# Capital Mobility and Monetary Policy


Miguel Fuentes D.
Claudio E. Raddatz
Carmen M. Reinhart
editors



Central Bank of Chile / Banco Central de Chile

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## Series on Central Banking, Analysis, and Economic Policies

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# Capital Mobility and Monetary Policy: An Overview

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The papers that comprise the different chapters of this volume were presented in the XVII Annual Conference on Central Banking that took place at the Central Bank of Chile, Santiago, during November 14 and 15, 2011.

While the global economic environment has changed considerably from the end of 2011 to the present for advanced and emerging economies alike, the themes and policy issues addressed by these papers share a timeless dimension. Collectively, the studies that comprise this volume deal with various aspects of the causes, consequences, and policy challenges associated with the repeated boom-bust cycles that have characterized market economies throughout most of their history. The papers have a decided open-economy focus and connect the prosperity-crisis-depression cycle to international capital flows and their impact on domestic and external indebtedness, currency fluctuations, and the banking sector; their connection to global factors, such as international interest rates, commodity prices and crises or turbulence outside the national borders is explored. While the analysis is tilted towards emerging markets, particularly in Latin America, the relevance of these topics for mature economies has been made plain by the Global Financial Crisis.

*Capital Mobility and Monetary Policy*, edited by Miguel Fuentes D., Claudio E. Raddatz, and Carmen M. Reinhart, Santiago, Chile. 

## 1. The Evolving Global Setting

At the time of the conference, the global outlook was notably brighter for emerging markets as a group while many (if not most) advanced economies continued to struggle with the aftermath of systemic banking crises. After a relatively promising 2010 and much discussion in policy circles of "green shoots," growth prospects for the United States, Japan, and especially Europe were being revised downwards. The depth of the financial, fiscal, and structural problems in the euro area became more apparent and the probability of a quick resolution slimmer. A novel element in the global setting was the relative resilience of emerging markets in the face of the financial meltdown in the "North." The relatively swift and sharp recovery in emerging markets following the global turmoil of 2008 to early 2009 posed a striking contrast to the 1930s when deep financial crises in the United States and Europe ushered in years (if not decades) of economic contraction and stagnation in the "South."

In both advanced and emerging economies, policymakers, academics, and the financial community were still trying to make sense of the financial tsunami that hit them in late 2008 and the channels through which the U.S. subprime mortgage crisis became viral and global almost synchronously. By 2011, the reverberations of the crisis in Europe were becoming clearer as the banking crises morphed into sovereign debt crises in a growing number of "periphery" countries (a group which now also includes Spain and Italy—in addition to Greece, Ireland and Portugal).[1] The range of options under discussion for dealing with and solving the fiscal and lack of international competitiveness problems of countries in the periphery included discussions of the relative merits of the departure from (if not dissolution of) the euro.

Emerging markets could not rely on history to provide a comparable turn of events to the Global Financial Crisis. At the height of the global crisis, capital flows to these countries predictably dried up overnight. Paradoxically, financial flows fled to the epicenter of the crisis (the United States) in search of safety (and/or liquidity). However, unlike other crisis episodes, the *sudden stop* did not last long for emerging markets and flows started to recover vigorously

1. Iceland, which also lost access to international capital markets, would be added to this group if non-euro-area countries were included in the casualty list. See Reinhart and Rogoff (this volume) about the connection between banking and debt crises.

in the second half of 2009, largely unaffected by the problems in Europe.[2] In effect, as the European periphery slid into a sovereign debt crisis of varying magnitudes and capital market access was lost, global investors in their eternal quest for higher yields increasingly saw emerging markets as the most attractive destination in an otherwise bleak global setting.

Commodity prices also followed a somewhat atypical pattern. Historically, recessions in the United States and the larger advanced economies have been associated with declining commodity prices.[3] Yet, after a precipitous but short-lived decline in late 2008, prices of primary commodities recovered and surpassed their pre-crisis levels.

All in all, with a few exceptions, emerging market economies were able to recover faster than advanced ones and sustain consistently higher rates of economic growth, which led some analysts to refer to the situation as a "two-speed world" (see for example IMF, 2011). The two-speed–world view was reinforced by the increasing realization that the recovery of advanced economies would not be quick and that private deleveraging and mounting fiscal problems (most marked in the European periphery) could lead to a protracted recession. The lack of "fiscal space" to stimulate demand in advanced economies as time progressed and public debts marched upward meant that advanced economies looked increasingly to external demand to fuel the recovery. Emerging economies, with their comparatively stronger economic performance, were the natural source of that demand. However, to act as the global engine of growth, emerging markets had to be willing to run larger trade and current account deficits, tolerate a more appreciated currency, and finance those deficits with potentially unstable capital inflows. The search for yield in emerging markets was fueled further by expansionary monetary policies in the United States and other advanced economies. In effect, after 2008 real ex-post short-term interest rates in the advanced economies were negative roughly half of the time (a phenomenon not seen since the late 1970s).

Owing to the sudden and drastic reversal of capital flows in late 2008 and the countless previous experiences with similar reversals over the course of history has led many emerging markets to be wary of

2. For the original sudden stop concept see Calvo (1998).

3. This North-South link has a long-standing history, as discussed in Dornbusch (1985).

"fickle financial flows."[4] In a setting in which capital flows are seen as potential harbingers of financial instability, it is not surprising that the policy discussion and academic research pursued a line of inquiry involving interrelated questions such as: What are the mechanisms behind the surge in capital inflows experienced by emerging markets before the crisis and after 2009? What are the consequences of such inflows—same as prior episodes—or are there new dimensions? What are the main channels of transmission of financial crises and what determines resilience to external turbulence? And, importantly, how should policy respond to these inflows and related effects so as to avoid the buildup of financial vulnerability at home?

The rest of this overview chapter reviews selective highlights of these articles and their contribution to the discussion of and literature on capital mobility, north-south linkages, financial crises, and macroeconomic policy. The chapter will be structured around the potential phases of the capital flow cycle: the rise (or bonanza), the demise (or reversal), and the policy reactions to either deal with "excessive" inflows or disorderly outflows.

## 2. The Rise in Capital Inflows (with an Emphasis on Latin America)

Both, between 2003 and 2008 and again between 2009 and 2012, emerging economies were the recipients of large inflows of capital. The earlier wave of inflows prior to the Global Financial Crisis and also for the years 2009 and 2010 were not primarily directed to the financing of ever-widening current account deficits. Burnt by severe crises since the mid-1990s emerging markets had embraced self-insurance and the earlier wave of capital flows was importantly channeled into reserve accumulation (which set new records for many emerging markets—not just China). This use of inflows was also representative for countries in Latin America as can be seen in the current account balances that appear in table 1. Current account surpluses are comparatively rare in Latin American countries.

The nearly balanced current account shown in table 1 for the euro area masks another surge in capital inflows that had taken place prior

4. As also highlighted in the IMF World Economic Outlook (2011), this balancing act was not occurring in an orderly fashion, with Latin American countries bearing a disproportionate share of the adjustment.

**Table 1. Current Account Balances, 2003-2012**
As a percent of GDP

| *Country group* | *2003-2007* | *2008* | *2009* | *2010* | *2011* | *2012* |
|---|---|---|---|---|---|---|
| Advanced economies | -0.88 | -1.14 | -0.14 | -0.02 | -0.17 | -0.13 |
| United States | -5.38 | -4.74 | -2.73 | -3.05 | -3.09 | -3.03 |
| Euro Area | 0.63 | -0.71 | 0.25 | 0.53 | 0.60 | 1.81 |
| Emerging and developing economies | 3.35 | 3.52 | 1.47 | 1.53 | 1.90 | 1.45 |
| Developing Asia | 4.31 | 5.85 | 3.72 | 2.47 | 1.58 | 1.06 |
| Latin America and the Caribbean | 0.90 | -0.90 | -0.71 | -1.21 | -1.34 | -1.73 |
| Japan | 3.86 | 3.30 | 2.91 | 3.71 | 2.02 | 0.99 |
| China | 6.14 | 9.31 | 4.87 | 4.01 | 2.76 | 2.60 |
| Brazil | 1.09 | -1.71 | -1.50 | -2.21 | -2.11 | -2.26 |
| Chile | 2.35 | -3.23 | 2.05 | 1.48 | -1.31 | -3.54 |

Source: IMF World Economic Outlook, April 2013.

to the 2008 crisis. The European Periphery—along with Iceland, the United Kingdom and the United States—was recording record current account deficits financed by increased borrowing from abroad, also in record volume. By 2008, Iceland's current account deficit was 28 percent of GDP, Greece's was 15 percent and Portugal and Spain's current account deficits were in the 9 to 13 percent range. Like many capital flow bonanza episodes of the past, this one would end just as badly.

The trends in the current account directly map to the observed trends and important regional differences in external indebtedness.

In contrast to previous periods of global economic turmoil, Latin America was remarkably well positioned to weather the headwinds of the Great Recession. Nowhere was this better seen than in a comparison of global external debt figures. As figure 1 demonstrates, Latin America had among the lowest levels of external debt in the world during the six years preceding the financial crisis. Not only that, Latin America was deleveraging at an extraordinarily fast pace, resulting in debt levels the rivaled those of the early 1970s, among the brightest periods of Latin American economic growth.

Figure 1 (from Reinhart and Rogoff, this volume) is based on 2003-2009 gross external debt as a percent of GDP. The left-hand panel of the figure indicates whether there was an increase in indebtedness to GDP over the 2003-2009 period, or a decrease (deleveraging). The right-hand panel gives the ratio of gross external debt to GDP as of the end of the second quarter of 2009. The group averages are based on a total data set of 59 countries.

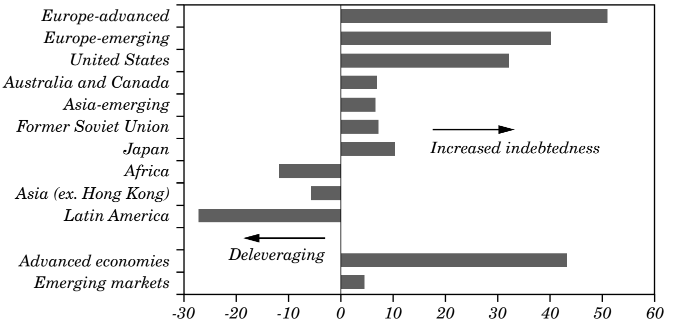
As the right-hand side of the figure illustrates, external debt burdens at the time of the crisis were particularly high in Europe, with an average external debt to GDP ratio across advanced European economies of over 200 percent, and an average external debt to GDP across emerging European economies of roughly 100 percent. A sizable share of the debt is intra-European, but nonetheless external to the country.

Famously profligate Latin America, by contrast to the advanced economies, had gross external debt liabilities averaging only around 50 percent of GDP at the time of the global crisis. Moreover, in contrast to the advanced countries that added an average of 50 percent of GDP to gross external debt during the recent period, Latin American countries actually reduced external debt by more than 30 percent of GDP.

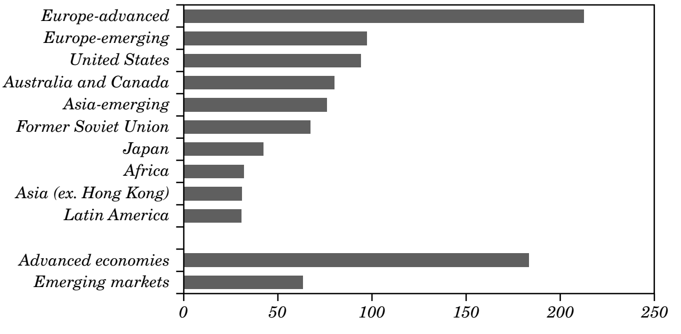
Importantly, Latin America lowered its foreign currency liabilities and shifted away from dollarized to domestic-denominated debt,

**Figure 1. Gross External Debt as a Percent of GDP: Averages for Selected 59 Countries, 2003-2009**
In percent

*A. Change in debt-to-GDP ratio, 2003-2009*




*B. Debt-to-GDP ratio*




Sources: International Monetary Fund, *World Economic Outlook*, World Bank, Quarterly External Debt Statistics (QEDS), and authors' calculations.
Notes: Data for 2009 end in the second quarter. The countries participating in QEDS included in these calculations are listed in what follows by region. *Advanced-Europe:* Austria, Belgium, Denmark, Finland, France, Germany, Greece, Italy, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland, United Kingdom, (15 countries). If Ireland were included, the averages would be substantially higher for this group; *Emerging Europe*: Bulgaria, Croatia, Czech Republic, Estonia, Latvia, Lithuania, Poland, Romania, Slovak Republic, Slovenia, and Turkey, (11 countries). *Former Soviet Union:* Armenia, Belarus, Georgia, Kazakhstan, Kyrgyz Republic, Moldova, Russia, and Ukraine (8 countries). *Africa*: Egypt, South Africa, and Tunisia (3 countries). *Asia-Emerging*: Hong Kong, India, Indonesia, South Korea, Malaysia, Thailand (6 countries). *Latin America*: Argentina, Bolivia, Brazil, Chile, Colombia, Costa Rica, Ecuador, El Salvador, Mexico, Paraguay, Peru, and Uruguay (12 countries). There are a total of 19 advanced economies and 40 emerging markets.

avoiding one of the major pitfalls of emerging market borrowing. Current accounts (as noted) in most of the region were in surplus, a relative rarity for the region. Indeed, domestic conditions in Latin America were so strong that one could not find a newspaper in the fall of 2008 or in 2009 that ran an article about the possibility of default in Latin America as a result of the global economic meltdown—itself a rarity.

This sharp deleveraging in the run-up to 2008-2009 is thus intimately connected with the drought in capital inflows to the region for several years prior to 2003. The low levels of external public and private debt at the outbreak of the crisis and the resilience of Latin America in particular, and emerging markets in general, to the crisis of the North, importantly catalyzed further capital inflows to emerging markets after the crisis. As the inflows persisted beyond 2010, current account surpluses became smaller, eventually giving way to deficits in a number of countries; old vulnerabilities had re-emerged.

## 2.1 The Drivers of Capital Inflows: Push or Pull?

There is considerable literature dating back to the early 1990s on whether capital flows to and from emerging markets are primarily driven by external or "push" factors such as international interest rates, commodity prices and general economic conditions in the world's financial centers, or by domestic "pull" forces, which often cite structural reforms, inflation stabilization, financial liberalization, or comparatively favorable domestic economic conditions in the recipient country.[5]

The articles by Forbes and Warnock, Fratchzer, Mendoza and Terrones, and Shin (in this volume) contribute to this body of work.

In the context of the post global financial crisis surge in capital flows to emerging markets, the actual and expected growth differential between previously discussed advanced and emerging economies figured prominently among the pull factors cited. It provided international investors with a strong incentive to invest in emerging markets. Of course, this growth differential does not trace out to what extent the accommodative monetary policies in the advanced economies, with their attendant low interest rates and ample global liquidity, helped emerging market growth. After

5. For a discussion and comprehensive bibliography of capital flow bonanzas and their causes, see Frankel (2011).

all, emerging-market banks did not suffer from the domestic credit market dislocations associated with deep banking crises. Furthermore, some of the recipients of large inflows were commodity producers that benefited from the quick and sharp rebound in commodity prices that took place after the crisis. The strength in commodity prices amid widespread recession in advanced economies is often linked to China's spectacular and sustained high rates of growth. Owing to a common view that China was in the process of internal rebalancing and that the country would remain in the high growth path of recent years, the strength in commodity prices was perceived as relatively persistent, leading to relatively high medium-run growth forecasts for these economies as depicted in the IMF projections from April 2011 shown in table 2.

The rebound in economic performance in emerging markets also resulted in the normalization of interest rates, which, *ceteris paribus*, provided an additional pull factor for international capital.

Finally, the resilience to the financial crisis shown by many emerging economies also served to highlight their improved fiscal position (to some extent this is reflected in a previous discussion on the significant reduction in public external debt), financial regulation, and institutional frameworks. While these improvements were the fruits of policies taken after the onset of the Asian and Russian financial crises, they had not been tested yet, and the relatively mild impact of the crisis in some of these countries validated these policies in the eyes of international investors.

Despite all the pull factors mentioned above, the coincidence of capital inflows with the large monetary policy expansions in advanced economies, record lows in nominal (and often real) interest rates; the apparent synchronicity and commonality shown by these inflows across countries, and the difficulties sorting whether the pull factors mentioned above were a cause or a consequence of the flows led many to view the latest episode of surging capital inflows to emerging markets as another example where associated pull factors played a crucial role in explaining the pattern of reallocation of global capital flows.

In principle, both push and pull factors can be cyclical (temporary) and subject to reversals. In practice, there is a tendency to view domestic policy reforms and institutional changes as less transitory than interest rate cycles in the United States and other financial centers or fluctuations in world commodity prices. Thus, the extent to which push and pull factors could explain the pattern of capital flows

**Table 2. Real GDP Growth and Projections in 2011**

| | | | | Projections | | |
|---|---|---|---|---|---|---|
| *Country group* | *03-08* | *2009* | *2010* | *2011* | *2012* | *2016* |
| World | 4.4 | -0.7 | 5.1 | 4.4 | 4.5 | 4.7 |
| Advanced economies | 2.3 | -3.4 | 3.0 | 2.4 | 2.6 | 2.4 |
| United States | 2.3 | -2.6 | 2.8 | 2.8 | 2.9 | 2.7 |
| Euro area | 1.9 | -4.1 | 1.7 | 1.6 | 1.8 | 1.7 |
| Emerging and developing economies | 7.4 | 2.8 | 7.3 | 6.5 | 6.5 | 6.8 |
| Developing Asia | 9.3 | 7.2 | 9.5 | 8.4 | 8.4 | 8.6 |
| Latin America and the Caribbean | 4.7 | -1.7 | 6.1 | 4.7 | 4.2 | 3.9 |
| Japan | 1.5 | -6.3 | 3.9 | 1.4 | 2.1 | 1.2 |
| China | 11.3 | 9.2 | 10.3 | 9.6 | 9.5 | 9.5 |
| Brazil | 4.2 | -0.6 | 7.5 | 4.5 | 4.1 | 4.2 |
| Chile | 4.7 | –1.7 | 5.3 | 5.9 | 4.9 | 4.3 |

Source: IMF World Economic Outlook, April 2011.

remains an important research question—not just to understand the past but to ascertain the odds of future reversals and their attendant macroeconomic dislocations.

Forbes and Warnock (in this volume) build on their previous work on the characterization and determinants of gross capital flows.[6] While most research on capital mobility during the 1990s focused on net capital flows—the difference between the inflows of non-residents and the outflows of residents—the crisis made apparent that the gross positions behind these net flows could shed important light on the nature of sudden capital movements, and also that gross positions were potentially more important for financial stability concerns that net positions. This point has also been recently stressed by Broner et al. (2013).

In an earlier contribution, Forbes and Warnock (2012) use data on gross inflows and outflows to characterize episodes of waves in net capital flows into surges, stops, starts, and retrenchments. In this taxonomy, *surges* and *stops* correspond to large gross inflows or outflows of capital by non-residents into or from a country, respectively. *Starts* and *retrenchments*, on the other hand, are large gross outflows and inflows of capital from a country's residents. Therefore, a large decline in net capital flows may result from a stop or a start depending on whether non-residents or residents are taking their capital out of the country. Conversely, a large increase in net capital flows may result from a surge or a retrenchment. Also, small movements in net capital flows may mask large movements in gross positions between residents and non-residents. In the last chapter of this volume, the authors extend their previous work using quarterly data on capital flows between 1980 and 2009 to analyze the characteristics of large capital flow episodes before and during the crisis. A key finding is that the majority of the more extreme episodes were fueled by debt flows rather than equity flows. Their analysis shows that equity-led flows respond mainly to country-specific factors and are largely unaffected by measures of global risk or other determinants of contagion. In contrast, debt-led flows are mainly related to global factors and regional contagion, with county-level factors associated mainly with growth shocks playing a secondary role.

A significant empirical regularity in the Forbes and Warnock analysis is that extreme episodes of capital flows are largely debt-

6. See Forbes and Warnock (2012).

related and associated with global factors and regional contagion. Among global factors, the authors find that global risk and interest rates are the most important determinants of extreme debt-related capital flow episodes. The strong association between debt flows, capital flow volatility, external factors, and contagion are in line with the discussion in Reinhart and Rogoff that connects surges in external debt to banking crises, and often sovereign debt crises, with the most extreme illustrations coming from advanced economies (particularly the cases of Iceland and Ireland).

These findings suggest an important role of push factors in the rise of capital inflows to emerging market countries. However, they also mask some heterogeneity in the type of global factor related to each different type of episode. In fact, while both risk and interest rates are associated with stops, surges are related mainly to global risk and growth. According to these results, global interest rates did not play a major role in the probability of a surge of inflows into a country.

Further evidence on the role of push factors for capital flows comes from Mendoza and Terrones, (in this volume). While this paper focuses on characterizing the cyclical patterns around episodes of credit booms, an interesting finding is that credit booms tend to be synchronized internationally, and sometimes culminate around "big events," such as the Asian and Russian crises, and the 2008 Global Financial Crisis. Since the authors also find that credit booms tend to be triggered by surges in capital inflows, it follows that these surges are, to an important extent, concentrated in time across countries, hinting at the presence of common push factors. Nonetheless, Mendoza and Terrones also find that credit booms have important domestic sources and are often preceded by TFP gains and financial reforms, although with less frequency among emerging compared to advanced countries.

Other recent studies have tried to determine the relative importance of push and pull factors. For instance, Fratzscher (2012) uses monthly data on capital flows from international mutual funds to study the role of push and pull factors in determining such inflows during the period 2005 to 2011. His results show that both types of factors matter, although pull factors or those related to common global economic conditions were the most important ones especially before the onset of the crisis. Domestic or pull factors gained prominence only after the recovery had begun. In a related study, Fratzscher, Lo Duca and Straub (2013) use an event study methodology to examine the role of quantitative easing (QE) announcements on international equity and bond flows, prices and yields. They find that both QE programs had noticeable effects on the global value of the dollar and induced a relevant portfolio across national borders. The announcement by the Federal Reserve of their intent to "taper" QE policies in the spring of 2013 (which would constitute another event study in the Fratzscher-Lo Duca-Straub approach) set in motion a far reaching sell-off of emerging market currencies and financial assets. One can only speculate that this event may have marked the end of the most recent capital flow bonanza era in emerging markets and would lend further support to their earlier findings.

Hyun Shin's chapter in this volume also identifies push factors (under the umbrella of global liquidity) as a key contributor to the surge of cross border capital flows observed in the second half of the 2000s and the post global financial crisis era. He highlights the central role of commercial banks in funneling funds from countries where liquidity was abundant, especially the U.S. bank funding market, to countries where expansionary macroeconomic policies were creating massive demand for those resources. This transmission mechanism also reminds us of the importance of policy spillovers and how they can be amplified by private banks (or, more generally, financial institutions). As discussed in the section on policy, the behavior of cross-border lending through commercial banks observed during the buildup to the 2008 financial crisis helps to draw important lessons for the design of regulations that make economies less prone to these costly disruptions.

