore, and fourteen-day repo for Thailand. The real rate is deflated by annual changes in consumer prices.

Significant tightening in monetary conditions only becomes apparent after 1995. Real short-term rates rose between 1995 and 1997 in all four Southeast Asian countries, albeit with more volatility in Thailand (specifically, a significant dip in the second half of 1995). Real effective exchange rates also appreciated after 1995. Prior to that, nominal effective exchange rates had been on a depreciating trend and real exchange rates were generally flat, following a period of depreciation in the 1980s. The real exchange rate of Singapore appreciated steadily from 1985 onward; throughout the period, the country maintained large surpluses. The extended period of stable real exchange rates in the other Southeast Asian countries is remarkable because the very rapid growth of these economies and the importance of the tradable goods sector in this process suggest that exchange rates should have appreciated as a result of Balassa-Samuelson effects. Empirical research reveals that Balassa-Samuelson effects are not present in the countries in the sample.[45]

Exchange rate appreciation thus did not play a direct role in the large trade or current account deficits in the first half of the 1990s.[46] Effective exchange rate appreciation may have been a factor in declining exports in 1996, contributing to market uncertainty and pressures on currencies, particularly in Thailand. Nevertheless, empirical evidence of overvaluation prior to the Asian crisis is mixed (see, for example, Chinn, 1998).

Would allowing the exchange rate to adjust more freely have helped reduce current account deficits prior to the crisis in Southeast Asia? More flexible exchange rates would probably have had different effects in different periods. Before the Mexican peso collapse in December 1994, allowing the exchange rate to float freely would most likely have resulted in currency appreciation. Paradoxically, while freeing the exchange rate might have lowered export growth and increased imports through price effects, it could have reduced imports through income effects, specifically by dampening capital inflows and investment demand and by giving monetary authorities more scope to tighten. In any case, policymakers acted as if exchange rate stability mattered a great deal. Cheong (2002) indicates that freeing

45. Drine and Rault (2004) find that the Balassa-Samuelson approach implies that the productivity differential between traded and nontraded goods sectors should be cointegrated with the corresponding relative prices; this is rejected by the data. One explanation is that there are other factors determining the real exchange rate that are not being taken into account.

46. A similar point is made in BIS (1996).

the exchange rate was not considered an option by Malaysia, in part because financial markets tend to overshoot and excessive volatility could threaten macroeconomic stability.[47] There was also concern in the region that appreciation would have hurt exporters, accentuated by growing competition with China in low-cost manufactures.

After the Mexican peso crisis, the effects of allowing more exchange rate adjustment are uncertain, as there were occasional periods of depreciation pressure. The debates on the appropriateness of allowing currencies to depreciate to reduce current account deficits became more pointed in 1996, when export revenue growth declined sharply.[48] Efforts to stabilize the exchange rate nevertheless continued in the region until the Thai baht collapsed; these stabilization efforts are partly reflected in high interest rates in 1997. Efforts to defend pegs by allowing interest rates to rise were criticized for their contractionary effects, but they may have been motivated by the high costs of devaluation resulting from currency mismatches.

3.1 Prudential Measures and Capital Controls

Apart from macroeconomic policies, and despite generally open capital accounts, Asian policymakers occasionally adopted measures that could influence the size of the current account or its perceived sustainability. First, a set of measures whose motivation was "prudential" was designed to limit vulnerabilities. Second, controls were put in place to stop destabilizing speculation in currency or asset markets and to increase monetary policy independence.

With regard to the first set of measures, several countries maintained restrictions on foreign borrowing or sought to influence it through regulation. In 1991, Indonesia imposed limits on foreign borrowing by the public sector (including private contracts with the public sector) and by banks, but these limits did not extend

47. Latifah Merican Cheong was, at the time, a senior official at Bank Negara Malaysia.

48. For example, the Philippine Socioeconomic Planning Secretary, Cielito Habito, was quoted in August 1996 as saying that the peso was overvalued and foreign exchange policy was inadequate to control the country's trade gap (see "Official Calls for Look at Forex Policy," United Press International, 16 August 1996). That same month, Bank Indonesia Governor Soedradjad defended Indonesia's exchange rate policy by saying it should not be designed merely to boost exports. This was partly in response to questions about a statement by Indonesia's finance minister that the rupiah was slightly overvalued (see "Indon Forex Policy Not Only for Exports: Banker," *Asia Pulse*, 9 August 1996).

to the private nonbank sector. Malaysia largely liberalized its capital account in 1973, but it maintained a set of foreign exchange controls that required approval on external borrowing above certain thresholds. Most (mainly long-term) external loans were only approved if firms earned foreign exchange. Cheong (2002) indicates that the goal of this restriction was largely prudential (that is, to ensure that entities incurring debt were able to service it), and it was not aimed at limiting borrowing per se. In the Philippines, public and private sector borrowing from abroad was subject to central bank approval in the mid-1990s. Controls were minimal in Thailand, although public sector foreign borrowing required approval by a foreign debt committee. For the private sector, the Bank of Thailand tried a somewhat different approach, implementing bank regulations to reduce the incentives for overseas financing. For example, in 1995, it sought to increase banks' reliance on domestic deposits (as opposed to external borrowing) by requiring banks with high loan-to-deposit ratios to lower them toward the industry average. It also modified the net foreign exchange position limit imposed on commercial banks by counting at less than 100 percent (in some cases zero percent) foreign assets or certain types of commercial bank credits in foreign currencies that the Bank of Thailand deemed risky (such as those for purchasing vacant lands and for personal consumption).

The effectiveness of these measures varied. Foreign borrowing by Indonesian firms contributed significantly to currency mismatches and the severity of its crisis, suggesting that its restrictions on foreign borrowing were not sufficiently effective to avert a crisis.

As for the second set of measures, the main example in this period is that of Malaysia, which implemented a set of (temporary) controls directed at capital inflows in early 1994.[49] The controls Malaysia imposed were motivated by three considerations.[50] First, capital inflows were large, rising from 3 percent of GDP in 1988 to 20 percent in 1993. Foreign capital was attracted by the high rates of return in Malaysia, buoyant equity markets, and expectations of ringgit appreciation. Second, while a large share of net capital

49. For discussions of this episode, see Bank Negara Malaysia (1993 pp 61–62, 1999) and Glick and Moreno (1995). Another well-known example is Thailand's attempt to curb speculation against the baht in May 1997 by limiting the ability of foreign residents to borrow baht and restricting links between the offshore and onshore markets. I do not focus on this here because these measures had no direct connection with efforts to influence current account balances and do not appear to have been effective (Edison and Reinhart, 2002).

50. Cheong (2002) addresses some of these points.

inflows were initially direct investment, other capital inflows became increasingly important as time passed, including short-term inflows and foreign borrowing through the banking sector. Third, the capital inflows circumvented existing controls and significantly eroded central bank measures to tighten liquidity. In an effort to discourage speculative flows, Malaysia had previously imposed ceilings on non-trade-related swap transactions between commercial banks and their foreign customers (on the offer side on 14 March 1989 and on the bid side on 1 June 1992). Bank liquidity continued to increase, however, due to unrestricted trade and investment inflows. The central bank was particularly concerned about sharp ringgit appreciation against the dollar (around 9 percent between December 1993 and January 1994), since "allowing the ringgit to appreciate sharply… from the inflows of funds that were of a very short-term nature would run the risk of an overshooting of the exchange rate. Any sudden reversals of the flows would have resulted in reverse pressure on the currency" (Bank Negara Malaysia, 1999, p. 289).

In response to these concerns, in January and February 1994, Bank Negara Malaysia imposed restrictions that limited foreign access to Malaysia's banking sector and short-term financial instruments.[51] Most of the restrictions were lifted within a year. These controls could have affected Malaysia's current account in two ways. First, they could have heightened monetary policy independence and facilitated monetary policy tightening to reduce current account deficits, if policymakers so desired, by allowing interest rates to be increased without triggering capital inflows or appreciation pressures. As illustrated in figures 5 and 6, the controls were associated with a ringgit depreciation against the U.S. dollar, which by August 1994 had offset the sharp appreciation cited earlier. The imposition of controls was also initially associated with a visible drop in Malaysian interest rates, followed by a rise that broadly tracked the increase in the Federal funds rate until the beginning of 1996. The gap between the Malaysian overnight rate and the U.S. Federal funds rate fell from nearly 4 percentage