All in all, the existing evidence regarding the determinants of capital inflows to countries points to both push and pull factors playing a role that varies in significance and in magnitude over time and across countries. However, the synchronization of episodes around big or systemic events, the importance of global factors, and the evidence of spillovers of very specific push measures strongly suggests that large episodes of capital inflows, the so-called surges, are mainly associated with push factors operating at a global level. Policies taken by the largest global economies seem to define a global financial cycle that spills over to the rest of the world. The events of the spring of 2013, following the Federal Reserve's announcement of its intent to move to a somewhat less expansionary phase of its monetary policy stance, have done little to contradict that conclusion.

## 2.2 The Consequences: Credit and Asset Price Booms and Busts

Regardless of their causes, the consequences of surges in capital inflows may be a source of concern for policymakers. It is often stated that extreme (in terms of their magnitude, relative to the size of the economy, their persistence, or both) episodes of capital inflows may result in real exchange misalignments that hurt a country's competitiveness. In the extreme, Dutch disease problems may arise or get exacerbated. Surging inflows fuel bubbles in key asset prices, such as real estate, that may threaten financial stability when they burst. A recent body of literature has used the techniques for identifying surges in capital inflows described above to characterize their consequences for credit growth, real exchange movements, as well as equity, and housing prices.

The starting point in this literature is the identification of extreme episodes of capital inflows using a variety of statistical methods and/or relying on events or chronologies similar to some of the methods discussed above. This literature generically refers to these episodes as "surges" or bonanzas (as in Reinhart and Reinhart, 2009) without considering that the finer distinctions depending on the residency of the agents or the types of capital flow differences across papers come mainly from variation in the filters used to define the surge or bonanza (including procedures to set thresholds, cyclical adjustments, etc.).

An issue that has received considerable attention in recent years has been the connection between capital inflow surges and credit booms, and especially their connection to crises. The chapter by Mendoza and Terrones (in this volume) focuses primarily on post 1960 credit booms and their determinants. A key finding of their analysis is that surges in capital inflows are an important determinant of credit booms (indeed, surges temporally precede credit booms), especially, but not exclusively, among emerging markets. As to financial crises, they note that not all credit booms end in crisis but lending booms precede all financial crises. Schularik and Taylor (2012), who focus on a dozen advanced economies over 1870-2009, arrive at similar conclusions.

A related literature has focused more directly on policy design, specifically taking into account the particular features of the relation between capital flows and bank lending. The chapter by Shin shows how the abundance of funding in international financial centers is channeled worldwide by banks, fueling credit expansions overseas and making banks in the recipient countries highly vulnerable to fluctuations in the availability of wholesale financing. The departing point of his argument is that, contrary to the standard view that fluctuations in a bank's leverage are due to their corporate finance decisions in terms of substituting equity for debt for a given level of assets, these fluctuations are mainly driven by growth in assets with a fixed level of equity. In this setting, banks borrow heavily and increase their leverage during expansions; the macroeconomic vulnerability introduced by rising leverage is discussed further in the next section. Shin documents this hypothesis with evidence from Europe and South Korea, showing that most of the expansion in bank balance sheets is driven by borrowing in wholesale international interbank markets, rather than in expansions of retail deposits.

The effect of capital flows on equity prices in the recipient economies is the subject of the work of Olaberria (in this volume). He studies the relation between cross border flows and equity price boom prices post 1990, paying special attention to the economic conditions that might mediate the relation between those variables. Specifically, he introduces proxies for the level of openness, the quality of institutions and the extent of financial development. Booms in equity prices are defined as deviations from a long run trend. The results from applying this methodology to the data indicate that capital inflows have a sizable impact on equity prices only in emerging economies, which are amplified by low institutional quality and modest financial development. This result, possibly owing to the definition of an equity boom used, is at odds with the episode-by-episode finding in Reinhart and Reinhart (2009) of a general rise in equity prices during the bonanza phase of the cycle. Beyond equity prices, Sá et al. (2011) focus on the nexus between real estate prices, capital inflows, credit and monetary policy in OECD economies up to and including the run-up to the Global Financial Crisis of 2008. Their results suggest that capital inflows have a significant and positive effect on real house prices, real credit to the private sector and real residential investment. Furthermore, the responses of housing variables to capital flow shocks are stronger in countries with more developed mortgage markets.

## 3. The Demise: From Inflows to Outflows

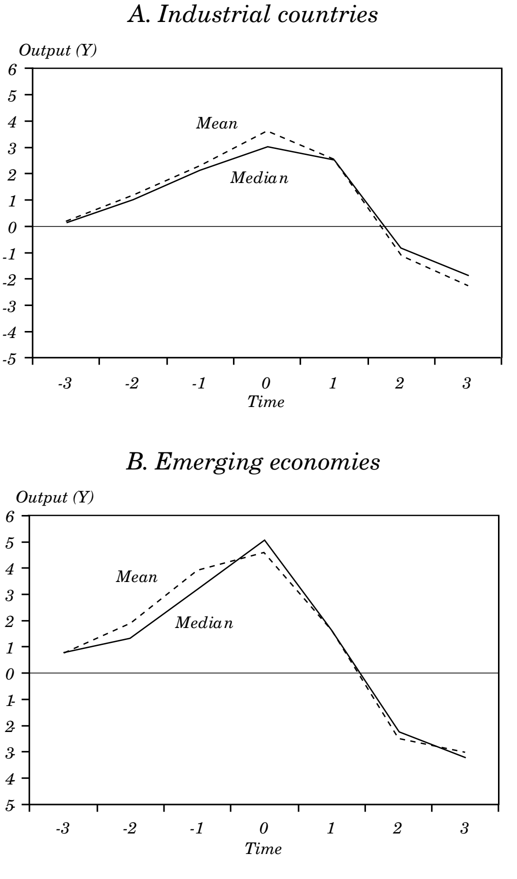
What happens in the economies that receive significant capital inflows when those inflows either cease (a sudden stop) or are altogether reversed? What if capital market access becomes very costly or altogether impossible? What becomes of the usually massive accumulation of private and public debt observed in recent years? Can we identify the channels through which disturbances in financial markets affect the real economy? These questions are hardly academic and it has been a source of recurring concerns for policy makers in emerging markets for decades and for many advanced economies more recently. Several of the papers included in this volume offer some insights from different and often complementary perspectives.

Reinhart and Rogoff (in this volume) provide a study of the major trends in private and government debt for emerging and industrialized economies since the late 19$^{th}$ century to the present. As discussed, high levels of domestic and external debt are intimately connected to previous surges in capital inflows (see, for example Mendoza and Terrones) that, in turn, often end in systemic banking crises. The connection between debt and banking crises is “equal opportunity” affecting advanced and emerging economies alike. Banking crises, in turn, usually lead to a sharp deterioration in public finances and, in the most extreme cases, culminate in sovereign debt crises. The toll on output levels and growth is significant. Put differently, as Reinhart and Reinhart (2009) document, the probability of a banking crisis conditional on a capital flow bonanza (or surge) in the preceding three years is significantly higher than the unconditional probability. Comparable statements can be made about sovereign debt, currency and inflation crises. The cumulative evidence that busts so often and predictably follow booms (albeit at uncertain timing) raises legitimate concerns for policymakers of the desirability of the boom in the first place.

While Reinhart and Rogoff primarily focus on public debt (domestic and external) and total external debt (public and private), the chapter by Mendoza and Terrones analyzes primarily domestic credit to the private sector. Taken together these studies *nearly* complete the larger picture of leverage cycles. Nearly refers to the fact that shadow banking, off balance sheet transactions, and private and public arrears are all varieties of “hidden debts” that are not captured by the conventional aggregates but often surface only in moments of crises. The Mendoza and Terrones analysis covers all the industrialized countries as well as 40 emerging economies; some of their most novel findings involve comparisons of these two groups. Among their findings is the somewhat surprising fact that the number of credit booms is remarkably similar in emerging and industrialized economies; the rapid increase in domestic bank credit is not a problem confined to less developed economies. An important implication of this is that countries should not expect to put episodes of financial instability behind them as their income level raises, reinforcing the need for appropriate financial supervision. There is no "graduation" from banking crises.

As to the dynamics of output, their analysis provides additional robust quantitative evidence that the capital inflow/credit boom phase is associated with above trend output (figure 2) just as the

**Figure 2. Credit booms and economic activity**
Cross-country means and medians of cyclical component of real GDP




Source: Mendoza and Terrones, this volume.

capital flow reversal and credit crunch phase is associated with recession and below trend growth. The patterns are strikingly similar for advanced and emerging economies, with the latter showing deeper recessions in the aftermath of the credit boom. However, in light of the six-year contraction in many advanced economies following the credit boom that culminated in the Global Financial Crises extending their analysis beyond 2010 (when their sample ends) may yield equally severe post-boom recessions in the industrialized economies.

Mendoza and Terrones also show that, consumption and investment fall below their trends in the demise of the credit booms, and that the magnitude is similar in the two groups of countries when the figures are normalized by the wider amplitude of the cycle in less advanced economies. A variable where there are significant differences among these groups of economies is in government consumption. In line with several of the papers in Céspedes and Galí (2012), fiscal policy in EMs is found to expand significantly more above trend in the run up of domestic credit, and contract more deeply in the downturn. As in Reinhart and Reinhart (2009) for capital flow bonanzas, another noteworthy result in Mendoza and Terrones is that the probability of currency crisis, banking crisis or Sudden Stops is higher during the tail end of the credit boom; although, the first two are more common than the third.

Contributing to the analyses of boom-bust cycles, Fuentes and Saravia (in this volume) take an in-depth look into the mechanisms that might explain why real activity declines sharply in the wake of financial market turmoil. They focus on the case of Chile and exploit a unique and rich data set of firms and their financing sources. The data they assemble lists all the banks that have extended loans to firms that have raised capital in domestic financial markets through either bonds or stocks. The balance sheet information of these firms plus the identity of their creditor banks is then merged with the financial statements of the banks, making it possible to analyze firms' investment decisions during recessions and how they are influenced by the banks' financial characteristics. The examination of the question of whether banks increased their leverage the most in the period prior to each crisis showed the sharpest decrease in subsequent lending. Their analysis suggests this is the case and that the firms that contracted loans with the most leveraged banks are the ones that showed the sharpest declines in investment. The novel micro-level evidence on the channels through which disturbances in financial markets during periods of financial distress affect developments in the real economy complements the broader findings already discussed.

## 4. The Policy Responses: From Capital Controls to Macroprudential Tools

Given the dire consequences that the financial crises of 2008-2009 had on the performance of many economies, policy makers and the academic community have devoted vast efforts to designing policy environments that can serve two purposes: preventing the onset of another disruption and, if the crisis does take place, mitigating its effects. The papers contained in this volume also touch on these very important issues.

The contribution of Shin has a special focus on policies that pertain to the regulation of the banking sector. He assigns a central role in his discussion of an appropriate regulatory framework to the non-core liabilities of the banking sector. As its name suggests, this source of funds of banks differ from the traditional retail deposits that constitute the traditional resource used by banks to sustain their lending. Non-core liabilities are instead provided by other financial intermediaries and are more volatile than core liabilities. Its volatility and usually quick retrenchment in periods of financial turmoil make them a key element to consider in the design of policies. Among non-core liabilities, Shin gives special attention to cross-border lending channeled by foreign banks and most certainly denominated in a different currency than that of the recipient country.

Shin proposes a useful taxonomy to establish three different types of macroprudential policies, all related to commercial banks: assets side tools, liabilities side tools and bank-capital oriented tools. In each category he discusses the relative merits of mostly well-known policies mentioning, when available, the empirical evidence of their effects in preventing crises. The discussion of policies aimed to curtail the increase in non-core liabilities (that is, liabilities side tools) is perhaps one of the most interesting. These prescriptions have the potential to be welfare enhancing since they can bridge the gap between the private costs of this source of funds that usually comes from outside the country with its full social cost that includes its potential to originate a crisis. Even though the different types of capital controls discussed have seemed attractive in principle, the empirical evidence mentioned by Shin and Fratzscher (also in this volume) casts doubts on their ability to affect the total volume of non-core liabilities contracted by the banking sector. Nevertheless, as Shin mentions, capital controls have been associated with changes in the composition of capital flows biasing them towards those less associated to economic crises.

The issue of capital controls is also analyzed in more depth by Fratzscher in this volume. The author takes an interesting perspective on this important policy discussion. Instead of revisiting the effects of adopting these restrictions to financial flows, Fratzscher examines the motivations that countries have to impose them. This is an important contribution to the empirical literature on this issue and surely has important policy implications. The main conclusion that the author draws from an extensive empirical analysis is that foreign-exchange goals, and not financial stability concerns, are the main drivers of restrictions to the cross-border trade of financial assets. In other words, an intense appreciation of the local currency is the factor that is most important for policy makers when deciding to establish currency controls. A pending issue and one that in all likelihood will motivate further research is if this traditional macroeconomic concern has lost ground to financial stability concerns in light of the increased prominence of macroprudential tools in the recent policy debate. The increased attention on macroprudential tools and capital controls as potential standard elements has been addressed by Ghosh et al. (2011) and Ostry et al. (2011). Those authors argue that even though restrictions to cross-border financial transactions are no substitute for sound macroeconomic policies, they appear to offer some benefits in terms of financial stability and resilience to crises.

In his exposition of macroprudential policies in his chapter of this volume, Shin makes an important point: the interconnection between macroprudential and more traditional macroeconomic policies such as, in particular, monetary policy. One clear example of this is the implications that changes in the interest rate have for short-term capital flows and hence for financial stability. In a world of increasing international financial integration, tighter domestic monetary conditions might be followed by an increase in capital inflows that in itself translates into higher credit growth and spending. The tradeoffs and challenges of coordinating domestic policy objectives in an open economy are the subject of the paper by Schmitt-Grohé and Uribe (in this volume). They present a simple model to illustrate the potential costs of keeping a pegged exchange rate regime in different degrees of financial integration. This work has important implications for the optimal degree of capital account openness for defaulter countries that are members of a currency union.

Reinhart and Rogoff conclude by showing that, according to the historical record, reductions of the debt to GDP ratio have been achieved through defaults (partial or total), higher inflation or the use of financial repression tools. Which of these surely unpleasant options is ultimately chosen depends on the institutional arrangements in place that constrain the choices of those in charge of economic policy.

## References


Broner, F., T. Didier, A. Erce, and S. Schmukler. 2013. "Gross Capital Flows: Dynamics and Crises." *Journal of Monetary Economics* 60(1): 113–33.

Calvo, G.A. 1998. "Capital Flows and Capital-Market Crises: The Simple Economics of Sudden Stops." *Journal of Applied Economics* 1(1): 35–54.

Céspedes, L.F. and J. Galí (eds.). 2013. *Fiscal Policy and Macroeconomic Performance*, Central Bank of Chile.

Dornbusch, R. 1985. "Policy and Performance Links between LDC Debtors and Industrial Nations." *Brookings Papers on Economic Activity* 16(2): 303–68.

Forbes, K.J. and F.E. Warnock. 2012. "Capital Flow Waves: Surges, Stops, Flight, and Retrenchment." *Journal of International Economics* 88(2): 235–51.

Frankel, J. 2011. *Monetary Policy in Emerging Markets: A Survey*. In *Handbook of Monetary Economics*, edited by B. Friedman and M. Woodford. The Netherlands: Elsevier.

Fratzscher, M. 2012. "Capital Flows, Push versus Pull Factors and the Global Financial Crisis." *Journal of International Economics* 88(2): 341–56.

Fratzscher, M., M. Lo Duca, and R. Straub. 2013. "On the International Spillovers of US Quantitative Easing." Working Paper Series 1557, European Central Bank.

Ghosh A.R., K.F. Habermeier, J.D. Ostry, M. Chamon, L. Laeven, M.S. Qureshi, and A. Kokenyne. 2011. "Managing Capital Inflows: What Tools to Use." IMF Staff Discussion Notes 11/06, International Monetary Fund.

International Monetary Fund. 2011. *Tensions from the Two-Speed Recovery: Unemployment, Commodities and Capital Flows.* World Economic Outlook April 2011.

Mendoza, E. and M. Terrones. 2008. "An Anatomy of Credit Booms: Evidence From Macro Aggregates And Micro Data." NBER Working Papers 14049, Washington: National Bureau of Economic Research.

Ostry, J.D., M.S. Qureshi, K.F. Habermeier, D.B.S. Reinhardt, M. Chamon, and A.R. Ghosh. 2010. "Capital Inflows: The Role of Controls." IMF Staff Position Notes 2010/04, International Monetary Fund.

Reinhart, C.M. and V.R. Reinhart. 2009. "Capital Flow Bonanzas: An Encompassing View of the Past and Present." In *NBER International Seminar in Macroeconomics* 2008, edited by J. Frankel and F. Giavazzi Chicago: Chicago University Press for the NBER.

Sá, F., P. Towbin, and T. Wieladek. 2011. "Low Interest Rates and Housing Booms: The Role of Capital Inflows, Monetary Policy and Financial Innovation." Working Paper 79, Globalization and Monetary Policy Institute, Federal Reserve Bank of Dallas.

Schularick, M. and A.M. Taylor. 2012. "Credit Booms Gone Bust: Monetary Policy, Leverage Cycles, and Financial Crises, 1870-2008." *American Economic Review* 102(2): 1029–61.

# Adapting Macroprudential Policies to Global Liquidity Conditions

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The global financial crisis that erupted in 2007 has had intellectual repercussions as well as large economic costs. Recent events in the advanced economies, especially the capital flow reversals and the looming banking sector crises in Europe, have shaken the conviction that traditional yardsticks of financial development such as the ratio of commercial bank assets to GDP, or of financial integration such as cross-border claims and liabilities as a proportion of GDP. And yet, those same measures of financial integration and financial development that were held up as the yardsticks of progress have, instead, turned out to be the engines of financial distress as capital flow reversals have gathered pace in Europe. In contrast, it has been the emerging economies with what were presumed to be "weak institutions" that have managed to weather the storm best.

For emerging economy policy makers, recent experience gives an opportunity to revisit some of the principles underpinning policies toward financial stability.

The traditional approach to prudential regulation has been to focus on the solvency of individual financial institutions, with the primary tool being the minimum capital requirement imposed on banks. The state of the art on prudential policy before the global financial crisis of 2007-2009 could have been summarized in terms of the following set of propositions.

— Minimum capital requirements serve as a buffer against loss on the assets of the bank, thereby protecting depositors from loss. If the government insures deposits, then the bank capital requirement also serves as a buffer against loss by taxpayers.

I thank the editors for their insight and comments on an earlier version of this paper.

*Capital Mobility and Monetary Policy*, edited by Miguel Fuentes D., Claudio E. Raddatz, and Carmen M. Reinhart, Santiago, Chile. 

— Minimum capital requirements ensure that the bank's owners have a stake in the value of the bank's assets, thereby ensuring that owners have sufficient "skin in the game," deterring moral hazard on their part toward excessive risk-taking.
— Having ensured financial stability through bank capital requirements, and in the presence of well-functioning international capital markets, monetary policy can focus on the task of macroeconomic stabilization by setting interest rates to stabilize components of aggregate demand, such as consumption and investment.

Recent experience has raised questions on the adequacy of a policy framework based on these propositions alone, and has spurred a reassessment of the purpose and effectiveness of prudential regulations.

Consider the traditional approach to banking regulation, and its focus on the soundness of individual institutions. To shield the creditors of the banks—especially the depositors—from the risk of loss on assets of the bank, requirements are set on minimum capital for banks as a proportion of their risk-weighted assets.

The basic philosophy of setting buffers against loss has been central in the international standards for banking regulation as led by the Basel Committee on Banking Supervision, which has coordinated the international discussion on the harmonization of international standards on banking regulation. The Basel III framework has continued the tradition of basing banking regulation on building buffers against loss. The centerpiece of the framework agreed on in 2010 was a strengthened common equity buffer of 7%, together with newly introduced liquidity requirements and a leverage cap to be phased in over an extended timetable running to 2019 (BCBS, 2010).

Basel III also incorporates a countercyclical capital surcharge that can be introduced at the discretion of national regulators, and foresees additional requirements on global SIFIs (systemically important financial institutions, the "G-SIFIs") in the form of capital surcharges. However, G-SIFIs discussions have revolved around the difficulties of cross-border resolution and the moral hazard of banks being "too-big-to-fail". Issues of excessive asset growth or cross-border banking flows that are of most interest to emerging economy policy makers have received less attention. In this respect, Basel III is *micro*-prudential in its focus, concerned with the solvency of individual banks; rather than being *macro*-prudential, concerned with the resilience of the financial system as a whole. The language of Basel III is revealing in this regard, with repeated references to greater "loss absorbency" of bank capital. However, achieving greater loss absorbency by itself is almost certainly inadequate in achieving a stable financial system, for two reasons.

— Loss absorbency does not directly address the procyclicality of the financial system and the *excessive asset growth* during booms.
— Preoccupation with loss absorbency diverts attention from the *liabilities side* of banks' balance sheets, and vulnerabilities from the reliance on unstable short-term funding and short-term foreign currency funding.

These two shortcomings have special importance for developing and emerging economies given their susceptibility to the fluctuations in global liquidity conditions. Indeed, the Basel process has focused almost exclusively on the imperatives of advanced country financial systems, rather than the needs of emerging and developing economies.

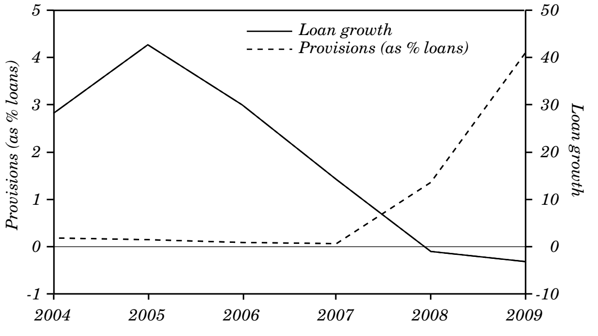
Consider now the issue of procyclicality and excessively rapid asset growth. During a lending boom, temporarily depressed risk measures, combined with high bank profitability, tend to bolster bank capital ratios. However, experience has shown repeatedly that rapid loan growth is only achieved at the cost of the build-up of systemic vulnerabilities. As the former BIS head Andrew Crockett (2000) has put it,

> "The received wisdom is that risk increases in recessions and falls in booms. In contrast, it may be more helpful to think of risk as increasing during upswings, as financial imbalances build up, and materializing in recessions." (Crockett, 2000).

As an illustration, take the example of Allied Irish Banks (AIB); although we could have chosen one of many other examples from the recent global financial crisis.

Figure 1 plots AIB's loan growth and loan loss provisions from 2004 to 2009. AIB's loan book increased 43% in 2005 and 30% in 2006, but loan growth came to a sudden halt with the onset of the global financial crisis. Loan loss provisions were low and falling throughout the lending boom, but the low measured risks were only masking the underlying vulnerability of the loan book, and provisions jumped above 4% by the end of 2009. AIB's capital ratios were highest at the peak of the boom in 2006 and did not issue timely warnings, as seen in table 1. The severity of the subsequent bust calls into question the

**Figure 1. Loan Growth and Provisions for Allied Irish Banks**




Source: Shin (2011), data from AIB Annual Reports.

**Table 1. Capital Ratios for Allied Irish Banks**
Percent

| | *2004* | *2005* | *2006* | *2007* | *2008* | *2009* |
|---|---|---|---|---|---|---|
| Tier 1 capital ratio | 7.9 | 7.2 | 8.2 | 7.5 | 7.4 | 7.2 |
| Total capital ratio | 10.7 | 10.7 | 11.1 | 10.1 | 10.5 | 10.2 |

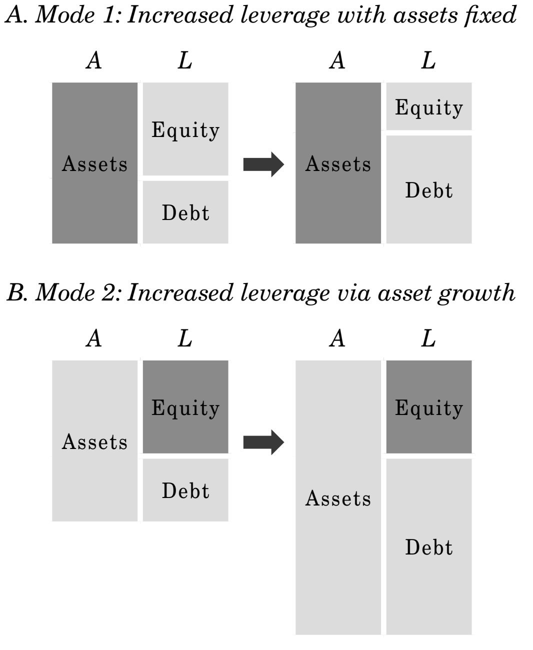
Source: AIB Annual Reports.

philosophy of relying on capital ratios while neglecting asset growth itself. The problem of excessive asset growth is not addressed easily within the framework of traditional banking regulation that focuses on capital as a buffer against loss, and points to the necessity of more active restraint on asset growth in order to curtail the build-up of vulnerabilities.

Procyclicality in asset growth is inherent to banking. In textbook discussions of corporate financing decisions, the set of positive net present value (NPV) projects is often taken as being exogenously given with the implication that the size of the balance sheet is fixed. Leverage increases by substituting equity for debt, such as through an equity buy-back financed by a debt issue, as depicted by the left hand panel in figure 2.

However, the left hand panel in figure 2 turns out to not be a good description of the way that the banking sector leverage varies over

**Figure 2. Two Modes of Leveraging Up**



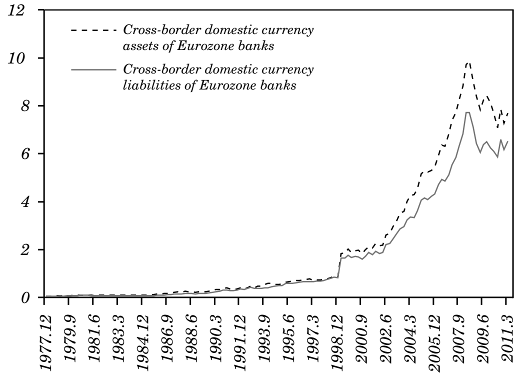

Source: Author's elaboration.

the financial cycle. The distinguishing feature of the banking sector leverage cycle is that leverage fluctuates through fluctuations in the total size of the balance sheet with equity being the pre-determined variable. Hence, leverage and total assets tend to move in lockstep, as depicted in the right hand panel of figure 2. Part of the increase in bank assets in boom times may be due to new positive net present value (NPV) projects that become available with improvements in economic fundamentals. However, the accumulated empirical evidence suggests that the procyclicality of the banking sector cannot be accounted for by the fundamentals alone, but instead points to shifting capacity to bear risk on the part of the banks themselves.[1]

The aggregate consequences of bank balance sheet management can be gleaned from the banking statistics of the Bank for International

1. Adrian and Shin (2008, 2010) discuss the evidence from US investment banks, while Bruno and Shin (2011) find in their empirical investigation of capital flows to emerging economies that non-US global banks behave similarly.

**Figure 3. Cross-Border Domestic Currency Assets of Eurozone Banks**
US$ trillion




Source: BIS Locational Banking Statistics, Table 5A.

Settlements (BIS). Since we will be appealing to the BIS statistics in some detail in what follows, some preliminary remarks are in order on how to read the numbers.

The BIS data comes in two forms. First is the locational banking statistics, which are based on the principle of residence, and which are consistent with the residency principle underlying balance of payments and national income statistics. Under the locational statistics, the branches and subsidiaries of the global banks are classified together with the host country banks. Second is the consolidated statistics, based on the nationality of the parent bank. Within the consolidated banking statistics, *foreign claims* include the local claims of branches and subsidiaries, while the *international claims* exclude local claims in local (that is host country) currency.[2]

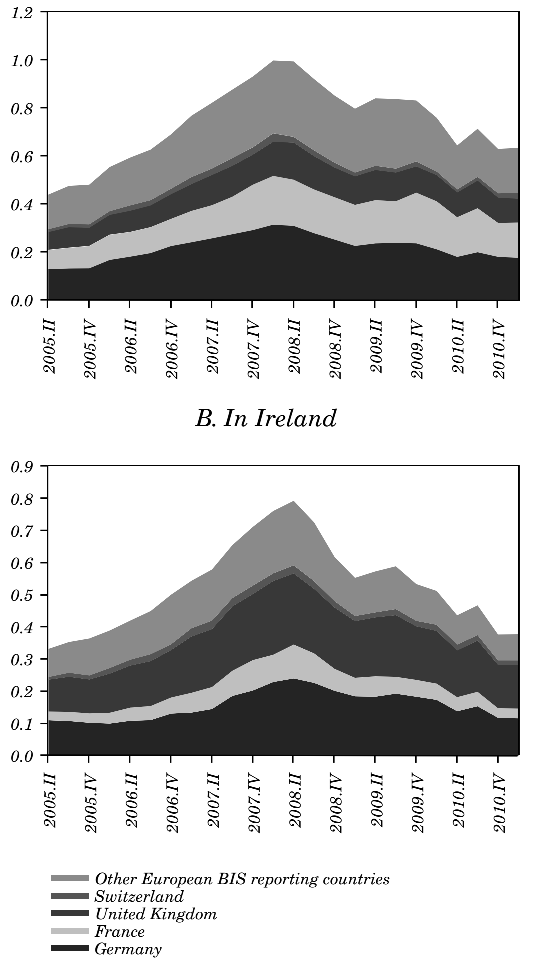
Figure 3 is from the BIS locational banking statistics, plotting the cross-border assets and liabilities of Eurozone banks in domestic currency. Thus, after 1999, the series denotes the cross-border euro-denominated lending and borrowing by the Eurozone banks. Figure 3 shows that cross-border banking within the Eurozone experienced

2. See BIS (2009) for details on the BIS banking statistics. See McGuire and von Peter (2009) for an example of how the BIS statistics can be used in combination to reconstruct aggregate cross-border banking positions.

explosive growth, especially after around 2003. The consequences for Spain and Ireland were that they were borrowing in increasing amounts from other European banks, as shown in figure 4.

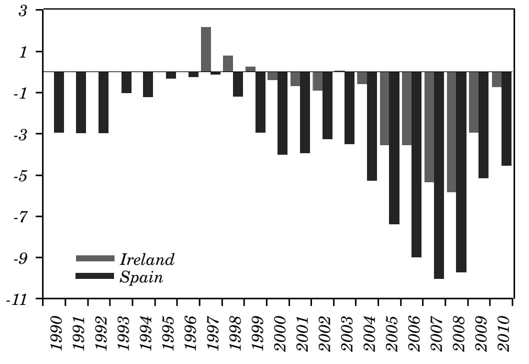
**Figure 4. International Claims of European BIS-reporting Banks on Counterparties in Spain and Ireland**
US$ trillion

*A. In Spain*




Source: BIS Consolidated Banking Statistics, Table 9D.

**Figure 5. Current Accounts of Ireland and Spain**
Current account balance as % of GDP




Source: IMF International Financial Statistics.

The banking flows were mirrored in the ballooning current account deficits of Spain and Ireland, as shown in figure 5. Spain and Ireland underwent residential property booms that were financed through the banking system by the credit supplied by banks, in other Eurozone economies, to the banking sectors of Spain and Ireland. The current account deficits of Spain and Ireland were, therefore, closely aligned to the gross banking sector flows. The "banking glut" in Europe represented by these charts sheds much light on current conjuncture and the European financial crisis of 2011. The European crisis carries the hallmarks of a classic "twin crisis" that combines a banking crisis with an asset market decline that amplifies banking distress. In the emerging market twin crises of the 1990s, the banking crisis was intertwined with a currency crisis. In the European crisis of 2011, the twin crisis combined a banking crisis with a sovereign debt crisis, where the mark-to-market amplification of financial distress interacted to worsen the banking crisis.

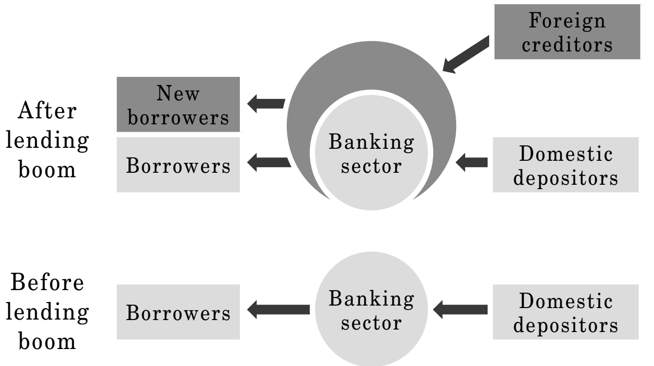
The vulnerability of the banking sector to run by its wholesale creditors, highlighted by the crisis in Europe, is equally relevant for emerging and developing economy financial systems. For open emerging economies, the wholesale funding obtained by the banking sector is often in foreign currency. Deleveraging episodes that materialize as a twin crisis are particularly harmful due to the ballooning of bank liabilities in domestic currency terms as the value of the domestic currency falls relative to the US dollar, even while the asset value of the bank suffers collapse in a crisis. In other words, during a twin crisis, bank equity gets squeezed from both directions—liabilities increase while asset values fall (Shin, 2010, Ch. 1).

Being members of the Eurozone prevented both Ireland and Spain from having autonomous monetary policy rein in domestic bank lending. However, the loss of autonomy over monetary policy is a more general theme that affects many more countries than just those of the Eurozone. For emerging and developing economies with open capital accounts whose domestic financial system is heavily influenced by the external environment, the degree of autonomy in monetary policy can be severely curtailed due to capital inflows un-doing the effects of tighter monetary policy. Faced with low interest rates in advanced economies and permissive funding conditions carried by the global banks, raising domestic interest rates may backfire by inducing greater carry trade inflows resulting in looser domestic financial conditions. For this reason, the policy maker may face a dilemma in meeting financial stability concerns through the use of monetary policy.

When the external environment curtails the effectiveness of monetary policy and funding conditions in global capital markets, additional policy tools may be required to lean against the build-up of financial vulnerabilities. Macroprudential policies are one way to fill the gap in the policy toolkit under such circumstances, although as we will discuss below, they are rarely a panacea. Macroprudential policies are aimed, in the first instance, at dampening the procyclicality of the financial system. They lean against excessive growth of lending in booms. At the same time, they are aimed at mitigating the emergence of vulnerabilities on the liabilities side that may result in sharp reversals in funding when global liquidity conditions deteriorate.

In what follows, we will consider in more detail the rationale for macroprudential policies, and how such policies may be designed and implemented. In particular, we will highlight the role played by the "non-core" liabilities of the banking sector as an indicator of the vulnerability of the financial system to shocks. Non-core liabilities serve as a measure of the risk appetite of financial intermediaries, both for domestic institutions and their foreign creditors, and hence the potential for a rapid curtailment of funding as global funding conditions deteriorate. Moreover, non-core liabilities can serve as an indicator of the "supply push" factor of global liquidity resulting from expansive monetary policies pursued by advanced economy central banks.

**Figure 6. Lending Boom Financed by Non-Core Liabilities**



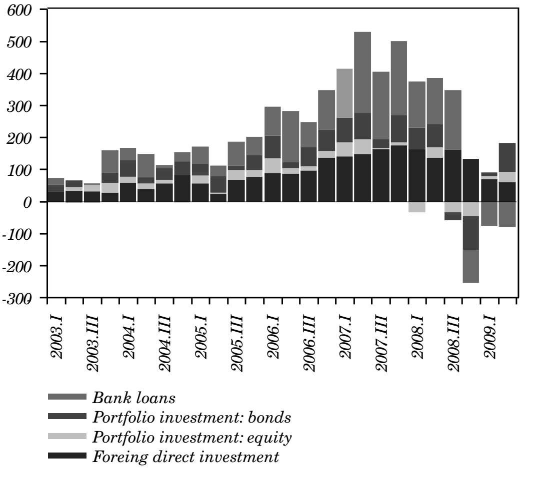

Source: Author's elaboration.

Figure 6 is a schematic illustration of the build-up of vulnerabilities associated with the growth of non-core liabilities. The bottom panel is the banking sector before a credit boom, while the top panel illustrates the system after the boom. As traditional deposit funding does not keep up with the credit growth, the banking sector's expansion is funded by non-core liabilities (in this case, from foreign creditors) building up vulnerabilities to deleveraging by foreign creditors.

Figure 7 is a chart from the IMF's Global Financial Stability Report of April 2010 showing the capital inflows into a group of 41 countries, including many emerging economies. The flows are disaggregated into the four main categories of capital flows. We see that aggregate FDI flows are steady and portfolio equity flows are small in net terms. However, banking sector flows display the signature procyclical pattern of surging during the boom, only to change abruptly and surge out with the deleveraging of the banking sector. The downward-facing Bank loans in 2008.IV is particularly striking.

Some macroprudential tools have close affinities with existing *micro*-prudential tools, except that the motivation is to ensure stability of the system as a whole, rather than individual bank solvency. In addition, there are more specialized macroprudential tools. An example is the levy on the non-core liabilities of banks introduced by Korea at the end of 2010 that counteracts the

**Figure 7. Components of Capital Flows**
US$ billion




Source: IMF Global Financial Stability Report, April 2010 p. 123.

distortions to global funding conditions and the "supply push" of funding by the global banks. We return to this example below.

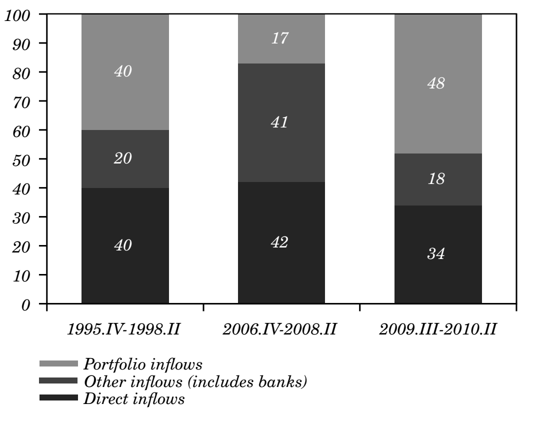
Macroprudential policies have important interactions with monetary policy and with other macro stabilization policies, such as capital flow management (CFM) policies (that is capital controls). A neat division between monetary policy and policies toward financial stability are difficult in theory and unlikely to be useful in practice. Short-term interest rates influence capital flows and the balance sheet composition of domestic and global banks, so that monetary policy has financial stability implications. By the same token, curtailing loan growth will have an impact on real economic activity, and hence will have a direct impact on the stabilization of macroeconomic activity.

The outline of the rest of the paper is as follows. We begin by reviewing the importance of external financing conditions for influencing domestic financial conditions through banking sector capital flows. We do so by drawing on the BIS cross-border banking statistics. We then review the range of macroprudential tools at the disposal of policy makers and compare the respective advantages and disadvantages, depending on the policy environment.

## 1. External Environment and Global Liquidity

The low interest rates maintained by advanced economy central banks in the aftermath of the 2007-9 financial crisis have ignited a lively debate about capital flows to emerging economies. A recent policy document on capital flows from the IMF (2011) has drawn attention to changes in the composition of capital flows between the most recent post-crisis episode; and the credit boom that immediately preceded the global financial crisis.

**Figure 8. Components of Capital Inflows to Emerging Economies ex China**

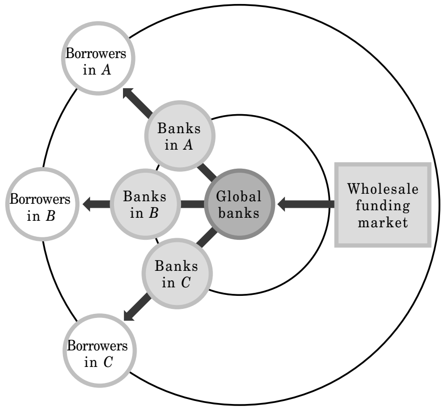



Source: IMF (2011, p. 14).

The IMF document (IMF, 2011) identifies three periods of rapid capital inflows in recent decades, the first being 1995.IV–1998.II associated with the subsequent Asian crisis, the period 2006.IV–2008.II associated with the 2008 financial crisis, and the most recent period in the aftermath of the crisis (2009.III–2010.II). The distinguishing feature of the boom that preceded the 2008 financial crisis is the role played by banking sector flows. Understanding the external environment and the role of cross-border banking is important in putting the recent crisis in context. The US dollar bank funding market has special significance in this debate.

As well as being the world's most important reserve currency and an invoicing currency for international trade, the US dollar is

**Figure 9. Structure of Cross-Border Banking and Capital Flows**




Source: Author's elaboration.

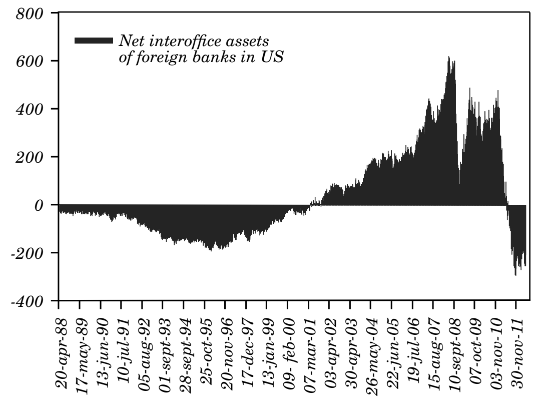
also the currency that underpins the global banking system. It is the funding currency of choice for global banks. One manifestation of the dollar's role as the currency for the global banking system is through the role of foreign banks in the US. The US hosts branches of approximately 160 foreign banks whose main function is to raise wholesale dollar funding in capital markets and then ship it to the head office. Some of the borrowed dollars will find their way back to the US to finance purchases of mortgage backed securities (MBS) and other assets.[3] But some of them will flow to Europe, Asia and Latin America where global banks are active local lenders. In this way, global banks become the carriers for the transmission of liquidity spillovers across borders. At the margin, the shadow value of bank funding will be equalized across regions through the portfolio decisions of the global banks, so that global banks become carriers of dollar liquidity across borders. In this way, permissive US liquidity conditions will be transmitted globally, and US monetary policy becomes, in some respects, *global* monetary policy.

Foreign bank branches in the US collectively raise over one trillion dollars of funding, of which over 600 billion dollars is

3. See Shin (2011) for discussion of the "global banking glut" associated with European banks.

channeled to headquarters.[4] A key quantity is the *net interoffice assets* of foreign bank branches in the US—the lending by branches and subsidiaries to headquarters—as given in figure 10. Interoffice assets increased steeply in the last two decades, saw a sharp decline in 2008, but bounced back in 2009, only to turn negative again in 2011 as the European crisis gathered pace.

**Figure 10. Net Interoffice Assets of Foreign-Related Institutions in the United States**
US$ billion



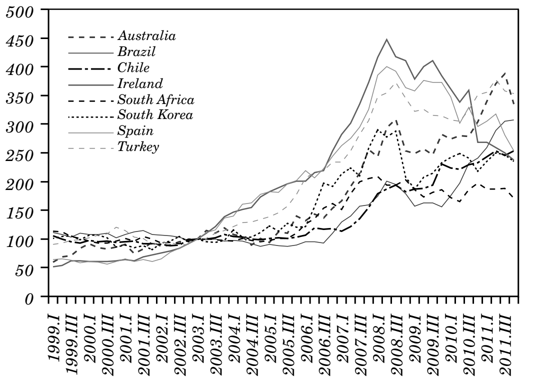

Source: Federal Reserve H8 series.

The large net positive interoffice accounts of foreign banks in the US highlights the potential for cross-border spillovers in monetary policy. Dollar funding that is shipped abroad to headquarters will be deployed globally according to portfolio allocation decisions that seek out the most profitable use of such funds. Thus, permissive liquidity conditions in the US dollar wholesale market will be transmitted via the global banking system to other parts of the world.

We can pick up the trail once the dollars are on lent to local borrowers in Europe, Asia and Latin America. The BIS locational banking statistics can provide more detailed information through

4. BIS (2010) "Funding Patterns and Liquidity Management of Internationally Active Banks" CGFS paper 39, May 2010, Bank for International Settlements. http://www.bis.org/publ/cgfs39.htm.

**Figure 11. External Claims (Loans and Deposits) of BIS Reporting Banks**
March 2003=100




Source: BIS Locational Banking Statistics, table 7A.

the external claims (loans and deposits) of the banks from the BIS reporting countries vis-à-vis many emerging economies.

Figure 11 plots the normalized series (with the values at March 2003 set to 100) of the cross-border claims against counterparties listed on the right of the figure. What is notable is the degree of synchronization of banking sector flows across disparate geographical regions of the recipient countries, especially in the period immediately leading up to 2008. However, it is notable that economies in Latin America, notably Brazil and Chile, saw relatively late surges in banking sector inflows, and did not see the rapid banking sector inflows that most other emerging economies experienced in the 2006–2008 period prior to the recent global financial crisis.