51. The central bank imposed a ceiling on the net external liability position of domestic banks (excluding trade-related and direct investment inflows); prohibited sales by residents to nonresidents of short-term securities (such as banker's acceptances, negotiable certificates of deposit, Bank Negara or Treasury bills, government securities maturing in one year or less, and any private security with a residual maturity of one year or less); prohibited bid-side commercial banks forward transactions with foreigners and nontrade related swaps.

points in November 1993 to around 41 basis points in January 1994; it later turned negative until about the fourth quarter of 1995. The controls thus appear to have stemmed appreciation pressures, and Malaysian authorities appear to have been able to raise interest rates by somewhat less during the period of Federal Reserve tightening. While growth slowed in Malaysia in 1994, it still ranged from around 9 to 10 percent in 1994–96. The controls were apparently not intended to reduce the current account deficit, which grew from 4.6 percent of GDP in 1993 to a peak of 9.7 percent in 1995.

Second, controls could have limited Malaysia's external debt and financial vulnerability, reducing the likelihood or costs of current account reversal at least for a time. It appears that vulnerability was in fact reduced. Malaysia's overnight rate remained somewhat below the Federal funds rate (and was also much less volatile than the Thai short-term rate) after controls were lifted and despite the turbulence that followed the collapse of the Mexican peso. A number of indicators suggest that controls may have helped reduce vulnerability. First, capital controls were associated with a leveling off in portfolio inflows. Second, Malaysia's external vulnerability indicators were better than its neighbors along several dimensions around 1995: (a) the debt-to-exports ratio, which was already lower than in neighboring countries because of Malaysia's policy of regulating external debt, fell by around 9 percentage points to 46.4 percent between 1993 and 1995; (b) foreign reserve cover was higher than in other Southeast Asian economies and (c) currency mismatch indicators were much better in Malaysia than in some of its neighbors in 1996, on the eve of the Asian crisis. However, while the ratio of domestic bank credit to the private sector to GDP fell (from 108 in 1992 to 106 in 1993), it increased again after capital controls were imposed in early 1994 (figure 3).

Three points may be made here. First, Malaysia's approach around this time appears to be broadly consistent with a strategy of reducing external vulnerability while maintaining high growth rates. Second, while in hindsight it would have been desirable to tighten policy by more, this was not necessarily obvious at the time given relatively low external vulnerability, rapid growth rates, and Singapore's history of sustaining large current account deficits for an extended period. Third, the various preventive measures—namely, restrictions on external debt, temporary capital controls, and reserve accumulation—were ultimately not sufficient to prevent a crisis. Because of its better balance sheet position, Malaysia was able to weather the 1997–98

Asian crisis without IMF support. However, the decline in output in 1998 was still very large. This and speculative pressures in the aftermath of the Russian crisis led to the imposition of capital controls in September 1998.[52]

4. Conclusions

This description of Southeast Asia's experience with current account deficits illustrates how high growth rates can be associated with significant external and domestic vulnerabilities. Rapid growth was linked to high rates of investment spending, which drove the current account cycle. It was also associated with increasing financial fragility, as suggested by rising credit-to-GDP ratios, high external debt exposure (particularly in short-term instruments), and currency mismatches.

Awareness of these vulnerabilities was incomplete, especially with regard to the extent of short-term debt exposure and currency mismatches. Also, the push for growth apparently restricted the range of policy responses. Policymakers sought to reduce current account deficits by encouraging more saving, but this was difficult to achieve in some of the countries discussed in this paper because saving rates were already high. Until the eve of the crisis, there appeared to be little desire to curb investment spending or to tighten fiscal policies that were generally considered sound or improving. The scope for monetary tightening was limited by efforts to stabilize currencies against the U.S. dollar, which was broadly consistent with a rapid-growth strategy during periods of dollar weakness against the yen. Monetary conditions did not tighten significantly until 1995. Real effective exchange rates did not appreciate until the mid-1990s, and they do not appear to have played a significant role in explaining large current account deficits up to that time. This conclusion is reinforced by research indicating that the impact of the exchange rate on current accounts or trade is weak in Southeast Asia. Nevertheless, sharp exchange rate appreciation