Bruno and Shin (2011) build a theoretical model of global banking where the assets of the global banks are the liabilities of the emerging economy banks and derive empirical predictions on the size of capital flows as a function of the leverage cycle of the banking sector, and verify that the theoretical predictions are confirmed in the data. In particular, the VIX index of the implied volatility of equity index options which is known to be a key explanatory variable for bank leverage (Adrian and Shin, 2010) is also highly significant in explaining both banking sector capital flows and domestic credit growth in the recipient economies.

## 2. Non-Core Liabilities as Macroprudential Indicators

Banks are the most important financial intermediaries in emerging and developing economies. To the extent that banking sector risks are mirrored in the size and composition of bank balance sheets, a useful set of signals may be those derived from the *liabilities side* of banking sector balance sheets. The liabilities side of the banking sector balance sheet will shed light on how much of the financing is being channeled through the banking system, and hence give insights on the risk attitude of the banking sector.

Even in a closed economy, the relative size of the banking sector vis-à-vis the rest of the financial sector is likely to reveal useful information on risk attitudes. When bank liabilities are increasing rapidly, this suggests households are supplying more credit *indirectly* through the banking sector rather than *directly* through some other means (for example, through the corporate bond market). If the "as if" preferences of banks were identical to the household sector, then it would not make a difference to the projects being financed in the economy whether the funding is directly or indirectly provided. However, as explained at the outset, procyclical behavior characterizes the banking sector where the lending standards vary more over the cycle than would be justified by the economic fundamentals alone (see Shin, 2011, for a formal model). Thus, an increase in the relative size of the banking sector during a boom is likely to entail lower lending standards and greater "risk appetite" in overall lending decisions.

The shifts in effective risk aversion entailed by such fluctuations in the relative size of the banking sector is key to resolving the apparent paradox where larger bank liabilities (short-term "safe" claims of households) are associated with greater risk taking in the economy. The paradox is only apparent because the apparently "safe" claims against the banks are being recycled in the form of loans to ultimate borrowers in the economy. When short-term "safe" claims on the banks increase, this is the mirror image of the greater quantity of lending that is being channeled through the banking sector. The model of the "Global Banking Glut" in Shin (2011) has further details of the precise mechanism.

Traditional monetary aggregates give a window on the size and composition of bank liabilities. Monetary aggregates such as M2 track the size of the deposit base of the domestic banking system, and hence can serve as a proxy for the claim of the household sector on the banking sector. However, traditional classifications of monetary aggregates focus on the transactions role of money as a medium of exchange. As such, the criterion is based on how close to cash—how "money-like"—a particular financial claim is. The classic study by Gurley and Shaw (1960) emphasized the distinction between "inside money," which is a liability of a private sector agent and "outside money," which is not (such as fiat currency). The traditional focus of monetary analysis has been on money as a medium of exchange.

Demand deposits are the archetypal money measure because such liabilities of the banking sector can be quickly transferred from one person to another. Savings deposits are less money-like, and hence figure in broader notions of money, such as M2, but even here they fall outside the M2 measure if the depositor faces restrictions on easy access to the funds. In this way, the traditional hierarchy of monetary aggregates goes from cash to the very liquid claims, such as demand deposits going out to more illiquid claims on the banking sector, such as term savings deposits. The criterion is how easily such claims can be used to settle transactions.

For financial stability purposes however, an alternative classification system for liability aggregates may be better suited, which is conceptually a better fit for the vulnerability to financial shocks and their propagation. The key task would be to draw on existing knowledge of the behavior of financial intermediaries, and to find the counterparts in banking sector liability aggregates that have implications on the procyclicality of the financial system. Traditional transactions-motivated monetary aggregates may not be the most useful measure in this respect.

A distinction made in Shin and Shin (2010) is between the *core* and *non-core* liabilities of the banking sector. Core liabilities are the funding that the bank draws on during normal times. What constitutes core funding will depend on the context and the economy in question, but retail deposits of the household sector would be a good example of core liabilities. When banking sector assets are growing rapidly, the core funding available to the banking sector is likely to be insufficient to finance the rapid growth in new lending. This is because retail deposits grow in line with the aggregate wealth of the household sector. Other sources of funding must then be tapped to fund rapidly increasing bank lending. The state of the financial cycle is thus reflected in the composition of bank liabilities.

Consider the following accounting framework, taken from Shin and Shin (2010). Suppose there are $n$ banks in the domestic banking system, indexed by $\{1, \dots, n\}$. The domestic household sector is given the index $n + 1$. The foreign creditor sector is given the index $n + 2$.

Bank $i$ has two types of assets. First, there are loans to end-users such as non-financial companies or households. Denote the total loans by bank $i$ to such end users of credit as $y_i$. Next, there are the claims against other financial intermediaries. Call these the "interbank" assets, although the term covers all claims on other intermediaries. The total interbank assets held by bank $i$ are

$$\sum_{j=1}^{n} x_j \pi_{ji}$$

where $x_i$ is the total debt of bank $j$ and $\pi_{ji}$ is the share of bank $j$'s debt held by bank $i$.

Note that $\pi_{i,n+1}$ is the proportion of the bank's liabilities held by the domestic creditor sector (for example, in the form of deposits), while $\pi_{i,n+2}$ is the proportion of the bank's liabilities held by foreign creditors (for example, in the form of short-term foreign currency-denominated debt). Since sectors $n + 1$ and $n + 2$ are not leveraged, we have $x_{n+1} = x_{n+2} = 0$. The balance sheet identity of bank $i$ is

$$y_i + \sum_{j=1}^{n} x_j \pi_{ji} = e_i + x_i$$

The left-hand side is the total assets of the bank. The right-hand side is the sum of equity and debt. Letting $x = [x_1 \dots x_n]$ and $y = [y_1 \dots y_n]$, we can write in vector notation the balance sheet identities of all banks as

$$y + x\Pi = e + x$$

where $\Pi$ is the matrix whose $(i,j)^{\text{th}}$ entry is $\pi_{ij}$. Solving for $y$,

$$y = e + x(I - \Pi).$$

Define leverage $\lambda_i$ as the ratio of total assets to equity and let $\Lambda$ be the diagonal matrix with $\lambda_i$ along the diagonal. Then,

$$y = e + e(\Lambda - I)(I - \Pi)$$

where $\Pi$ is the matrix of interbank liabilities. By post-multiplying the above equation by the unit column vector $u$, we can sum up the rows of the vector equation above, and we have the following balance sheet identity

$$\sum_i y_i = \sum_i e_i + \sum_i e_i z_i \left(\lambda_i - 1\right)$$

where $z_t$ is given by the $i^{\text{th}}$ row of $(I - \Pi)u$. Here, $z_i$ has the interpretation of the proportion of the bank's liabilities that come from outside the banking sector—that is the proportion of funding that comes either from the ultimate domestic creditors (for example, deposits) or the foreign sector (for example, foreign-currency denominated banking sector liabilities). In this way, we can re-write the aggregate balance sheet identity in the following way

Total Credit = Total Equity of Banking Sector
+ Liabilities to Non-bank Domestic Creditors
+ Liabilities to Foreign Creditors

The accounting framework above helps us to understand the connection between (i) the procyclicality of the banking system, (ii) systemic risk spillovers, and (iii) the stock of non-core liabilities of the banking system. Within this accounting framework, the *core liabilities* of a bank can be defined as its liabilities to the non-bank domestic creditors (such as through retail deposits). Then, the *non-core liabilities* of a bank are either (i) a liability to another bank, or (ii) a liability to a foreign creditor.

Two features distinguish non-core liabilities. First, non-core liabilities include claims held by intermediaries on other intermediaries. Second, they include liabilities to foreign creditors, who are typically the *global* banks, and hence also intermediaries, albeit foreign ones. Even for liabilities to domestic creditors, if the creditor is another intermediary, the claim tends to be short-term. The distinction between core and non-core liabilities becomes meaningful once there are differences in the empirical properties of the two types of liabilities.

Table 2 is a two-way classification of banking sector liabilities that distinguishes the traditional concern with the liquidity of monetary aggregates for transactions' purposes together with the question of whether the liabilities are core or non-core.

**Table 2. Classification of Core versus Non-Core Liabilities**

| | *Core liability* | *Intermediate* | *Non-core liability* |
|---|---|---|---|
| *Highly liquid* | Cash<br>Demand deposits (households) | Demand deposits (non-financial corporate) | Repos<br>Call loans<br>Short-term FX bank debt |
| *Intermediate* | Time deposit and CDs (households) | Time deposit and CDs (non-financial corporate) | Time deposit and CDs (banks & securities firms) |
| *Illiquid* | Trust accounts (households)<br>Covered bonds (households) | Trust accounts (non-financial corporate) | Long-term bank debt securities (banks & securities firms)<br>ABS & MBS |

Source: Shin and Shin (2010).

Hahm and others (2010) examine the components of Korean banks' liabilities, sub-divided into the two-dimensional categorization illustrated in table 1, that is, by classifying liabilities into how liquid they are, and who holds them. They exhibit evidence of a clear hierarchy within each liquidity category of the relative "stickiness" of the liability, depending on whether the liability is due to the household sector, non-financial corporate sector or financial corporate sector. In this way, core liabilities are more stable (or "sticky") than non-core liabilities. For instance, retail deposits of household savers would be more stable than corporate deposits, which in turn could be sub-divided into non-financial company deposits and financial institution deposits.

In an open emerging economy where the banking system is open to funding from global banks, rapid increases in the non-core liabilities of the banking system would show up as capital inflows through increased foreign exchange-denominated liabilities of the banking system. For this reason, foreign exchange denominated liabilities of the banking sector can be expected to play a key role in diagnosing the potential for financial instability.

For the case of Korea, Shin and Shin (2010) proposed a definition of non-core liabilities as the sum of (i) foreign exchange denominated bank liabilities (ii) bank debt securities, (iii) promissory notes (iv) repos and (v) certificates of deposit.[5] Note that this measure of non-core liabilities is an approximation of "true" non-core liabilities defined in our accounting framework above, as the classification is still based upon financial instruments rather than actual claim holders. For instance, households can hold bank debt securities such as debentures and CDs, and those must be excluded from the non-core liabilities.

The right hand panel in figure 1 charts the non-core liabilities of the Korean banking sector, taken from Shin and Shin (2010) with the FX liabilities shown in red. It is noticeable how the first peak in non-core liabilities coincides with the 1997 crisis. After a lull in the early 2000s, non-core liabilities increase rapidly in the run-up to the 2008 crisis.

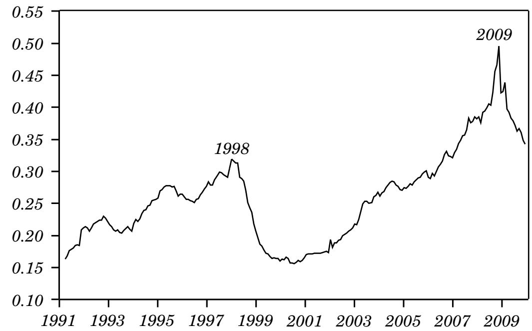
Note also that the peak in these series occurs some weeks after the outbreak of the crisis. This is because the total amounts are measured in Korean won, and the outbreak of the crisis coincides with a rapid depreciation of the won, which implies an increase in the won value of the foreign currency denominated bank liabilities.

The left hand panel of figure 12 is the plot of the non-core liabilities as a fraction of M2. We see that the relative size of non-core liabilities to M2 is highly procyclical. There is substantial variation in the ratio of non-core liabilities to M2, ranging from around 15% of M2 to a peak of 50% at the height of the 2008 crisis following the bankruptcy of Lehman Brothers. The pronounced procyclicality of the non-core liability series for Korea should not come as a surprise given our earlier discussion of the balance sheet management practices of banks and the perverse nature of the demand and supply responses to asset price changes and shifts in measured risks. During a credit boom when measured risks are low and funding from global banks is easy to come by, we would expect to see strong credit growth fueled by capital inflows into the banking sector, often in foreign exchange.

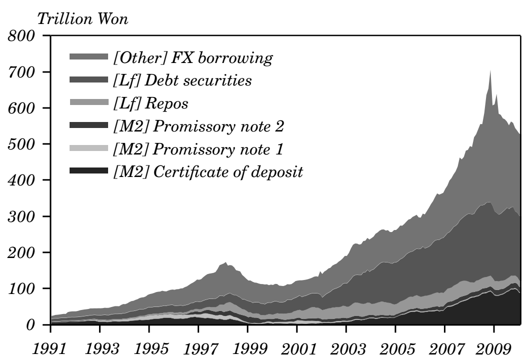
5. The peaks in the series occur some weeks after the start of the crisis, as the non-core series are measured in Korean won and the won depreciated sharply during the 1997 and 2008 crises, increasing the won value of foreign exchange-denominated liabilities.

**Figure 12. Non-Core Banking Sector Liabilities of Korea**

*A. Non-core liabilities as fraction of M2*




*B. Non-core liabilities of Korean banks*

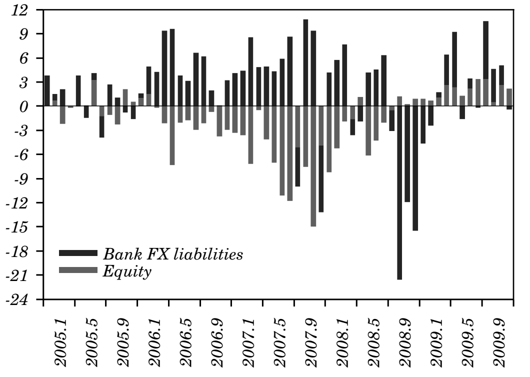



Source: Shin and Shin (2010), data from Bank of Korea.

Figure 13, taken from Shin and Shin (2010), shows how capital flows associated with foreign currency liabilities of the banking sector played a key role in the foreign exchange liquidity crisis of 2008 in Korea. Figure 13 plots and compares the capital inflows and outflows for two sectors—the equity sector and the banking sector.

The equity sector (in light bars) actually saw *net inflows* during the crisis in the autumn of 2008. Contrary to the common misperception (perpetuated by television broadcasts from the stock exchange after turbulent trading) that the exit of foreign investors from the Korean stock market is the main reason for capital outflows,

**Figure 13. Net Capital Flows of Equity and Banking Sector**
US$ billion




Source: Shin and Shin (2010), data from Bank of Korea.

we can see that the flows in the equity sector were *net positive* immediately after the crisis.

There are good reasons for why the equity sector should see net positive flows during a crisis. Equity outflows have two mitigating factors. During a crisis, not only do stock prices fall sharply, but there is also a steep depreciation of the local currency relative to dollar terms. For both reasons, foreign investors suffer a “double whammy” if they withdraw from the local stock market. Provided that the exchange rate is allowed to adjust, equity outflows will not be the main culprit in draining foreign currency reserves. When Korean investors have equity investments abroad, the repatriation flows back to Korea will outweigh the outflows from foreign investors.

However, the banking sector is different for three reasons. First, foreign currency liabilities of the banks have a face value that must be met in full. Second, the face value is in foreign currency. Third, the dynamics of deleveraging, sets off amplifying effects through price changes and shifts in measured risks.

For all three reasons, the deleveraging of the banking sector is associated with precipitous capital outflows. Unlike long-term investors—such as pension fund, mutual fund and life insurance companies—leveraged institutions are vulnerable to erosion of their capital, and hence engage in substantial adjustments of their assets, even to small shocks. The feedback loop generated by such reactions to price changes amplifies shocks.

As seen in figure 13, the banking sector in Korea saw very substantial capital outflows in the aftermath of the Lehman crisis. In the three months following the Lehman bankruptcy, the outflow from the banking sector was 49 billion dollars, which more than accounts for the decrease in Korea's foreign exchange reserves from over 240 billion dollars before the Lehman crisis to 200 billion at the end of 2008. Deleveraging by banks and the associated amplification effects have figured prominently in emerging economy financial crises.

As a practical matter, the classification into core and non-core is not so clear-cut. For a small and medium-sized enterprise with an owner-manager, the bank deposits of that firm could be seen as household deposits. However, the firm could be a major firm with access to market finance, which can issue bonds and then deposit the proceeds of the bond sale in the banking system. Nevertheless, the distinction between core and non-core bank liabilities provides a better window on the actual exposure of the banking sector to financial risk and their willingness to increase exposures. As such, the relative size of non-core liabilities can be used as a monitoring tool to reflect the stage of the financial cycle and the degree of vulnerability to potential setbacks.

Hahm, Shin and Shin (2011) test the hypothesis that the greater incidence of non-core liabilities is associated with greater vulnerability to crises by conducting a cross-country panel probit study of financial crises. The study is conducted using the IMF's International Financial Statistics (IFS) where the liability of the banking sector to foreign creditors is used as one of several non-core liability measures. They find that, non-core liabilities indeed figure prominently in explaining financial crises, even in the presence of other predictive variables such as the credit to GDP ratio that has received much attention in the policy community.

## 3. Macroprudential Tools

Macroprudential policy aims to secure financial stability by leaning against the excessively rapid loan growth in the banking sector. One useful taxonomy is to distinguish between *asset side tools* that limit bank loan growth directly, *liabilities side tools* that limit vulnerability to liquidity and currency mismatches, and *bank capital-oriented tools* that limit loan growth through altering incentives of banks. Table 3 summarizes the macroprudential tools and their main advantages and drawbacks. The rest of this section will be devoted to a more detailed examination of their properties.

**Table 3 Taxonomy of Macroprudential Tools**

| | *Policy tool* | *Advantages* | *Drawbacks* |
|---|---|---|---|
| Asset side tools | Loan-to-Value (LTV) cap | Low administrative burden | Ineffective during rapid housing boom |
| | Debt service-to-Income (DTI) cap | Ties loan growth to wage growth | High administrative capacity needed for data on income |
| | Loan-to-Deposit caps | Low administrative burden | Distorts bank funding<br>Not applicable to foreign banks |
| | Reserve Requirement | Low administrative burden | Ineffective with low interest rates, burdens central bank |
| Liabilities side tools | Levy on wholesale bank liabilities | Price based measure<br>Acts on broad liability aggregates | Needs legislation<br>Cannot narrowly target FX vulnerability |
| | Levy on FX-denominated bank liabilities | Price-based measure<br>Enhances monetary policy<br>Counters FX risk | Needs legislation<br>Narrow base of levy |
| Bank capital-oriented tools | Countercyclical capital requirements | Conforms to Basel III | Difficulty in calibration level playing field issues |
| | Forward-looking provisioning | Modifies bank incentives | Objections from accounting standard setters |
| | Leverage cap | Modifies bank incentives | Not price based<br>Open to circumvention<br>Vulnerable to bank FDI |

Source: Author's elaboration.

## 3.1. Bank Capital-Oriented Tools

### 3.1.1 Capital requirements that adjust over the cycle

The balance sheet management of banks is inherently procyclical. The rise in asset values that accompanies a boom results in higher capital buffers at financial institutions, supporting further lending in the context of an unchanging benchmark for capital adequacy. In the bust, the value of this capital can drop precipitously, possibly even necessitating a cut in lending.[6]

Capital requirements that lean against the credit or business cycle can mitigate the lending cycle. The framework for countercyclical capital buffers as envisaged in the Basel III framework has focused on the ratio of credit to GDP. This ratio has been proven to be useful as an indicator of the stage of the financial cycle, as demonstrated by the work of BIS economists, notably by Borio and Lowe (2002, 2004). Under the Basel III framework, the ratio of credit to GDP has been given a central role. The initial consultation document (BCBS, 2009) issued by the Basel Committee first proposed a countercyclical capital surcharge. The idea that the required capital buffer should vary over the financial cycle had been discussed for some time, and had been argued in the Geneva Report on bank regulation (Brunnermeier and others, 2009). The Basel Committee's approach can be seen as the concrete implementation of the concept by selecting the credit to GDP ratio as the appropriate cyclical indicator.

Conceptually, it is natural that credit growth should be scaled by normalizing it relative to some underlying fundamental measure. Normalizing credit growth by GDP has many advantages. GDP is an aggregate flow measure of economic activity that reflects current economic conditions, and one which is readily available under the basic national income calculations. Moreover, it is a measure that has a high degree of standardization across countries, which helps in competition and level playing field disputes in the consistent implementation of international banking regulations.

However, there are measurement challenges even for the concept of credit growth. To serve as a signal of procyclicality, credit growth should mirror the risk taking attitudes or market risk premiums, where they are relevant. The need for judgment is important in

6. For example, see Kashyap and Stein (2004) and Adrian and Shin (2010).

emerging and developing economies where long-term structural change through financial development may render credit growth statistics less useful as a gauge of risk appetite.

For instance, if the ratio of private credit to GDP shows rapid increases due to informal credit arrangements moving on to the formalized banking sector, then such a development has benign consequences for financial stability. In contrast, if the ratio of private credit to GDP increases due to a housing boom that is fed by cheap credit and the recycling of funding by non-financial companies, then the financial stability implications are more worrying.

The simple credit to GDP ratio may suffer from the fact that the aggregate measures of credit growth may mask some subtleties that cannot be summarized in one simple aggregate. It is also conceivable that there may be endogenous changes in the economic relationships between variables if the reduced-form economic relationships that underpin credit and GDP are used for policy purposes.

One possible counterargument to the accusation that the credit to GDP ratio may be too blunt could be that any policy maker will be exercising judgment when interpreting the figures. Also, it could be argued that there is an asymmetry between the upswing part of the financial cycle and the downswing part, and that most of the asynchronicity of financial cycles show up during the downswing. During the upswing, it may be argued that the policy of "leaning against the wind" can use the information contained in the rapid growth of the credit to GDP ratio.

Assenmacher-Wesche and Gerlach (2010) present an opposing viewpoint to the emphasis placed by Borio and Lowe (2002, 2004) on the credit to GDP ratio as an informative signal of the build-up of vulnerabilities in the economy. Assenmacher-Wesche and Gerlach (2010) take a skeptical line on the link between credit growth and property price increases. Although they find that credit shocks are associated with increases in real GDP and equity prices, the authors do not find evidence that credit growth has a large impact on property prices. The authors take this result as evidence that the bulk of the variation in credit growth is related to expected future changes in real economic activity, and they conclude that the widely accepted view that fluctuations in credit growth have been a major driver of property price shocks, seems to not be supported by the data.

Assenmacher-Wesche and Gerlach's (2010) study uses data from the OECD countries covering the period 1986–2008. Hence, their study applies to advanced economies rather than for developing and emerging economies. However, the difficulty of finding conclusive evidence for the link between credit and property prices may be more widely applicable. The fundamental difficulty is that a simple credit to GDP ratio does not have a conceptual framework that can easily link the measurement to measures of financial vulnerability. The skeptic could always argue that a surge in credit could either be due to a structural change in the economy, the increase in positive net present value projects, and hence, the *demand* for credit that is fully justified by the fundamentals, or simply the migration of lending relationships to the formal banking sector that were previously taking place in the informal sector.