52. Capital controls imposed in September 1998 were also intended to give policymakers the leeway to boost growth, as well as to interrupt speculative pressures against the ringgit. By that time, however, Malaysia's current account had switched to surplus, so I do not focus on this episode here. The episode illustrates that even economies with relatively strong balance sheet positions can experience significant speculative pressures. These controls are discussed extensively elsewhere; see for example, Bank Negara Malaysia (1999), Cheong (2002), Edison and Reinhart (2002), Tamirisa (2004), and Kaplan and Rodrik (2002).

after the mid-1990s appears to have contributed to weaker exports and adverse shifts in market sentiment.

Policymakers occasionally used controls as a device to reduce vulnerabilities, to insulate their economies from market volatility, and to gain monetary independence. In Malaysia prior to the crisis, these measures appear to have reduced external vulnerability, although the imposition of capital controls in 1994 was not subsequently associated with a significant reduction in either growth or current account deficits.

The behavior of macroeconomic indicators since 1997–98 suggests that one of the primary lessons Southeast Asian economies took from the crisis is a strong desire to reduce vulnerabilities. Some policymakers now see a large current account deficit as a sign of possible excess, particularly when accompanied by evidence of other imbalances, such as rapid credit growth and very high, and possibly unsustainable, rates of investment and growth. Emphasis is increasingly placed on reducing external vulnerabilities. In line with this interpretation, growth rates have been much lower, on average, in the 2000s than they were in the first half of the 1990s. Current accounts have been in surplus for most of the period since the Asian crisis. In the case of Malaysia, they have increased sharply and are beginning to resemble the rising current account pattern observed in Singapore. Investment spending has only gradually recovered. Credit-to-GDP ratios remain well below the peaks observed in 1997–98. Foreign reserves now exceed the thresholds suggested by some conventional rules of thumb.

APPENDIX

Macroeconomic Indicators

Table A1. Macroeconomic Indicators for Southeast Asia, 1990–2005

Indicator	*1990*	*1991*	*1992*	*1993*	*1994*	*1995*	*1996*	*1997*	*1998*	*1999*	*2000*	*2001*	*2002*	*2003*	*2004*	*2005*
Real GDP[a]																
Indonesia	7.2	7.0	6.5	6.8	7.5	8.2	7.8	4.7	−13.1	0.8	5.4	3.6	4.5	4.8	5.1	5.6
Malaysia	9.0	9.5	8.9	9.9	9.2	9.8	10.0	7.3	−7.4	6.1	8.9	0.3	4.4	5.5	7.2	5.2
Philippines	3.0	−0.6	0.3	2.1	4.4	4.7	5.8	5.2	−0.6	3.4	6.0	1.8	4.4	4.9	6.2	5.0
Singapore	9.2	6.6	6.3	11.7	11.6	8.1	7.8	8.3	−1.4	7.2	10.0	−2.3	4.0	2.9	8.7	6.4
Thailand	11.6	8.1	8.1	8.3	9.0	9.2	5.9	−1.4	−10.5	4.4	4.8	2.2	5.3	7.0	6.2	4.5
Consumer prices[a]																
Indonesia	7.8	9.4	7.5	9.7	8.5	9.4	7.0	6.2	58.0	20.7	3.8	11.5	11.8	6.8	6.1	10.5
Malaysia	3.0	4.4	4.8	3.6	3.7	3.5	3.5	2.6	5.1	2.8	1.6	1.4	1.8	1.1	1.4	3.0
Philippines	13.2	18.4	8.9	7.6	9.0	8.5	9.1	5.9	9.7	6.4	4.0	6.8	2.9	3.5	6.0	7.6
Singapore	3.5	3.4	2.3	2.3	3.1	1.7	1.4	2.0	−0.3	0.0	1.3	1.0	−0.4	0.5	1.7	0.5
Thailand	5.9	5.7	4.2	3.3	5.1	5.8	5.9	5.6	8.1	0.3	1.6	1.7	0.6	1.8	2.8	4.5
Government financial balance[b]																
Indonesia	1.1	−0.6	−0.8	−0.5	0.3	0.8	0.8	−0.4	−1.9	−2.1	−1.5	−2.4	−0.9	−1.8	−1.3	−0.5
Malaysia	3.8	4.3	4.8	5.5	7.4	6.5	5.7	7.5	4.3	4.0	1.5	4.7	4.1	4.4	1.8	1.7
Philippines	−3.5	−2.1	−1.2	−1.5	1.0	0.6	0.3	0.1	−1.9	−3.8	−4.0	−4.0	−5.3	−4.6	−3.8	−2.7
Singapore	n.a.	9.4	12.5	15.4	11.4	12.4	16.3	9.0	6.5	4.1	8.5	4.7	4.3	6.5	5.6	6.9
Thailand	4.9	4.3	2.6	1.9	2.7	3.0	0.9	−1.5	−2.8	−3.3	−2.2	−2.4	−1.4	0.4	0.1	−0.6