Further research will be necessary to determine to what extent the simple credit to GDP ratio can serve as a finely calibrated signal that can support the use of automatic tightening of bank capital standards, as envisaged in the Basel III framework.

It would be uncontroversial to say that the less unanimity there is on the interpretation of the signal, the greater will be the political economy challenges faced by policy makers in acting decisively and in a timely fashion in heading off financial booms that build up vulnerabilities.

If the triggering of the countercyclical capital requirements is predicated on the exercise of discretion and judgment by the authorities, then political economy problems associated with the exercise of such discretion put the authorities under pressure from powerful interest groups. The political economy problem is similar to that of central banks that tighten monetary policy to head off property booms. Since there are private sector participants (such as construction companies or property developers) who are the beneficiaries of the short-term boom, they can be expected to exert pressure on policy makers or engage in general lobbying. The political economy problems will be more acute if there are controversies on the exact stage of the financial cycle or the degree of conclusiveness of the empirical evidence invoked by the policy authorities. A potential disadvantage of the countercyclical capital buffer is that it relies on the triggering of additional capital requirements in response to quantitative signals. Although such quantitative measures are relatively straightforward in simple theoretical models, there may be considerable challenges in the smooth and decisive implementation in practice.

### 3.1.2 Forward-looking provisioning

Forward-looking provisioning requires the build-up of a loss-absorbing buffer in the form of provisions at the time of making the loan, and shares similarities with the countercyclical capital buffer. However, there is a key difference between provisioning and equity in its accounting treatment. In the case of forward-looking provisioning, the provision is not counted as bank capital, and hence is less likely to influence bank management that targets a specific return on equity (ROE) level. To the extent that the bank uses its capital as the base on which to build its total balance sheet, the larger size of the equity base will result in a larger balance sheet, and hence the greater use of debt to finance the assets. During the credit boom, the build-up of greater assets using debt financing will contribute to the build-up of vulnerabilities.

The accounting treatment of the loss buffer as a provision, rather than as equity thus has a potentially crucial effect on bank behavior. By insisting on forward-looking provisioning, the bank's equity is reduced by the amount of the provision. During a boom, such a reduction of bank capital can play an important role in "letting off steam" in the pressure to build up the bank's balance sheet by removing some of the capital base of the bank. An early reference to the specific rules and procedures as well as the empirical studies that underpin the specific quantitative features of the scheme is given in Fernández, Pagés and Saurina (2000). A more recent update is provided by Saurina (2009) in a World Bank note.

Although forward-looking provisioning has been important in cushioning the Spanish banking system from the initial stages of the global financial crisis, there is a question mark as to whether building up loss absorbing buffers, on their own, can be sufficient to cushion the economy from the bursting of a major property bubble, as Spain has discovered in the recent financial crisis in Europe.

### 3.1.3 Leverage caps

Caps on bank leverage may be used as a way to limit asset growth by tying total assets to bank equity (Morris and Shin, 2008). The rationale for a leverage cap rests on the role of bank capital as a constraint on new lending rather than the Basel approach of bank capital as a buffer against loss.

The main mechanism is the cost of bank equity, which is regarded by the bank as being a more expensive funding source than short-term debt. By requiring a larger equity base to fund the total size of the balance sheet, the regulator can slow down asset growth.

The experience of Korea teaches some lessons in the use of leverage caps. In June 2010, the Korean regulatory authorities introduced a new set of macroprudential regulations to mitigate excessive volatility of foreign capital flows. Specific policy measures included explicit ceilings on foreign exchange derivatives positions of banks, regulations on foreign currency bank loans, and prudential regulations for improving foreign exchange risk management of financial institutions. These policy measures were intended to limit short-term foreign currency denominated borrowings of banks, and did so by requiring banks to put up more equity capital if they chose to increase volatile debt. Korea's leverage cap on bank FX derivative positions introduced in June 2010 saw some success in limiting the practice of banks hedging forward dollar positions with carry trade positions in the Korean won funded with short-term US dollar debt.

## 3.2 Asset Side Tools

Asset side tools act as brakes on bank asset growth directly, counteracting the superficial and temporary strength of individual bank capital ratios that are inflated due to temporarily depressed measures of risk, or higher profitability during booms. Inevitably, there are tools that straddle alternative categories. For instance, the reserve requirement imposed by central banks is an asset side tool, but is more naturally discussed in connection with the non-core liabilities levy below. Here, we begin with LTV and DTI.

### 3.2.1 Loan-to-value and debt-service-to-income caps

When monetary policy is constrained, administrative rules that limit bank lending, such as caps on loan-to-value (LTV) ratios and debt-service-to-income (DTI) ratios may be a useful complement to traditional tools in banking supervision. LTV regulation restricts the amount of the loan to not exceed some percentage of the value of the collateral asset. DTI caps operate by limiting the debt service costs of the borrower to not exceed some fixed percentage of verified income.

Conceptually, it is useful to distinguish two motivations for the use of LTV and DTI rules. The first is the consumer protection motive, where the intention is to protect household borrowers who may take on excessively burdensome debt relative to the reasonable means to repay it from wage income. Under this motivation, LTV and DTI rules would be similar to the rules against predatory lending to uninformed households. Although this is an important topic in consumer protection policy, this is not the motivation that is relevant for macroprudential policy, and is not discussed in this report.

Instead, the macroprudential rationale for imposing LTV and DTI caps is to limit bank lending to prevent both the build-up of non-core liabilities to fund such loans, and also to lean against the erosion of lending standards that are associated with rapid asset growth.

It is important to reiterate why conventional microprudential tools such as minimum capital requirements are insufficient to stem excessive asset growth. As illustrated by the example of AIB in the earlier analytical background section, minimum capital requirements rarely bite during a lending boom when bank profitability is high, and when measured risks are low. Recall that AIB's capital ratios were at their highest immediately before the onset of the global financial crisis.

Although LTV ratio caps are familiar tools, the use of DTI caps is less widespread. For Korea and some Asian economies, such as Hong Kong, the use of DTI ratios has been an important supplementary tool for macroprudential purposes. DTI rules have the advantage that bank loan growth can be tied (at least loosely) to wage growth in the economy. Without this fundamental anchor, an LTV rule by itself will be susceptible to the amplifying dynamics of a credit boom, which interacts with an increase in the value of collateral assets during a housing boom. Even though the LTV rule is in place, if house prices are rising fast enough, the collateral value will rise simultaneously, making the constraint bind less hard.

In the case of Hong Kong, the use of DTI rules takes on added significance due to the fact that Hong Kong has a currency board based on the US dollar, and hence does not have an autonomous monetary policy. As such, monetary policy shocks are transmitted directly to Hong Kong.

### 3.2.2 Loan-to-deposit caps

A cap on the loan to deposit ratio limits credit growth by tying it to the growth in deposits. The Korean supervisory authority announced in December 2009 that it would reintroduce the loan-to-deposit ratio regulation that had been scrapped in November 1998 as a part of the government deregulation efforts. According to the regulation, the ratio of Korean won denominated loans to won-denominated deposits should fall below 100% by 2013. The rationale for this policy was to restrict loan growth, by tying the growth of lending to the deposit base.

Since the deposit base constitutes the baseline, the definition of what qualifies as deposits has strict guidelines. For instance, negotiable certificates of deposit (CDs) are not included in the measure of deposits in the denominator in computing the ratio. The requirement to meet the 100% ceiling was set for the end of 2013, but the banks anticipated the eventual cap and began reducing their loan-to-value ratios in anticipation of the implementation of the cap.

However, one potential weakness of the regulation is that the rule does not apply to the Korean branches of foreign banks. Since foreign bank branches supply a substantial amount of foreign exchange denominated lending to Korean banks and firms, the exemption of foreign bank branches leaves a gap in the regulation. However, this gap would not have been easily filled within the framework of a loan-to-deposit cap, since foreign bank branches, by their nature, rely mostly on funding from headquarters or from wholesale funding, rather than local deposit funding.

For domestic banks, the loan to deposit ratio cap has two effects. First, it restrains excessive asset growth by tying loan growth to the growth in deposit funding. Second, there is also the direct effect on the growth of non-core liabilities, and hence on the build-up of vulnerabilities that come from the liabilities side of the balance sheet. In this respect, there are similarities between the loan to deposit cap and the levy on non-core liabilities, to be discussed below.

Indeed, at the theoretical level, the loan-to-deposit cap can be seen as a special case of a non-core liabilities levy (to be discussed below) where the tax rate is kinked, changing from zero to infinity at the threshold point. However, the comparison with the non-core liabilities levy is more difficult due to the fact that the loan to deposit cap only applies to loans, not total assets or total exposures (including off balance sheet exposures).

### 3.3 Liabilities Side Tools

Liabilities side tools address the build-up of vulnerabilities to liquidity and currency mismatches and the underpricing of risk on global capital markets. A levy on the non-core liabilities of banks acts to mitigate the build-up of systemic risks through currency or maturity mismatches. The levy works by counteracting the distortions to global funding conditions and the "supply push" of funding by the global banks.

### 3.3.1 Levy on non-core liabilities

As already discussed in earlier sections of this report, the stock of non-core liabilities reflects the stage of the financial cycle and the extent of the underpricing of risk in the financial system. A levy or tax on the non-core liabilities can serve to mitigate pricing distortions that lead to excessive asset growth. The Financial Stability Contribution (FSC) recommended by the IMF in its report (IMF, 2010) on the bank levy to the G20 leaders in June 2010, is an example of such a corrective tax.

The levy on non-core liabilities has several features that impact overall financial stability. First, the base of the levy itself varies over the financial cycle. The levy bites hardest during the boom when non-core liabilities are large, so that the levy has the properties of an automatic stabilizer even if the tax rate itself remains constant over time. Given the well-known political economy challenges to the exercise of discretion by regulators, the automatic stabilizer feature of the levy may have important advantages.

Second, the levy on non-core liabilities addresses financial vulnerability while leaving the essential functioning of the financial system in channeling core funding from savers to borrowers unaffected. By targeting only non-core liabilities, the levy addresses externalities associated with excessive asset growth and systemic risk arising from interconnectedness of banks. In other words, the levy addresses the "bubbly" element of banking sector liabilities, rather than the core liabilities of the banking system.

Third, the targeting of non-core liabilities can be expected to address the vulnerability of emerging economies with open capital accounts to sudden reversals in capital flows due to deleveraging by banks. Indeed, for many emerging economies, the levy on non-core liabilities could be aimed more narrowly at the foreign currency denominated liabilities only. Shin (2011) discusses some of the potential advantages of a levy on non-core liabilities of this sort.

The revenue raised by the levy is a secondary issue. The main purpose of the levy is to align incentives. A good analogy is with the Congestion Charge used to control car traffic into central

London. Under this charge, car drivers pay a daily fee of 8 pounds to drive into central London. The main purpose of the charge is to discourage drivers from bringing their cars into central London, thereby alleviating the externalities associated with traffic congestion. In the same way, the non-core liabilities bank levy should be seen primarily as a tool for aligning the incentives of banks closer to the social optimum. The revenue raised by the levy would also be of benefit, perhaps for a market stabilization fund, but the revenue is a secondary issue.

In December 2010, Korea announced that it would introduce a *Macroprudential Levy* aimed at the foreign exchange-denominated liabilities of banks–both domestic banks and the branches of foreign banks. The proposal passed the legislative process in April 2011, and came into effect in August 2011.

The rate for the Korean levy has been set at 20 basis points for short-term FX denominated liabilities of up to one year, falling to 5 basis points for long-term liabilities exceeding five years. The proceeds from the levy will be held in a special account of the pre-existing Exchange Stabilization Account, managed by the finance ministry. The proceeds may be used as part of the official foreign exchange reserves.

There is a key difference between Korea's macroprudential levy and the outwardly similar levy introduced by the UK. In the UK's case, the revenue goes into the general fiscal account of the government, and hence can be regarded as a revenue raising measure. In contrast, the Korean levy has its revenue ring-fenced for specific use in financial stabilization.

### 3.3.2 Unremunerated reserve requirements

Perhaps the best-known traditional form of capital control has been unremunerated reserve requirements (URR), where the central bank requires importers of capital to deposit a certain fraction at the central bank. The prevalence of the URR is owed, in large part, to the fact that the central bank has been in charge both of prudential policy and also of macroeconomic management, and the central bank normally has had discretion to use URR policies without going through the legislative procedures associated with other forms of capital controls, such as levies and taxes.

The recent IMF staff discussion note (Ostry and others, 2011) has a comprehensive discussion of the experience of countries in their use of URRs. Most central banks impose some type of reserve requirement for deposits, especially when the deposits are under government sponsored deposit insurance. The rationale in such cases for the reserve requirement is as an implicit insurance premium to be paid by the bank in return for the deposit insurance.

The macroprudential motivation for URR is to impose an implicit tax on those components of financial intermediary liabilities other than insured deposits that are likely to impose negative spillover effects. The introduction of a reserve requirement for the non-deposit liabilities of banks would raise the cost of non-deposit funding for banks, and thereby restrain the rapid growth of such liabilities during booms. In this respect, the reserve requirement on non-deposit liabilities would have a similar effect on a tax or levy on such liabilities, to be discussed below.

Some recent examples of the use of URR are discussed in Ostry and others (2011, p. 28). Chile set up a URR in 1991 at a 20% rate, with varying length depending on the maturity of the balance sheet item. The rate was subsequently increased to 30% and the deposit was set at one year, regardless of the maturity. However, the URR rate was reduced to zero in 1998.

Colombia set up a 40% URR in 2007, where withdrawals within six months were met with a heavy penalty. The rate was increased to 50% in May 2008. Also, to prevent circumvention via the classification of some flows as FDI, a two-year minimum stay requirement was implemented for inward FDI.

Although the URR is an implicit tax on a balance sheet item, the implied tax rate itself will vary with the opportunity cost of funds, and hence on the prevailing interest rate. The variability of the implicit tax rate necessitates some adjustment of the reserve rates, and the requirements will need to be raised to a high level when interest rates are low. This is potentially one disadvantage of the URR relative to other measures.

Another issue is the challenges of managing the central bank's balance sheet as a consequence of URRs. The reserves would have to be held on the central bank's balance sheet as a liability, with implications for the fluctuations in the money supply in line with the private sector's use of non-deposit liabilities, and the selection of counterpart assets on the central bank's balance sheet.

Although not central, there are also differences in the revenue implications between the reserve requirement, and a levy or tax. The reserve requirement would raise revenue to the extent that the net income on the assets held by the central bank that is funded by the reserves would be positive. Hence, the bigger the interest spread between the asset and liability, the larger would be the income.

There is one advantage of the reserve requirement that is not shared by the levy, which is that the banks would have access to a liquid asset in case there is liquidity shortage or a run in the financial market. In this respect, the reserve requirement would have some of the features of the Basel III liquidity requirement on banks (BCBS, 2010).

However, a disadvantage of the reserve requirement is that it only applies to banks, rather than the wider group of financial institutions that use non-core liabilities. When faced with the possibility of arbitrage, or with structural changes that shift intermediation activity from banks to the market-based financial intermediaries, the reserve requirement would be less effective.

#### 3.3.3 Relative merits of URR versus levies/taxes

The long preparation period needed for the macroprudential levy in Korea offers useful lessons on the relative merits of unremunerated reserve requirements, and levies or taxes. The legislative process required to implement a levy could entail considerable delays in the introduction and effectiveness of the policy. In the case of Korea, the initial discussions concerning the levy began in February 2010, but the eventual announcement of the implementation followed in December 2010. The legislative hurdles were cleared in April 2011, for implementation in August 2011. The whole process took 18 months, illustrating the challenges of setting up a new system.

When the external environment is changing rapidly, such long delays make the new introduction of a levy cumbersome and impractical as the first line of defense. Nevertheless, as in Korea's case, alternative measures that rely on existing legislation or other temporary measures can be used in the interim until the longer-term policy measures come into force.

In practice, the choice between URR, and levies or taxes is driven by practicality or reasons of administrative expediency, rather than on matters of principle. Typically, the central bank is the best-established policy institution that has direct contact with the financial markets and institutions. The long established status of the central banks in most countries explains why URRs have been more prevalent than levies or taxes.

There are, however, exceptions to this rule. In the case of Brazil, the *inflow tax* (IOF) was introduced some time ago (in 1993), and the legislation has been in effect since. Although the tax rate has been set a zero during times when the tax was not implemented, the infrastructure has been available for "dusting off" as circumstances have demanded.

Unlike a tax, a URR can usually be removed (or set to zero) more easily because the budget is not directly reliant on its revenues. For a similar reason, the macroprudential levy set by Korea has been designed so that the revenue does not have any budgetary implications, precisely in order to forestall potential political economy concerns.

## 3.4. Capital Controls

We conclude the paper by examining the relationship between macroprudential policies and other macro stabilization policies, including capital controls.

To the extent that the external environment in the global banking system is a key determinant of the vulnerability of the economy to financial excesses, considerations of macroprudential policies cannot easily be separated from the currently active debate on the merits of capital controls. The IMF has recently suggested the more neutral term "capital flow management" (CFM) policies (IMF, 2011), rather than the more emotive term "capital controls," reflecting the more receptive attitude by the IMF to the imposition of capital controls.

Indeed, some macroprudential tools have many similar attributes to the tools used in capital controls. For this reason, the IMF has suggested a classification of policies along the capital flow management (IMF, 2011, p. 41). The suggested three-part taxonomy is as follows.

— **Prudential tools.** These encompass existing or new tools of prudential regulation that have, primarily, a domestic focus, and are not aimed primarily at correcting capital flow distortions. Examples include LTV rules, caps on the loan to deposit ratio, leverage caps, etc.

— **Currency-based tools**. These tools are prudential measures that address vulnerabilities that originate from distortions in the external environment such as global liquidity conditions, but which restrict activity or impose costs based on currency distinctions rather than on the residency of the investor. Examples include the levy on short-term foreign exchange denominated liabilities of the banking sector implemented by Korea (the "macroprudential levy").

— **Residency-based tools.** These are the traditional capital control (or "CFM") tools that restrict activity or impose costs based on the residence of the investor. Examples include administrative restrictions on ownership, and taxes on portfolio inflows (IOF) currently being imposed by Brazil.

Capital controls raise a complex set of issues concerning their ultimate objectives—that is whether the objective is to hold down the exchange rate, or to limit the total volume of inflows in order to slow down the appreciation of the exchange rate. These issues merit a separate discussion, and will not concern us here. In this report, we will focus exclusively on the financial stability impact of macroprudential policies.

Capital controls have two broad rationales. The first as a macroeconomic policy tool aimed at leaning against the appreciation of the exchange rate. The second as a prudential tool, used for financial stability objectives. This report will not have much to say about the first objective. The IMF's paper from its Strategy, Policy and Review Department discusses the variety of capital control tools and their rationale (IMF, 2011).

The distinguishing feature of capital control tools is that they discriminate on the basis of residence of the investor—that is whether the investor is domestic or foreign. The tools include inflow taxes such as Brazil's IOF, as well as administrative measures that restrict banning certain activities, or investments that foreign investors can hold.

Although capital controls have been employed in order to affect the pace of exchange rate appreciation, the evidence on their effectiveness remains controversial. However, there is much better evidence on the financial stability implications of capital controls.

Regarding the financial stability objective, Ostry and others (2011) note that there is a strong empirical association between capital controls on one hand and less severe forms of credit booms and FX borrowing on the other (Ostry and others, 2011, p. 21). In reference to the recent global financial crisis, the authors regard this as a natural experiment for the effectiveness of capital controls, and note that the evidence is "suggestive of greater growth resilience in countries that had either capital controls (especially on debt liabilities) or prudential measures in place in the years prior to the crisis" (Ostry and others, 2011, p. 23). There are also important implications for monetary policy autonomy. De Gregorio, Edwards and Valdés (2000) find that capital controls allowed Chile's Central Bank to target a higher domestic interest rate over a period of 6 to 12 months.

The likely channel, through which capital controls have their financial stability effects, is through their effect on the *composition* of capital flows, rather than the total amount. De Gregorio, Edwards and Valdés (2000) and Cárdenas and Barrera (1997) show that capital controls are likely to have titled the composition of inflows away from short-term claims and debt claims, toward longer-term claims that have more benign financial stability implications. The survey paper by Magud, Reinhart and Rogoff (2011) conducts a "meta-analysis" of the existing survey literature on the effects of capital controls. Their results are based on a meta-analysis of 37 empirical studies and the main findings are four-fold concerning the effectiveness of capital controls on inflows. They (i) make monetary policy more independent, (ii) alter the composition of capital flows, and (iii) reduce real exchange rate pressures (although the evidence on the latter is more controversial). However, they (iv) do not reduce the volume of net flows (and hence the current-account balance).

To the extent that capital controls have an effect on the composition of capital flows and the likely pace of currency appreciation that give some additional autonomy to monetary policy, both features appear to point to some role of capital controls within the broader macroprudential policy framework.

## 4. Concluding Remarks

In this paper, we have given an overview of the policy options that can complement traditional tools of bank regulation and monetary policy in reining in the excesses in the financial system. Macroprudential policies aim to lean against excessive asset growth during booms, and thereby achieve more sustainable long-term loan growth. The mirror image of moderating asset growth is the mitigation of vulnerabilities on the liabilities side.

The policy debate on macroprudential policies in the Financial Stability Board (FSB) and the Basel Committee on Banking Supervision (BCBS) has taken place with the focus largely on the developed financial systems that were at the eye of the storm in the recent financial crisis of 2007-9. To the extent that the current global conjuncture with permissive global liquidity conditions is driven by expansive monetary policies pursued by advanced economy central banks, macroprudential policies that are aimed at achieving financial stability have many points of contact with capital control tools, or using the more neutral terminology currently in fashion, the capital flow management (CFM) tools.

Capital flow management tools often have broader macro objectives, such as leaning against the overly-rapid appreciation of the domestic currency; the exact dividing line between tools for financial stability and tools for macroeconomic management can be somewhat fuzzy. Although the study of macroprudential policy frameworks is in its infancy, there is a quickly accumulating body of work on the subject. Based on the existing literature and recent insights, this paper has provided an analytical framework regarding the motivations for, and effects of, macroprudential rules on financial institutions to consider a range of policy proposals as to their applicability in general.

## References


Adrian, T. and H.S. Shin. 2008. "Procyclical Leverage and Value-at-Risk." *Federal Reserve Bank of New York Staff Reports 338* http://www.newyorkfed.org/research/staff_reports/sr338.html.

————. 2010. "Liquidity and Leverage." *Journal of Financial Intermediation* 19(3): 418–437.

Assenmacher-Wesche, K. and S. Gerlach. 2010. "Financial Structure and the Impact of Monetary Policy on Property Prices." Working Paper, Goethe University, Frankfurt, http://www.stefangerlach.com/Asset%20prices%20(21%20Apr%202010).pdf.

Bank for International Settlements. 2009. "Guide to the International Financial Statistics." http://www.bis.org/statistics/intfinstatsguide.pdf.

————. 2010. "Funding Patterns and Liquidity Management of Internationally Active Banks." CGFS Paper 39, May 2010, http://www.bis.org/publ/cgfs39.htm.

Bank of England. 2009. "The Role of Macroprudential Policy: A Discussion Paper." http://www.bankofengland.co.uk/publications/other/financialstability/roleofmacroprudentialpolicy091121.pdf.

Basel Committee on Banking Supervision. (BCBS) 2009. "Strengthening the Resilience of the Banking Sector." December 2009 http://www.bis.org/publ/bcbs164.pdf.

————. 2010. "International Regulatory Framework for Banks (Basel III)." *Bank for International Settlements*, http://www.bis.org/bcbs/basel3.htm.

Borio, C. and P. Lowe. 2002. "Asset Prices, Financial and Monetary Stability: Exploring the Nexus." BIS Working Paper 114 (Basel: Bank for International Settlements, July).

————. 2004. "Securing Sustainable Price Stability: Should Credit Come Back from the Wilderness?" BIS Working Paper 157.

Brunnermeier, M., A. Crockett, C. Goodhart, A. Persaud, and H.S. Shin. 2009. "Geneva Report on the World Economy 11: The Fundamental Principles of Financial Regulation."

Bruno, V. and H.S. Shin. 2011. "Capital Flows, Cross-Border Banking and Global Liquidity." Working Paper http://www.princeton.edu/~hsshin/www/capital_flows_global_liquidity.pdf.

Cárdenas, M. and F. Barrera. 1997. "On the Effectiveness of Capital Controls: The Experience of Colombia During the 1990s." *Journal of Development Economics* 54(1): 27–57.

Crockett, A. 2000. "Marrying the Micro- and Macro-Prudential Dimensions of Financial Stability." Remarks before the Eleventh International Conference of Banking Supervisors, Basel, 20–21 September. http://www.bis.org/speeches/sp000921.htm.

De Gregorio, J., S. Edwards, and R. Valdés. 2000. "Controls on Capital Inflows: Do They Work?" *Journal of Development Economics* 63(1): 59–83.

Fernández, S., J. Pagés, and J. Saurina. 2000. "Credit Growth, Problem Loans and Credit Risk Provisioning in Spain." Bank of Spain Working Paper 18, http://www.bde.es/informes/be/docs/dt0018e.pdf.

Gurley, J.G. and E.S. Shaw. *Money in a Theory of Finance*. Brookings Institution, Washington, D.C., 1960.

Hahm, J., F.S. Mishkin, H.S. Shin, and K. Shin. 2010. "Macroprudential Policies and the Role of the Central Bank." Study commissioned by the Bank of Korea.

Hahm, J., H.S. Shin, and K. Shin. 2011. "Non-Core Bank Liabilities and Financial Vulnerability." Working Paper http://www.princeton.edu/~hsshin/www/noncore.pdf.

International Monetary Fund. 2010. "A Fair and Substantial Contribution by the Financial Sector." Report by the IMF to the G20, June 2010 http://www.imf.org/external/np/g20/pdf/062710b.pdf.

———. 2011. "Recent Experiences in Managing Capital Inflows – Cross-Cutting Themes and Possible Policy Frameworks." Strategy, Policy and Review Department, February 2011.

Kashyap, A. and J. Stein. 2004. "Cyclical implications of the Basel II Capital Standards." *Federal Reserve Bank of Chicago Economic Perspectives* 28(1).

Magud, N., C.M. Reinhart, and K.S. Rogoff. 2011. "Capital Controls: Myth and Reality—A Portfolio Balance Approach." NBER Working Paper 16805, National Bureau of Economic Research.

McGuire, P. and G. von Peter. 2009. "The US Dollar Shortage in Global Banking." *BIS Quarterly Review*, March 2009, Bank for International Settlements.

Morris, S. and H. S. Shin. 2008. "Financial Regulation in a System Context." *Brookings Papers on Economic Activity*, Fall 2008, 229–274.

Ostry, J. D., A. Ghosh, K. Habermeier, L. Laeven, M. Chamon, M.S. Qureshi, and A. Kokenyne. 2011. "Capital Inflows: The Role of Controls." IMF Staff Discussion Note 10/06.

Saurina, J. 2009. "Dynamic Provisioning: Experience of Spain." *World Bank Policy Brief* 7, 2009, http://rru.worldbank.org/documents/CrisisResponse/Note7.pdf.

Shin, H.S. 2010a. *Risk and Liquidity*, 2008 Clarendon Lectures in Finance, Oxford University Press.

————. 2010b. "Macroprudential Policies Beyond Basel III." Policy Memo, http://www.princeton.edu/~hsshin/www/MacroprudentialMemo.pdf.

————. 2011. "Global Banking Glut and Loan Risk Premium." 2011 Mundell-Fleming Lecture, http://www.princeton.edu/~hsshin/www/mundell_fleming_lecture.pdf.

Shin, H.S. and K. Shin. 2010. "Procyclicality and Monetary Aggregates." NBER Discussion Paper 16836, http://www.nber.org/papers/w16836.

# Pegs, Downward Wage Rigidity and Unemployment: The Role of Financial Structure

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A characteristic of the current crisis in Europe is that countries in its periphery have found themselves increasingly cut off from international financial markets. In the present study, we ask how such changes in the financial structure influence the welfare consequences of maintaining a fixed exchange rate regime. We address this issue in the context of a dynamic model of an emerging economy with involuntary unemployment developed in an earlier paper (Schmitt-Grohé and Uribe, 2011).

In that model, negative external shocks lead to involuntary unemployment because of the combination of downward nominal wage rigidity and a currency peg. The mechanism is as follows. Consider the economy's adjustment to a negative tradable output shock, such as deterioration in the terms of trade. Households respond to this negative external shock by lowering their demand for consumption goods. In the nontraded sector, the decline in aggregate demand causes the relative price of nontradables to fall. In turn, firms face lower prices but unchanged costs. The reason costs are unchanged is that nominal wages are downwardly rigid and the exchange rate is pegged, so that real wages expressed in terms of tradables are unable to fall. As a result, firms demand fewer hours of labor. The resulting underemployment is involuntary because at the going wage rate workers would prefer to work longer hours.

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As shown in Schmitt-Grohé and Uribe (2011), in this environment the optimal exchange rate policy brings about full employment at all times by depreciating the value of the domestic currency during periods of low aggregate demand. The resulting real allocation is Pareto optimal. Elsewhere we show that in this model, currency pegs create a pecuniary externality (Schmitt-Grohé and Uribe, 2012). The nature of the externality is that agents fail to internalize that high current absorption of tradables drives up real wages, which, once the expansion is over, fall only sluggishly (due to nominal rigidities), causing underemployment along the way.

The present paper shows that this externality gives rise to two paradoxical results. First, a country with a fixed exchange rate regime might enjoy higher welfare under financial autarky than when it has access to an internationally traded risk-free bond. In a version of the model calibrated to match salient features of the Argentine economy, we find that the fixed exchange rate economy with access to an international bond requires an increase in total consumption of two-thirds of one percent every period to be as well off as a fixed exchange rate economy in financial autarky. Second, the welfare cost of pegging the currency may be larger in financially open economies than in financially closed ones. This finding suggests that the pressure on central banks to abandon a currency peg in favor of optimal exchange rate policy may be larger in the absence of capital controls.

The remainder of the paper is organized in five sections. Section 1 presents the model of a small open economy with involuntary unemployment due to downward nominal wage rigidity, originally developed in Schmitt-Grohé and Uribe (2011). Section 2 characterizes welfare under the optimal exchange rate policy and under a currency peg in a financially autarkic economy. Section 3 introduces an internationally traded, risk-free bond and shows that in this environment, the welfare costs of currency pegs may be higher than under financial autarky. Section 4 shows that peggers may be better off in a financially closed economy. Section 5 concludes.

## 1. The Model

Our theoretical framework builds on Schmitt-Grohé and Uribe (2011). The model is one of a small open economy in which nominal wages are downwardly rigid, giving rise to an occasionally binding constraint. The labor market is assumed to be perfectly competitive.

As a result, even though all participants understand that wages are nominally rigid, they do not act strategically in their pricing behavior. Instead, workers and firms take factor prices as given. The model features a traded and a nontraded sector, and aggregate fluctuations are driven by stochastic movements in the supply of traded goods.

## 1.1 Households

The economy is populated by a large number of infinitely lived households with preferences described by the utility function

$$\mathbb{E}_0 \sum_{t=0}^{\infty} \beta^t U(c_t), \tag{1}$$

where $c_t$ denotes consumption, $U$ is a utility index assumed to be increasing and strictly concave and to satisfy $\lim_{c \to 0} U'(c) = \infty$ and $\lim_{c \to \infty} U'(c) = 0$; the parameter $\beta \in (0, 1)$ is a subjective discount factor, and $\mathbb{E}_t$ is the expectations operator conditional on information available in period $t$. Consumption is assumed to be a composite good made of tradable and nontradable goods via the aggregation technology

$$c_t = A(c_t^T, c_t^N), \tag{2}$$

where $c_t^T$ denotes consumption of tradables, $c_t^N$ denotes consumption of nontradables, and $A$ (defined over positive values of both its arguments) denotes an aggregator function assumed to be homogeneous of degree one, increasing and concave and to satisfy the Inada conditions. These assumptions imply that tradables and nontradables are normal goods.

Households are assumed to be endowed with an exogenous and stochastic amount of tradable goods, $y_t^T$, and a constant number of hours, $\bar{h}$, which they supply inelastically to the labor market.[1] Because of the presence of nominal wage rigidities in the labor market, households will in general only be able to work $h_t \leq \bar{h}$ hours each period. Households take $h_t$ as exogenously determined. Households also receive profits from the ownership of firms, denoted $\phi_t$ and expressed in terms of tradables. The household's sequential budget constraint in period $t$ is given by

1. In Schmitt-Grohé and Uribe (2011), we consider the case of an endogenous labor supply.

$$c_t^T + p_t c_t^N + d_t = y_t^T + w_t h_t + \mathbb{E}_t q_{t,t+1}^* + \phi_t, \tag{3}$$

where $p_t$ denotes the relative price of nontradables in terms of tradables in period $t$ and $w_t$ denotes the real wage rate in terms of tradables in period $t$. The variable $d_{t+1}$ is a state-contingent payment of the household to its international creditors, chosen in period $t$. The random variable $d_{t+1}$ can take on positive or negative values. A positive value of $d_{t+1}$ in a particular state of period $t + 1$ can be interpreted as the external debt due in that state and on that date. The variable $q_{t,t+1}^*$ denotes the period $t$ price of an asset that pays one unit of tradable good in one particular state of period $t + 1$ divided by the probability of occurrence of that particular state conditional on information available in period $t$. It follows that $\mathbb{E}_t q_{t,t+1}^* d_{t+1}$ is the period $t$ price of the state-contingent payment $d_{t+1}$. The household faces a borrowing limit of the form

$$\lim_{j\to\infty} \mathbb{E}_t q_{t,t+j}^* d_{t+j} \leq 0, \tag{4}$$

which prevents Ponzi schemes, where $q_{t,t+j}^* \equiv \prod_{s=1}^{j} q_{t+s-1,t+s}^*$, for $j \geq 1$. The optimization problem of the household consists in choosing contingent plans $c_t, c_t^T, c_t^T$, and $d_{t+1}$ to maximize equation (1) subject to the aggregation technology in equation (2), the sequential budget constraint (3), and the borrowing limit (4). Letting $\lambda_t$ denote the Lagrange multiplier associated with equation (3), the optimality conditions associated with this dynamic maximization problem are equations (2), (3), and (4) holding with equality and

$$\frac{A_2\left(c_t^T, c_t^N\right)}{A_1\left(c_t^T, c_t^N\right)} = p_t, \tag{5}$$

$$\lambda_t = U'\left(c_t\right) A_1\left(c_t^T, c_t^N\right), \tag{6}$$

and

$$\lambda_t q_{t,t+1}^* = \beta \lambda_{t+1}, \tag{7}$$

where $A_i$ denotes the partial derivative of $A$ with respect to its $i^{\text{th}}$ argument.

Optimality condition (5) can be interpreted as a demand function for nontradables. Intuitively, it states that an increase in the relative price of nontradables induces households to engage in expenditure switching by consuming relatively fewer nontradables. Our maintained assumptions regarding the form of the aggregator function $A$ guarantee that for a given level of $c_t^T$, the left-hand side of this expression is a decreasing function of $c_t^T$. Optimality condition (7) equates the marginal benefits and the marginal costs of purchasing one-step-ahead contingent claims denominated in tradable goods.

## 1.2 Firms

The nontraded good is produced using labor as the sole factor input by means of an increasing and concave production function, $F(h_t)$. The firm operates in competitive product and labor markets. Profits, $\phi_t$, are given by

$$\phi_t = p_t F(h_t) - w_t h_t.$$

The firm chooses $h_t$ to maximize profits taking the relative price, $p_t$, and the real wage rate, $w_t$, as given. The optimality condition associated with this problem is

$$p_t F'(h_t) = w_t. \tag{8}$$

This first-order condition implicitly defines the firm's demand for labor.

## 1.3 Downward Nominal Wage Rigidity

Let $W_t$ denote the nominal wage rate and $E_t$ the nominal exchange rate, defined as the domestic-currency price of one unit of foreign currency. Assume that the law of one price holds for traded goods and that the foreign currency price of traded goods is constant and normalized to unity. Then, the real wage in terms of tradables is given by

$$w_t \equiv \frac{W_t}{E_t}.$$

Nominal wages are assumed to be downwardly rigid. Specifically, we impose that

$$W_t \geq \gamma W_{t-1}, \quad \gamma \geq 0.$$

with $\gamma \geq 0$. The presence of nominal wage rigidity implies the following restriction on the dynamics of real wages:

$$w_t \geq \gamma \frac{w_{t-1}}{\varepsilon_t}, \tag{9}$$

where

$$\varepsilon_t \equiv \frac{E_t}{E_{t-1}}$$

denotes the gross nominal depreciation rate of the domestic currency.

The presence of downwardly rigid nominal wages implies that the labor market in general will not clear at the inelastically supplied level of hours $\bar{h}$. Instead, involuntary underemployment, given by $\bar{h} - h_t$, may be a regular feature of this economy. Actual employment must satisfy

$$h_t \leq \bar{h} \tag{10}$$

at all times. Finally, at any point in time, real wages and employment must satisfy the slackness condition

$$\left(\bar{h} - h_t\right)\left(w_t - \gamma \frac{w_{t-1}}{\varepsilon_t}\right) = 0 \tag{11}$$

This condition states that periods of unemployment must be accompanied by a binding wage constraint. It also states that when the wage constraint is not binding, the economy must be at full employment.

## 1.4 Market Clearing

Market clearing in the nontraded sector requires that

$$c_t^N = F(h_t). \tag{12}$$

Combining this market clearing condition, the definition of firm profits and the household's sequential budget constraint yields

$$c_t^N + d_t = y_t^T + \mathbb{E}_t q_{t,t+1}^* d_{t+1}. \tag{13}$$

It remains to specify the asset market structure and the monetary policy regime. In the following sections, we consider several variants of these two key features of the economic environment.

## 2. The Welfare Costs of Pegs under Financial Autarky

We now study the role of exchange rate policy in an environment of financial autarky. To this end, we assume that households are cut off from international capital markets. Because the capital account is closed, consumption of tradables must equal tradable output at all times. As a result, the market clearing condition (13) collapses to

$$c_t^T = y_t^T. \tag{14}$$

This condition makes it clear that under financial autarky, consumption of tradables inherits all of the volatility present in tradable output. More importantly for the purpose of our investigation, because nominal wages are downwardly rigid, swings in the absorption of tradable goods can potentially spill over to the nontraded sector. While the monetary authority can do nothing about the volatility in traded consumption, it can, through appropriate policies, keep those fluctuations from causing unemployment in the nontraded sector. Monetary policy thus becomes responsible for ensuring full employment under financial autarky.

The following definition presents the set of conditions governing aggregate dynamics under financial autarky.

**—Definition 1** *General disequilibrium dynamics under financial autarky*. Under financial autarky, aggregate dynamics are given by stochastic processes $c_t$, $c_t^T$, $c_t^T$, $h_t$, $p_t$ and $w_t$ satisfying equations (2), (5), (8) to (12) and (14), given the exogenous stochastic process $y_t^T$, an exchange rate policy and the initial condition $w - 1$.

It will prove convenient to define the full-employment real wage in any period $t$, given a certain level of tradable consumption $c_t^T$. We denote this variable by $\Omega(c_t^T)$. Based on equation (8), $\Omega(c_t^T)$ is formally defined as

$$\Omega\left(c_t^T\right) \equiv \frac{A_2\left(c_t^T, F\left(\bar{h}\right)\right)}{A_1\left(c_t^T, F\left(\bar{h}\right)\right)} F'\left(\bar{h}\right). \tag{15}$$

The assumptions made on the form of the aggregator $A$ guarantee that $\Omega(c_t^T)$ is strictly increasing in $c_t^T$. The intuition for why the full-employment real wage is increasing in consumption of tradables is as follows. Given the relative price of nontradables, an increased desire to consume tradable goods is accompanied by an increased demand for nontradables. In turn, the elevated demand for nontradables pushes the relative price of these goods upward, creating an incentive for entrepreneurs to hire more labor. However, because the economy is already at full employment in the nontraded sector, the increased demand for labor causes the real wage to rise to a level at which the quantity of hours demanded by firms equals the full-employment level $\bar{h}$.

We are now ready to formally characterize optimal exchange rate policy under financial autarky.

—**Proposition 1** *Optimal exchange rate policy under financial autarky*. Suppose that the economy is in perpetual financial autarky. Then, $h_t = \bar{h}$ and the real allocation is Pareto optimal if and only if the exchange rate regime satisfies

$$\varepsilon_t \geq \gamma \frac{w_{t-1}}{\Omega\left(y_t^T\right)}, \tag{16}$$

for all $t \geq 0$.

—**Proof** Suppose that the economy is in financial autarky ($c_t^T = y_t^T$) and that $\varepsilon_t \geq \gamma(w_{t-1}/\Omega(y_t^T))$. Assume that $h_t < \bar{h}$ for some $t \geq 0$. Then, by the slackness condition (11), we have that $w_t = \gamma(w_{t-1}/\varepsilon_t)$. Combining this expression with $\varepsilon_t \geq \gamma(w_{t-1}/\Omega(y_t^T))$ yields $w_t \leq \Omega(y_t^T)$. Finally, using equations (8) and (15) to get rid of $w_t$ and $\Omega(y_t^T)$, respectively, we obtain

$$\frac{A_2\left(y_t^T, F\left(h_t\right)\right)}{A_1\left(y_t^T, F\left(h_t\right)\right)} F'\left(h_t\right) \leq \frac{A_2\left(y_t^T, F\left(\bar{h}\right)\right)}{A_1\left(y_t^T, F\left(\bar{h}\right)\right)} F'\left(\bar{h}\right).$$

This is a contradiction, however, because the left-hand side of this inequality is strictly decreasing in $h_t$ and because $h_t < \bar{h}$. Therefore, $h_t$ must equal $\bar{h}$ at all times, as claimed. Now suppose that the economy is in financial autarky and that $h_t = \bar{h}$ for all $t \geq 0$. It follows from equations (8) and (15) that $w_t = \Omega(y_t^T)$. Combining this expression with equation (9) yields $\varepsilon_t \geq \gamma(w_{t-1}/\Omega(y_t^T))$, as claimed. To see that the full-employment allocation is Pareto optimal, simply note that the processes $h_t = \bar{h}$ and $c_t^T = y_t^T$ for all $t$ represent the solution to the problem of maximizing equation (1), subject to equations (2), (10), (12) and (14), which is the optimization problem of a social planner who is not constrained by downward nominal wage rigidity.

It follows from Proposition 2 that when the economy is in financial autarky, the optimal exchange rate policy calls for a devaluation whenever the economy experiences a sufficiently large negative tradable-endowment shock. To see this more transparently, replace $w_{t-1}$ for $\Omega(y_{t-1}^T)$ in equation (16) to obtain

$$\varepsilon_t \geq \gamma \frac{\Omega\left(y_{t-1}^T\right)}{\Omega\left(y_t^T\right)}; \quad t > 0.$$

Since $\Omega$ is strictly increasing, we have that $\varepsilon_t > 1$ when $y_t^T$ falls sufficiently below $y_{t-1}^T$. The intuition behind this result is as follows: In response to a fall in tradable output, all other things equal, households feel poorer and, as a consequence, reduce their demands for both tradable and nontradable goods. The contraction in the demand for the nontraded good depresses its relative price, which in turn induces firms to cut supply. This causes a fall in the aggregate demand for labor. Full employment, therefore, requires a reduction in the real wage, $W_t/E_t$. Because the nominal wage, $W_t$, is downwardly rigid, however, the required decline in the real wage must be brought about via a depreciation of the domestic currency, that is, via an increase in $E_t$.

Should the central bank fail to devalue the domestic currency in a situation of depressed demand for tradables like the one described in the previous paragraph, unemployment would ensue. In this case, a negative shock that originates in the traded sector would spread to the nontraded sector. It follows immediately that a currency peg, defined as an exchange rate policy that sets $\varepsilon_t = 1$ at all times, is in general not optimal under financial autarky. We formalize this result in the following corollary.

—**Corollary 1** *Nonoptimality of currency pegs under financial autarky*. Suppose that the economy is in financial autarky. Then, in general, the exchange rate policy $\varepsilon_t = 1$ for all $t \geq 0$ does not implement the Pareto-optimal allocation.

A natural question is how far the allocation induced by a currency peg is from the Pareto-optimal allocation. One way to measure this distance, is to gauge how costly it is in terms of welfare to adhere to a currency peg as opposed to following the optimal exchange rate policy. This question is essentially quantitative. For this reason, we resort to numerical simulations. Specifically, using a calibrated version of the model, we compare the levels of welfare associated with the optimal exchange rate policy and with a currency peg.

We assume a constant relative risk aversion (CRRA) form for the period utility function, a constant elasticity of substitution (CES) form for the aggregator function and an isoelastic form for the production function of nontradables:

$$U(c) = \frac{c^{1-\sigma} - 1}{1-\sigma},$$

$$A\left(c^T, c^N\right) = \left[a\left(c^T\right)^{1-\frac{1}{\xi}} + (1-a)\left(c^N\right)^{1-\frac{1}{\xi}}\right]^{\frac{\xi}{\xi-1}},$$

and

$$F(h) = h^{\alpha}.$$

We calibrate the model at a quarterly frequency. All parameter values are taken from Schmitt-Grohé and Uribe (2011) and are shown in table 1.