Table A1. (continued)

Indicator	*1990*	*1991*	*1992*	*1993*	*1994*	*1995*	*1996*	*1997*	*1998*	*1999*	*2000*	*2001*	*2002*	*2003*	*2004*	*2005*
Government debt[b]																
Indonesia	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	15.2	24.7	44.6	75.8	91.8	78.2	69.4	60.3	55.4	46.3
Malaysia	79.5	73.3	64.4	55.7	47.6	41.1	35.3	31.9	36.4	37.3	36.6	43.6	45.6	47.8	48.1	46.2
Philippines	55.9	54.0	64.4	76.4	63.9	60.8	53.2	55.7	56.1	59.6	64.6	65.7	71.0	77.7	78.5	71.8
Singapore	77.0	79.2	83.0	74.3	69.8	72.4	72.7	71.9	83.5	89.8	84.1	97.1	99.0	104.8	102.7	102.9
Thailand	17.0	13.0	10.6	8.4	6.1	4.6	3.8	5.4	12.7	21.2	23.3	24.8	31.0	27.6	27.8	26.0
External debt/exports[c]																
Indonesia	272.1	269.3	266.0	242.2	269.2	273.9	258.8	241.9	300.3	295.1	220.8	233.7	223.5	213.6	194.9	n.a.
Malaysia	52.1	49.7	49.2	55.5	51.6	46.4	50.7	60.0	57.9	49.5	42.6	51.2	51.7	48.2	41.4	n.a.
Philippines	379.0	370.6	340.7	325.9	302.6	225.0	215.5	198.2	179.7	169.2	153.7	185.7	173.5	177.7	157.6	
Singapore	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Thailand	121.8	132.6	128.7	143.1	144.8	177.2	202.5	190.7	192.7	165.7	115.4	103.4	87.2	64.5	52.7	n.a.
Terms of trade[a]																
Indonesia	5.6	−2.9	−2.4	0.2	−1.7	−0.1	0.5	5.2	−14.9	31.8	−7.8	3.1	−3.3	−8.0	−3.6	−0.2
Malaysia	1.0	0.8	−0.2	0.2	−0.0	0.8	0.0	1.0	−0.9	−0.9	2.1	−1.2	−0.3	1.0	2.0	0.4
Philippines	0.5	2.9	2.1	1.2	3.1	−0.9	−1.2	0.3	1.3	−2.6	−3.2	0.9	1.1	−3.5	−5.0	−5.0
Singapore	n.a.	n.a.	−1.3	0.0	−3.3	−1.6	−0.3	−2.6	−0.2	−0.8	−2.9	−4.5	−5.2	−4.3	−1.5	−2.8
Thailand	−2.7	−1.2	0.9	−0.3	2.3	−0.9	−2.3	1.4	−3.8	0.8	−8.1	−7.1	2.0	4.3	−1.0	−5.1

Source: IMF; CEIC Data; World Bank, Global Development Finance; Datastream; Institute for International Finance; national data.
a. Annual change, in percent.
b. As a percentage of GDP; refers to central government.
c. In percent
n.a.: Not available.

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