**Table 1. Calibration**[a]

| *Parameter* | *Value* | *Description* |
|---|---|---|
| $\gamma$ | 0.99 | Degree of downward nominal wage rigidity (Schmitt-Grohé and Uribe, 2011) |
| $\sigma$ | 5.00 | Inverse of intertemporal elasticity of consumption (Ostry and Reinhart, 1992) |
| $y^T$ | 1.00 | Steady-state tradable output |
| $\bar{h}$ | 1.00 | Labor endowment |
| $a$ | 0.26 | Share of tradables (Schmitt-Grohé and Uribe, 2011) |
| $\xi$ | 0.44 | Intratemporal elasticity of substitution (González Rozada and others, 2004) |
| $\alpha$ | 0.75 | Labor share in nontraded sector (Uribe, 1997) |
| $\beta$ | 0.9375 | Quarterly subjective discount factor (Schmitt-Grohé and Uribe, 2011) |

Source: Authors' elaboration.
a. See Schmitt-Grohé and Uribe (2011) for details.

A novel parameter in our model is $\gamma$, governing the degree of downward nominal wage rigidity. In Schmitt-Grohé and Uribe (2011), we present empirical evidence on the size of this parameter. This evidence suggests that nominal wages are downwardly but not upwardly rigid and that a realistic value of $\gamma$ is close to unity. We set $\gamma = 0.99$, which is conservative in the sense that the empirical evidence analyzed points to values greater than 0.99. For instance, in Schmitt-Grohé and Uribe (2011), we analyze data on unemployment and nominal wage growth in ten peripheral European countries that are either on the euro or pegging to it over the period 2008.I and 2011.II Our analysis shows that unemployment increased in all ten countries during this period. At the same time, nominal hourly wages fell in only three countries and by a maximum of 5.1 percent over the 13 quarters considered. This means that the smallest implied value of $\gamma$ in this sample is 0.996. Our calibrated value of 0.99 implies that over the 13 quarters considered, nominal wages could have fallen by 13 percent, which is more than twice the maximum observed wage decline. This is the precise sense in which we argue that our choice of $\gamma$ allows for more downward wage flexibility than observed in the recent European crisis.[2]

We also borrow from earlier work (Schmitt-Grohé and Uribe, 2011) the stochastic process driving aggregate fluctuations in our economy. Specifically, we assume that tradable output and the country interest rate, denoted $r_t$, follow a bivariate, first-order, autoregressive process of the form

$$\begin{bmatrix} \ln y_t^T \\ \ln \dfrac{1+r_t}{1+r} \end{bmatrix} = A \begin{bmatrix} \ln y_{t-1}^T \\ \ln \dfrac{1+r_{t-1}}{1+r} \end{bmatrix} + \nu_t, \tag{17}$$

where $\nu_t$ is a white noise of order 2 by 1 distributed $N(0,\Sigma_\nu)$. The parameter $r$ denotes the deterministic steady-state value of $r_t$. The country interest rate $r_t$ represents the rate at which the country could borrow in international markets if it was open to capital flows. In the present autarkic economy, the country interest rate plays no role

2. This calculation assumes that the nominal price of tradables abroad, $P_t^{T*}$, is constant, but our calibration of $\gamma$ continues to be conservative even if we allow for a realistic value for foreign inflation. Over the 13-quarter period in question. the German consumer price index grew by a cumulative 3.7 percent. Combining this figure with the maximum observed wage decline of 5.1 percent yields 8.8, which is still significantly smaller than the 13 percent decline in nominal wages allowed by our calibration.

other than helping forecast tradable output. In the next section, we consider an economy with access to international financial markets, in which $r_t$ will govern the costs of external funds. In Schmitt-Grohé and Uribe (2011), we estimate the system (17) using Argentine data over the period 1983.I to 2001.IV. Our OLS estimates of the matrices $\mathbf{A}$ and $\mathbf{\Sigma}_\nu$ and of the scalar $r$ are

$$\mathbf{A} = \begin{bmatrix} 0.79 & -1.36 \\ -0.01 & 0.86 \end{bmatrix};$$

$$\mathbf{\Sigma}_\nu = \begin{bmatrix} 0.00123 & -0.00008 \\ -0.00008 & 0.00004 \end{bmatrix};$$

$r = 0.0316.$

We discretize the AR(1) process given in equation (17) using 21 equally spaced points for $\ln y_t^T$ and 11 equally spaced points for $\ln(1 + r_t) / (1 + r)$. For details, see Schmitt-Grohé and Uribe (2011).

We numerically approximate the lifetime utility of the representative household under the optimal exchange rate policy by applying the method of value function iteration over a discretized state space. Under optimal exchange rate policy, the state of the economy in period $t \geq 0$ is the exogenous variable $y_t^T$. The welfare of the representative household under the optimal exchange rate policy can be approximated by solving the following simple Bellman equation:

$$v^{\mathrm{AUT,OPT}}\left(y_t^T\right) = U\left[A\left(y_t^T, F\left(\bar{h}\right)\right)\right] + \beta \mathbb{E}_t v^{\mathrm{AUT,OPT}}\left(y_{t+1}^T\right),$$

where $\nu^{\mathrm{AUT,OPT}}$ denotes the value function of the representative household under autarky and optimal exchange rate policy.

Approximating the dynamics of the model under a currency peg is computationally more demanding than doing so under optimal exchange rate policy. The reason is that aggregate dynamics can no longer be cast in terms of a Bellman equation, because of the distortions introduced by nominal rigidities. We therefore approximate the solution by policy function iteration over a discretized version of the state space $(y_t^T, w_{t-1})$. An additional source of complication is the emergence of a second state variable, $w_{t-1}$, which, unlike $y_t^T$, is endogenous. For the discretization of $w_{t-1}$, we use 500 equally spaced points for its logarithm.

We quantify the welfare cost of living in an economy in which the central bank pegs the currency by computing the percent increase in the consumption stream of the representative household living in the currency peg economy that would make him as happy as living in the optimal exchange rate economy. Specifically, one can express the value function associated with a currency peg as

$$v^{\mathrm{AUT,PEG}}\left(y_t^T, w_{t-1}\right) = \mathbb{E}_t \sum_{s=0}^{\infty} \beta^s \frac{\left(c_{t+s}^{\mathrm{AUT,PEG}}\right)^{1-\sigma} - 1}{1-\sigma},$$

where $c_t^{\mathrm{AUT,PEG}}$ denotes the stochastic process of consumption of the composite good in the currency peg economy, given the initial state $(y_t^T, w_{t-1})$. Define the proportional compensation rate $\lambda^{\mathrm{PEG|AUT}}(y_t^T, w_{t-1})$ implicitly as

$$\mathbb{E}_t \sum_{s=0}^{\infty} \beta^s \frac{\left[c_{t+s}^{\mathrm{AUT,PEG}}\left(1+\lambda^{\mathrm{PEG\,|\,AUT}}\left(y_t^T, w_{t-1}\right)\right)\right]^{1-\sigma} - 1}{1-\sigma} = v^{\mathrm{AUT,OPT}}\left(y_t^T\right).$$

Solving for $\lambda^{\mathrm{PEG|AUT}}(y_t^T, w_{t-1})$, we obtain

$$\lambda^{\mathrm{PEG\,|\,AUT}}\left(y_t^T, w_{t-1}\right) = \left[\frac{v^{\mathrm{AUT,OPT}}\left(y_t^T\right)\left(1-\sigma\right)+\left(1-\beta\right)^{-1}}{v^{\mathrm{AUT,PEG}}\left(y_t^T, w_{t-1}\right)\left(1-\sigma\right)+\left(1-\beta\right)^{-1}}\right]^{1/(1-\sigma)} - 1.$$

This expression makes it clear that the compensation $\lambda^{\mathrm{PEG|AUT}}(y_t^T, w_{t-1})$ is state dependent. We compute the probability density function of $\lambda^{\mathrm{PEG|AUT}}(y_t^T, w_{t-1})$ by sampling from the ergodic distribution of the state $(y_t^T, w_{t-1})$ under the currency peg.

We find that when financial markets are closed, the welfare losses due to suboptimal monetary policy can be large for countries facing large external shocks. Table 2 shows that the mean welfare cost of a currency peg relative to the optimal policy is 6.5 percent of consumption each period.[3] Figure 1 displays the density function of the welfare cost of pegs under autarky. The support of this density ranges from a minimum of 1.8 percent to a maximum above 20 percent.

3. This number falls to 4.1 percent when $\gamma$ is lowered to 0.98. This is still a large number as welfare costs of stabilization policy go. If we relate this value of $\gamma$ to the empirical evidence from the European periphery discussed earlier, the model would allow nominal wages to fall by 26 percent from 2008.I to 2011.II, which is five times larger than the largest observed decline in nominal wages.

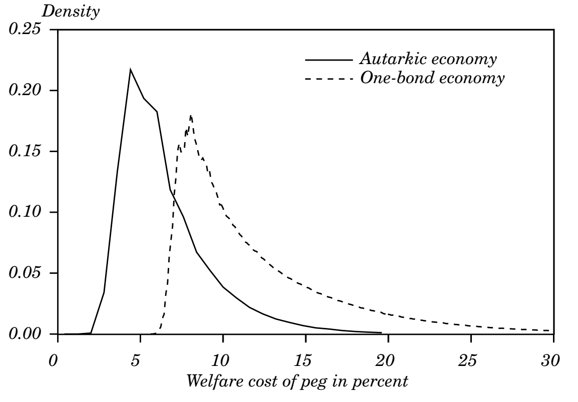
**Table 2. Welfare Costs of Currency Pegs[a]**

| | | *Unemployment* | | | | $\Delta(ln(w_t))$ | *Devaluation* | |
|---|---|---|---|---|---|---|---|---|
| | | *Mean* | | *Std. deviation* | | *Std. deviation* | *Mean* | |
| *Financial structure* | *Welfare cost (mean)* | *Optimal* | *Peg* | *Optimal* | *Peg* | *Optimal* | *Optimal* | *Peg* |
| Autarky, $d_t = 0$ | 6.5 | 0.0 | 9.0 | 0.0 | 8.0 | 9.2 | 10.5 | - |
| One-bond economy | 12.3 | 0.0 | 14.5 | 0.0 | 12.0 | 18.1 | 17.4 | - |

Source: Authors' elaboration.

a. The welfare cost of a peg is calculated as the percentage increase in the entire consumption path associated with a peg required to yield the same level of welfare as the optimal monetary policy. The unemployment rate is expressed in percent. The standard deviation of the log change in real wages is in percent. The mean devaluation rate is in percent with the mean taken over periods in which $\varepsilon_t > 1$.

**Figure 1. Probability Density Function of the Welfare Cost of Currency Pegs**




Source: Authors' elaboration.

These are extremely large numbers as welfare costs of suboptimal policy go in macroeconomics, which suggests that monetary policy can play an important role in moderating the negative effects of adverse external shocks. The root of these large welfare losses is that a currency peg causes unemployment of 9 percent of the labor force, on average. By contrast, unemployment is nil at all times under the optimal monetary policy. The key difference between the optimal monetary policy and the currency peg is that the former allows for reductions in the real wage in periods of weak aggregate demand. The standard deviation of real wage changes under the optimal exchange rate policy is significant, at 9.2 percent. Recall that these real wage changes are what would occur in a flexible-wage economy. The optimal policy engineers efficient reductions in real wages during recessions by means of appropriate devaluations of the domestic currency. We find that these devaluations are large. The minimum devaluation rate compatible with full employment is 10.5 percent, on average.[4] By contrast, a currency peg in combination with downward nominal wage rigidity prevents the downward adjustment of real wages during contractions, causing massive unemployment.

4. The minimum devaluation rate compatible with full employment is given by $\varepsilon_t = \gamma w_{t-1}/\Omega(y_t^T)$. For the present calibration, $\mathbb{E}(\varepsilon_t\, \varepsilon_t > 1) = 1.105$, or 10.5 percent, which is the number given in the text.

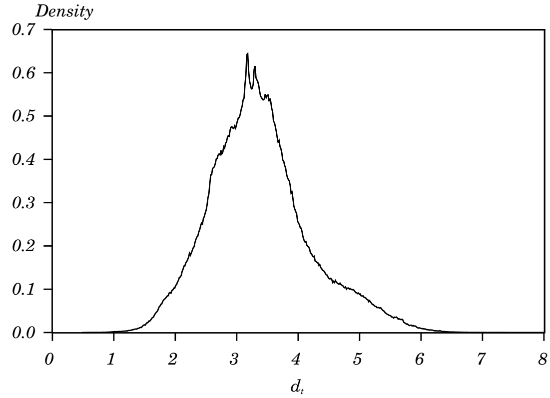
The rate of unemployment is highly volatile under a currency peg, with a standard deviation of 8.0 percentage points. In turn, the high volatility of unemployment implies a highly volatile supply and consumption of nontradable goods. As a result, total consumption is also more volatile under a currency peg than under the optimal policy. The standard deviation of $\ln(c_t)$ more than doubles from 3.2 percent under the optimal policy to 7.3 percent under a currency peg (not shown in the table).

## 3. Do More Complete Markets Ameliorate the Costs of Pegs?

Thus far, we have established that for the type of shocks considered in our model, suboptimal exchange rate policy has large negative welfare consequences under financial autarky, posing great policy challenges to central banks in emerging countries. It would be natural to conjecture that these challenges would become more manageable the more complete asset markets are. In this section we show that this conjecture need not hold. We find that the welfare cost of a currency peg can be higher when financial markets are open than when they are closed. This result implies that central banks that peg their currencies have greater incentives to abandon the fixed exchange rate regime in favor of the optimal exchange rate policy when the economy is open to international capital flows than when it is financially closed.

The intuition behind this result has to do with two opposing forces determining the welfare costs of currency pegs, which we call the consumption-smoothing versus consumption-level tradeoff. One force is the increased ability of financially open economies to insure against tradable endowment shocks. This force tends to reduce the cost of pegs because it reduces the extent to which negative endowment shocks in the traded sector, through their contractionary effects on aggregate absorption, lead to unemployment in the nontraded sector under currency pegs. The second force is that the average level of external debt is higher in the economy with access to financial markets (see figure 2). As we will explain shortly, the higher the level of debt, the larger the welfare cost associated with a peg, because the level of external debt amplifies the volatility of real-wage changes, making nominal rigidities bind more often. When the second force dominates the first (that is, when the consumption-level effect dominates the

**Figure 2. The Distribution of External Debt in the One-Bond Economy under a Currency Peg**




Source: Authors' elaboration.

consumption-smoothing effect), the counterintuitive result obtains, namely, that a currency peg is more costly vis-à-vis the optimal exchange rate policy when financial markets are open than when they are closed.

We make asset markets more complete than under autarky by introducing a one-period bond denominated in terms of tradables that is traded internationally and carries an interest rate $r_t$ when held from period $t$ to $t + 1$. We assume full dollarization of households' liabilities, because this is arguably the case of greatest empirical interest in emerging countries. Under this financial market structure, market clearing in the traded sector becomes

$$c_t^T + d_t = y_t^T + \frac{d_{t+1}}{1+r_t} \tag{18}$$

and

$$d_{t+1} \leq \bar{d}. \tag{19}$$

Equation (19) is a borrowing limit that prevents agents from engaging in Ponzi schemes. We set the parameter $\bar{d}$ at the natural debt limit.

The following definition gives the set of conditions governing aggregate dynamics under this asset market structure.

—**Definition 2** *General disequilibrium dynamics in the one-bond economy*. General disequilibrium dynamics in the one-bond economy are given by stochastic processes $c_t$, $c_t^T$, $c_t^N$, $h_t$, $p_t$, $d_{t+1}$ and $w_t$ for $t \geq 0$, satisfying equations (2), (5), (8) to (12), (18) and (19), given the exogenous stochastic processes $y_t^T$, $r_t$, an exchange rate policy and the initial conditions $d_0$ and $w_{-1}$.

As before, we consider two exchange rate regimes: a currency peg, $\varepsilon_t = 1, \forall t \geq 0$, and the optimal exchange rate policy. The family of optimal exchange rate policies in the one-bond economy is identical to the one derived in the autarkic economy (see Proposition 2), except that $y_t^T$ is replaced by $c_t^T$ as the argument of the function $\Omega$ in equation (16). We therefore have the following proposition.

—**Proposition 2**. Consider an economy satisfying Definition 2. Then, $h_t$ equals $\bar{h}$ for all *t,* and the real allocation is Pareto optimal if and only if the exchange rate regime satisfies

$$\varepsilon_t \geq \gamma \frac{w_{t-1}}{\Omega(c_t^T)}, \tag{20}$$

for all $t \geq 0$.

—**Proof** The proof is analogous to the proof of Proposition 2.

As in the case of financial autarky, we approximate aggregate dynamics by discretizing the state space and applying the value function iteration method in the case of optimal exchange rate policy and the method of policy function iteration in the case of a fixed exchange rate policy. The numerical problem is now more complex due to the emergence of two additional state variables: the endogenous state $d_t$ and the exogenous state $r_t$. We use 501 equally spaced points to discretize the debt subspace.

An important difference between the autarkic and one-bond economies is that the latter features positive debt, on average. Figure 2 displays the unconditional distribution of external debt in the one-bond economy when exchange rate policy takes the form of an exchange rate peg. The mean external debt is 3.38, or 26 percent of annual output. The average level of debt in the present environment is determined to a large extent by the assumption that agents are impatient—note that $\beta(1 + \mathbb{E}r_t)$ is less than unity—and by aggregate uncertainty.[5] Impatience induces agents to choose debt levels near the natural limit, $\bar{d}$, whereas uncertainty gives an incentive for precautionary savings and, therefore, for keeping debt below the natural limit.

As in the case of financial autarky, we define the welfare cost of a currency peg vis-à-vis the optimal exchange rate policy as the percent increase in the consumption stream induced by a currency peg that makes households as well off as households living in the optimal exchange rate economy. Formally, letting $\lambda^{\text{PEG|BOND}}(y_t^T, r_t, d_t, w_{t-1})$ denote the welfare cost of a currency peg relative to the optimal exchange rate policy in the one-bond economy, we have that

$$\lambda^{\text{PEG}\,|\,\text{BOND}}\left(y_t^T, r_t, d_t, w_{t-1}\right) = \left[\frac{\dfrac{\upsilon^{\text{BOND,OPT}}\left(y_t^T, r_t, d_t\right)}{\left(1-\sigma\right)+\left(1-\beta\right)^{-1}}}{\dfrac{\upsilon^{\text{BOND,PEG}}\left(y_t^T, r_t, d_t, w_{t-1}\right)}{\left(1-\sigma\right)+\left(1-\beta\right)^{-1}}}\right]^{1/(1-\sigma)} - 1,$$

where $\nu^{\text{BOND,PEG}}(y_t^T, r_t, d_t)$ and $\nu^{\text{BOND,PEG}}(y_t^T, r_t, d_t, w_{t-1})$ denote, respectively, the value function of the representative household under the optimal exchange rate policy and under a currency peg in the one-bond economy.

Table 2 shows that the mean welfare cost of a currency peg relative to the optimal exchange rate policy, $\mathbb{E}\lambda^{\text{PEG|BOND}}(y_t^T, r_t, d_t, w_{t-1})$, is 12.3 percent. That is, households would require a permanent increase in consumption of 12.3 percent to not have incentives to put pressure on their central bank to abandon the peg. This large welfare cost stems from the fact that the average unemployment rate in the currency peg economy is 14.5 percent. The average cost of pegs in the one-bond economy is much larger than the 6.5 percent obtained under autarky. Indeed, as can be seen from figure 1, the entire density function of welfare costs of pegs in the one-bond economy is located to the right of the corresponding density under financial autarky.

Because the average levels of debt in the autarkic and one-bond economies are so different, comparing the relative merits of

5. The subjective discount factor was calibrated to ensure a debt-to-output ratio of 26 percent per year, which is the ratio observed in Argentina between 1983 and 2001. See Schmitt-Grohé and Uribe (2011) for more details.

alternative exchange rate policies across asset market structures is more meaningful at common initial values of the state vector. Two initial conditions that are of particular interest: the one in which the level of debt equals its autarkic value of zero ($d_0 = 0$) and the one in which the level of debt equals its mean in the one-bond economy under a currency peg ($d_0 = 3.38$). Accordingly, we compute the welfare cost of a currency peg for these two values of initial debt. For the remaining state variables, we set the initial levels of tradable endowment and of the real interest rate at their respective unconditional means, namely, $y_0^T = \mathbb{E}(y_t^T) = 1$ and $r_0 = \mathbb{E}(r_t) = 0.0316$, and the initial value of the past real wage at the full-employment level when tradable consumption is unity, $w_{-1} = \Omega(1) = 2.13$.

Table 3 shows that the welfare cost of pegs are also extremely high at the initial conditions considered. In all four cases, agents in the peg economy require an increase of more than 3.5 percent of the entire consumption process to be as well off as in the optimal exchange rate economy. A novel result of the present investigation is that the welfare cost of a currency peg relative to the optimal exchange rate policy is larger when the economy is financially open than when it is financially closed. Specifically, table 3 shows that conditional on the initial net foreign asset position being zero ($d_0 = 0$), the welfare cost of a currency peg relative to the optimal exchange rate policy in the autarkic economy is 3.7 percent, almost two percentage points lower than the corresponding conditional welfare cost in the financially open economy, which is 5.4 percent.

**Table 3. Financial Structure and the Welfare Costs of Currency Pegs[a]**
Percent

| | *Welfare cost* | |
|---|---|---|
| *Financial structure* | $d_0 = 0$ | $d_0 = \mathbb{E}(d_t)$ |
| Autarkic economy | 3.7 | 10.0 |
| One-bond economy | 5.4 | 9.6 |

Source: Authors' elaboration.
a. The welfare cost of a currency peg relative to the optimal policy is computed at $y_0^T = \mathbb{E}(y_t^T) = 1$, $r_0 = \mathbb{E}(r_t) = 0.0316$, $w_{-1} = \Omega(1) = 2.13$, and at two values of $d_0$, namely, zero (the autarkic level) and $\mathbb{E}(d_t) = 3.38$, where $\mathbb{E}(d_t$ denotes the unconditional mean of debt in the one-bond economy under a currency peg. The welfare cost of a peg is calculated as the percent increase in the consumption process associated with a peg required to yield the same level of welfare as the optimal exchange rate policy.

This result is surprising because one might expect that as financial markets become more complete, agents would be able to better insure against external shocks, making suboptimal policy less harmful. The result is due to the fact that under a currency peg, the average unemployment rate is larger in the one-bond economy than in the autarkic economy (14.5 versus 9.0 percent). The intuition why a peg creates more unemployment in the one-bond economy than in the closed economy is clear, but a bit involved. It has to do with the fact that the one-bond economy has a positive level of external debt, on average, whereas the autarkic economy features no debt by construction. In the one-bond economy, under a currency peg, the debt-to-output ratio is 0.26 per year. This debt requires the allocation of some tradable output to paying interest. As a result, households optimally choose an average level of tradable consumption that is lower than the corresponding level in the autarkic economy (0.9 versus 1.0). This means that a given shock to the tradable endowment represents a larger share of traded consumption in the one-bond economy than in the autarkic economy. This translates into higher volatility of the growth rate of tradable consumption (5.1 percent in the one-bond economy versus 4.1 percent in the autarkic economy). Recalling that the flexible-wage real wage, $\Omega(c_t^T)$, is a function of tradable consumption alone (equation 15), we have that a higher variance of tradable consumption growth is associated with a higher volatility of the flexible-wage real wage growth (18.1 percent in the one-bond economy versus 9.2 percent in the autarkic economy). In turn, a higher volatility in the growth rate of the flexible-wage real wage means that under a peg, the constraint on nominal wages will bind more often, which implies that the one-bond economy will experience unemployment more often than the autarkic economy. Finally, more frequent unemployment spells are welfare decreasing, as they reduce the supply and consumption of nontraded goods.

Our intuition for why a currency peg is more costly in the one-bond economy than under autarky suggests that this result could be overturned if one were to define financial autarky as a situation in which the country is forced to run a balanced current account in every period—so that the level of external debt stays constant over time—but carries a debt burden equal to the average external debt in the one-bond economy with a fixed exchange rate policy. Under this definition of financial autarky, equation (14) becomes

$$c_t^T = y_t^T - \frac{r_t}{1+r_t} d^a, \tag{21}$$

where $d^a$ denotes the constant level of external debt in this version of the autarkic economy. We set $d^a$ equal to 3.38, which, as mentioned above, is the unconditional mean of external debt in the one-bond economy with a fixed exchange rate regime. This experiment amounts to eliminating the consumption-level force from the consumption-smoothing versus consumption-level tradeoff.

Table 3 shows that the welfare cost of a peg relative to the optimal exchange rate policy conditional on the initial debt being equal to 3.38 is 9.6 percent, slightly below the welfare cost of a currency peg in the autarkic economy with external debt equal to 3.38 at all times. This result is more intuitive and is due to the fact that in the autarkic economy, tradable consumption is lower, on average, than when debt was fixed at zero. As a result a given shock to the endowment of tradables causes a larger percent increase in tradable consumption. In addition, the autarkic economy is now hit by an additional shock, the interest rate, which adds even more volatility to the tradable consumption process.

## 4. Should Peggers Restrict Capital Flows?

Consider a country that is highly committed to a peg. We have in mind arrangements like the Eurozone, in which breaking away from the common currency appears difficult for reasons that go beyond the state of the business cycle. In this section, we investigate whether, given that the country is pegging the exchange rate, it would be desirable to restrict capital account transactions as a way to reduce the inefficiencies caused by negative external shocks.

We address this issue by considering two economies in which the currency is fixed. In one economy, the capital account is closed (possibly through explicit government regulation). As in previous sections, we refer to this economy as the autarkic economy. In the second economy, the capital account is unrestricted, and households have access to an internationally traded bond. As before, we refer to this environment as the one-bond economy.

The specific question we aim to answer is whether closing the capital account could be desirable. In the absence of downward nominal wage rigidity, the answer is trivially no. For given identical initial conditions, welfare must be higher in the economy with an open capital account. The result follows directly from the facts that the competitive equilibrium is Pareto optimal under flexible wages and that the autarkic allocation is feasible in the one-bond economy.

When wages are downwardly rigid, however, it is no longer the case that welfare must be higher in the financially open economy than in the closed one. The reason is that the currency peg economy with wage rigidity (whether open or closed) has a pecuniary externality. The nature of this externality has to do with the fact that, in states in which aggregate absorption contracts sufficiently, the lower bound on nominal wages binds, causing involuntary unemployment. The household understands this mechanism, but because of its atomistic nature, it is unable to internalize the fact that its individual expenditure contributes to the generation of unemployment.

Whether agents are better or worse off in the open economy than under financial autarky is the result of a tradeoff. On one hand, opening the current account provides households with a financial instrument to smooth consumption. On the other hand, opening the current account induces households to accumulate foreign debt, which aggravates the inefficiencies introduced by the pecuniary externality. The reason why the inefficiencies are larger under a larger net debt position is that, as explained earlier, traded consumption is lower, on average, in economies with larger levels of external debt, because resources must be devoted to servicing the external obligations. This implies that external shocks have a relatively larger effect on traded consumption the larger the average level of external debt. And higher volatility of traded consumption growth causes the lower bound on nominal wages to bind more often.

We define the welfare cost of financial autarky for peggers as the percent increase in the consumption stream associated with the financially autarkic economy under a peg necessary to make households as well off as households living in the one-bond economy under a peg. Formally, let $\lambda^{\text{AUT}|\text{PEG}}(y_t^T, r_t, d_t, w_{t-1})$ denote the welfare cost of financial autarky for peggers. Then $\lambda^{\text{AUT}|\text{PEG}}(y_t^T, r_t, d_t, w_{t-1})$ is defined as the solution to

$$\mathbb{E}_t \sum_{s=0}^{\infty} \beta^s \frac{\left[c_{t+s}^{\text{AUT,PEG}}(1+\lambda^{\text{AUT}|\text{PEG}}(y_t^T, r_t, d_t, w_{t-1}))\right]^{1-\sigma} - 1}{1-\sigma} = v^{\text{BOND,PEG}}\left(({}_t^T, r_t, d_t, w_{t-1}\right),$$

**Table 4. The Welfare Cost of Financial Autarky for Peggers**[a]
Percent

| | *Initial debt* | |
|---|---|---|
| | $d_0 = 0$ | $d_0 = \mathbb{E}(d_t)$ |
| Welfare cost | −0.7 | 0.9 |

Source: Authors' elaboration.
a. The welfare cost of financial autarky relative to the one-bond economy is computed at $y_0^T = \mathbb{E}(y_t^T) = 1$, $r_0 = \mathbb{E}(r_t) = 0.0316$, $w_{-1} = \Omega(1) = 2.13$, and at two values of $d_0$, namely, zero (the autarkic level) and $\mathbb{E}(d_t) = 3.38$, where $\mathbb{E}(d_t)$ denotes the unconditional mean of debt in the one-bond economy under a currency peg. The welfare cost of financial autarky for peggers is defined as the percent increase in the consumption process associated with financial autarky in a pegging economy required to yield the same level of welfare as the one enjoyed by households in the one-bond economy under a peg.

where $c_t^{\text{AUT,PEG}}$ denotes consumption in the financially autarkic economy under a currency peg in period $t$, and $\nu^{\text{BOND,PEG}}(y_t^T, r_t, d_t, w_{t-1})$ denotes the welfare level of households living in the one-bond economy under a currency peg when the current state is $(y_t^T, r_t, d_t, w_{t-1})$. Solving for $\lambda^{\text{AUT}|\text{PEG}}(y_t^T, r_t, d_t, w_{t-1})$, we obtain

$$\lambda^{\text{AUT}|\text{PEG}}\left(y_t^T, r_t, d_t, w_{t-1}\right) = \left[\frac{\upsilon^{\text{BOND,PEG}}\left(y_t^T, r_t, d_t, w_{t-1}\right)(1-\sigma) + (1-\beta)^{-1}}{\upsilon^{\text{AUT,PEG}}\left(y_t^T, r_t, d_t, w_{t-1}\right)(1-\sigma) + (1-\beta)^{-1}}\right]^{1/(1-\sigma)} - 1,$$

where $\nu^{\text{AUT,PEG}}(y_t^T, r_t, d_t, w_{t-1})$ denotes the level of welfare in the financially autarkic economy under a peg when the current state is $(y_t^T, r_t, d_t, w_{t-1})$.

Table 4 displays the welfare cost of financial autarky for peggers. Consider first the case in which financial autarky is taken to be a situation in which net foreign assets are zero at all times ($d_t = 0$ for all $t$). To make the welfare comparison meaningful, we also set the initial level of foreign debt in the one-bond economy to zero. In both economies, the initial endowment and the initial interest rate are set at their respective unconditional means. The initial past real wage is set at the full-employment level when traded absorption equals unity. The table reveals the surprising result that a pegging economy would be better off never opening its capital account. That is, welfare is higher under financial autarky than in the one-bond economy. Moreover, the welfare cost of liberalizing the capital account is sizable, at two-thirds of one percent. As explained above, the reason for this finding is that forcing the economy to have zero debt at all times reduces the inefficiencies introduced by the combination of downward wage rigidity and a currency peg. This benefit more than outweighs the cost of not being able to finance external shocks.

The benefit of living in autarky disappears if the country chooses to close the capital account in a situation in which its external debt is sufficiently high. To show this, we redefine autarky to mean a situation in which the current account is zero at all times, but the level of debt is positive (and constant). Equation (21) displays the country's resource constraint under this definition of autarky. In terms of the notation of that equation, we set $d^a$, the constant level of external debt, at 3.38, which equals the unconditional mean of debt in the one-bond economy under a peg. Table 4 shows that in this case, the welfare cost of autarky is 0.9 percent of consumption. This means that a country with a significant amount of debt (26 percent of output) is worse off closing its capital account. The intuition for this result is clear. Closing the capital account when the level of external debt is high does not ameliorate the inefficiencies introduced by the combination of wage rigidity and a fixed exchange rate, but it does prevent the economy from smoothing consumption through the current account.

This result suggests that if a country that is a member of a currency union, such as Greece, defaults (bringing its external debt close to zero) but decides to stick to the currency union, it would be better off preventing its citizens from borrowing abroad. Curiously, individual agents would prefer the lifting of such capital controls. Therefore, a referendum asking people's opinion on the adoption of capital controls would fail. But society as a whole would be badly served by capital account liberalization, because of the pecuniary externality identified above. On the other hand, if the indebted economy chose to neither default nor abandon the currency union, then it would find it in its own interest to keep the current account open to allow households to smooth consumption over time.

## 5. Conclusion

In this paper, we study the role of financial market structure in determining the welfare consequences of currency pegs in small open emerging economies. The central friction in the theoretical framework we use in our analysis is downward nominal wage rigidity. This nominal rigidity in combination with a fixed exchange rate regime gives rise to downward rigidity in real wages. Therefore, negative external shocks, such as terms-of-trade deteriorations or increases in the country interest rate, cause involuntary unemployment, as wages fall only sluggishly to clear the labor market.

The frictions embedded in our model give rise to two surprising results. First, a pegging economy might be better off with a closed capital account than with an open capital account. Second, the welfare gain from switching from a peg to the optimal (full-employment) exchange rate policy might be larger in financially open economies than in financially closed ones. This finding suggests that central banks in financially open economies have greater incentives to avoid hard currency pegs.

One avenue along which the analysis presented in this paper could profitably be extended is to introduce a meaningful reason for firms to hold dollarized liabilities. Such a modification has the potential to counterbalance the expansionary effect of devaluations stressed here and in that way enhance the appeal of fixed exchange rates.

## References

González Rozada, M. P.A. Neumeyer, A. Clemente, D.L. Sasson, and N. Tratcher. 2004. "The Elasticity of Substitution in Demand for Non-Tradable Goods in Latin America: The Case of Argentina." Research Network Working Paper R-485. Washington: Inter-American Development Bank.

Ostry, J.D. and C.M. Reinhart. 1992. "Private Saving and Terms of Trade Shocks: Evidence from Developing Countries." *IMF Staff Papers* 36(3): 495–517.

Schmitt-Grohé, S. and M. Uribe. 2011. "Pegs and Pain." Manuscript, Columbia University.

————. 2012. "Prudential Policy for Peggers." Manuscript, Columbia University.

Uribe, M. 1997. "Exchange-Rate-Based Inflation Stabilization: The Initial Real Effects of Credible Plans." *Journal of Monetary Economics* 39(2): 197–221.

# A Decade of Debt

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Public debts in the advanced economies have surged in recent years to levels that have not been recorded since the end of World War II. Through 2010, the average public debt/GDP ratio for all the advanced economies has surpassed the pre-World War II peaks reached during the World War I and subsequently during the Great Depression.[1] Private debt levels, particularly those of financial institutions and households, are similarly in uncharted territory and represent (in varying degrees) potential contingent liability of the public sector in many countries, including the US.

As documented in Reinhart, Rogoff, and Savastano (2003) for emerging market countries, large public debt overhangs do not unwind quickly and seldom painlessly. In particular, debt-to-GDP ratios are seldom reduced entirely through consistent robust economic growth. More commonly, reducing debt levels significantly



1. Unless otherwise noted, public debt in this policy analysis refers to gross central government debt. As such, it does not include other levels of government indebtedness (for example, state and local debt in the US), nor does it encompass public enterprise debt, or debt that carries an explicit (let alone implicit) government guarantee. Contingent liabilities of the government associated with Social Security benefits are not incorporated in our long (a century or, for some countries, more) of government debt data and its analysis. Domestic public debt is government debt issued under domestic legal jurisdiction. Public debt does not include obligations carrying a government guarantee. Total gross external debt includes the external debts of *all* branches of government as well as private debt issued by domestic private entities under a foreign jurisdiction.

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has relied on fiscal austerity, debt restructuring (sometimes outright default), or a combination of these.

In a complementary analysis of private debt deleveraging episodes following systemic financial crises, Reinhart and Reinhart (2011) show that the debt reduction process goes on for an average of about seven years. Also, because of declining output and accumulating arrears on existing debts, private debt ratios usually continue to climb even until two or three years after the height of the financial crisis—delaying the effective reduction of debt ratios.[2]

The combination of high and climbing public debts (a rising share of which is held by major central banks) and the protracted process of private deleveraging makes it likely that the ten years from 2008 to 2017 will be aptly described as a decade of debt. As such, the issues we raise in this policy analysis will weigh heavily on the public policy agenda of numerous advanced economies and global financial markets for some time to come. The following summarizes key aspects of our recent body of work on public debt and financial crises. Of course, if global real interest rates remain very low for an extended period, carrying costs of debt will be correspondingly low, and exceptionally high leverage ratios can persist longer than usual. However, as we emphasize in Reinhart and Rogoff (2009), interest rates can turn far faster than debt levels, so if deleveraging does not occur, debt will be a continuing vulnerability. The analysis that follows draws on and expands various strands of our earlier work.[3]

Historically, high leverage episodes have been associated with slower economic growth. This observation applies to the high-debt episodes that follow on the heels of wars as well as to their peacetime counterparts. It also characterizes episodes where high debt levels were not associated with markedly higher interest rates.[4]

2. Private deleveraging, as measured by new borrowing (see Fostel and Geanokoplos, 2008 and Geanokoplos, 2009) usually begins to slow down markedly or decline during the crisis and, in some cases, just before the onset of crisis.

3. Specifically, this Policy Analysis draws on Reinhart and Rogoff (2008, 2009, 2010a, 2010b, 2011a, 2011b). Although much of this policy analysis is devoted to synthesizing earlier work, there is important new material here, including the discussion of how World War I and Great Depression debt were largely resolved through outright default and restructuring, whereas World War II debts were often resolved through financial repression. We argue that financial repression is likely to play a big role in the exit strategy from the current buildup. We also highlight here the extraordinary external debt levels of Ireland and Iceland compared with all historical norms in our database.

4. See Gagnon and Hinterschweiger (2011) for an analysis of the links between debt and interest rates.

Surges in private debt lead to private defaults (which most often become manifest in the form of banking crises).[5] Banking crises are associated with mounting public debt, which ultimately lead to a higher incidence of sovereign default or, more generally, restructuring of public and private debts.

Specifically, banking crises and surges in public debt help to "predict" sovereign debt crises. Of course, this historical pattern had been dominant prior to the era of mega bailouts ushered in with the 1992 Japanese domestic banking crisis, followed by (on an international scale) the 1994–95 Mexican peso crises, reinforced during the Asian crisis with the South Korean package, and reaching ever escalating historic highs on both domestic and international dimensions at the time of this writing. The "bailout approach" in the current episode began in the summer of 2007 in the US in response to the subprime mortgage crisis and morphed into the most serious advanced-economy debt crisis since the 1930s.

A more subtle form of debt restructuring takes the form of "financial repression" (which had its heyday during the tightly regulated Bretton Woods system). Limiting investment choices of the private sector importantly facilitated sharper and more rapid debt reduction from the late 1940s to the 1970s than would have otherwise been the case (Reinhart and Sbrancia, 2011). We conjecture here that the pressing needs of governments to reduce debt rollover risks and curb rising interest expenditures in light of the substantial debt overhang, combined with an aversion to more explicit restructuring, may lead to a revival of financial repression. This includes more directed lending to government by captive domestic audiences (such as pension funds), explicit or implicit caps on interest rates, and tighter regulation on cross-border capital movements.[6] A less generous depiction of financial repression (definition in box 1) would include the savaging of pension funds.

Section 1 places the recent surge in government debt in the advanced economies in historical perspective, distinguishing the timing and magnitudes of earlier high-debt episodes. Section 2 summarizes our findings on the temporal causal links between

5. See Kaminsky and Reinhart (1999).

6. There is a literature on financial repression in emerging-market economies (see Easterly, 1989 and Giovannini and De Melo, 1993, for example). However, the Bretton Woods system embraced in 1946 established a system of tightly regulated financial markets based on the three pillars of (1) directed credit; (2) interest rate ceilings; and (3) foreign exchange controls (see box 1).

financial crises, rapid surges in public debt, and subsequent sovereign restructuring or outright default. In section 3 we document that high debt is associated with slower growth—a relationship that is robust across advanced and emerging markets since World War II, as well an earlier era. The last large wave of sovereign defaults or restructurings in the advanced economies during the early 1930s (outright defaults were confined to the handful of countries on the losing side of World War II) is discussed in section 4, which also describes the heavy-handed financial regulation (often referred to as financial repression) that helped rapidly reduce the World War II debt overhang. The concluding section suggests many of the elements of financial repression have already begun to resurface (a trend that is likely to gather momentum in coming years), as governments simultaneously grapple with the difficult choices associated with substantial debt reduction.

### Box 1. Financial Repression Defined

The term financial repression was introduced in the literature by the works of Edward Shaw (1973) and Ronald McKinnon (1973). Subsequently, the term became a way of describing emerging-market financial systems prior to the widespread financial liberalization that began in the 1980 (see Agenor and Montiel, 2008, for an excellent discussion of the role of inflation and Giovannini and de Melo, 1993; and Easterly, 1989 for country-specific estimates). However, as we document in this paper, financial repression was also the norm for advanced economies during the post–World War II period and in varying degrees up through the 1980s. We describe here some of its main features.

#### Pillars of financial repression

1. Explicit or indirect caps or ceilings on interest rates, particularly (but not exclusively) those on government debts. These interest rate ceilings could be effected through various means, including (1) explicit government regulation (for instance, Regulation Q in the US prohibited banks from paying interest on demand deposits and capped

interest rates on saving deposits); (2) ceilings on banks' lending rates, which were a direct subsidy to the government in cases where it borrowed directly from the banks (via loans rather than securitized debt); and (3) interest rate cap in the context of fixed coupon rate nonmarketable debt or (4) maintained through central bank interest rate targets (often at the directive of the Treasury or Ministry of Finance when central bank independence was limited or nonexistent). Allan Meltzer's (2003) monumental history of the Federal Reserve (volume I) documents the US experience in this regard; Alex Cukierman's (1992) classic on central bank independence provides a broader international context.

2. Creation and maintenance of a captive domestic audience that facilitated directed credit to the government. This was achieved through multiple layers of regulations from very blunt to more subtle measures. (1) Capital account restrictions and exchange controls orchestrated a "forced home bias" in the portfolio of financial institutions and individuals under the Bretton Woods arrangements. (2) High reserve requirements (usually nonremunerated) as a tax levy on banks (see Brock, 1989, for an insightful international comparison). Among more subtle measures, (3) "prudential" regulatory measures requiring that institutions (almost exclusively domestic ones) hold government debts in their portfolios (pension funds have historically been a primary target), (4) transaction taxes on equities (see Campbell and Froot, 1994) also act to direct investors toward government (and other) types of debt instruments, and (5) prohibitions on gold transactions.

3. Other common measures associated with financial repression aside from the ones discussed above are (1) direct ownership (for example, in China or India) of banks or extensive management of banks and other financial institutions (for example, in Japan) and (2) restricting entry into the financial industry and directing credit to certain industries (see Beim and Calomiris, 2001).

Source: Reinhart and Sbrancia (2011) and sources cited therein.

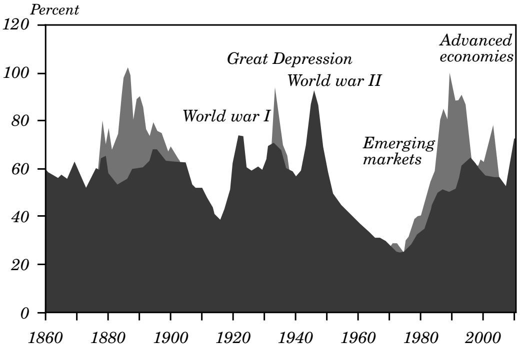
## 1. Surges in Public Debt

Throughout the ages and across continents, war has been a recurrent causal force behind rapid deteriorations in government finances and surges in public indebtedness. This pattern shows through in world debt aggregates and individual country histories. Thus, it is not surprising to see that, particularly for the advanced economies, two spikes in debt aggregates correspond to the two world wars (figure 1). The smaller set of independent (largely European) economies that populated the globe in the early 1800s experienced a similar sharp run-up in debt during the Napoleonic Wars.

During peacetime, a leading factor behind rapid surges in public debt has been severe or systemic financial crises. With the growing tendency toward increasing government involvement in rescue operations, the link between public debt and financial crashes has become more pronounced in the past two decades or so. More general and chronic fiscal problems (because governments systematically overspend, do not have the political will or ability to tax effectively, or a combination of the two) tend to produce more gradual debt buildups.

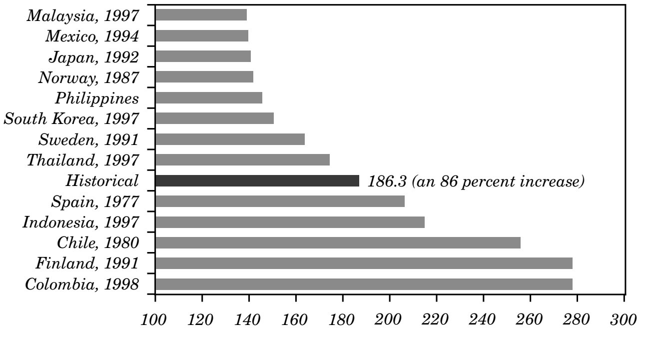
As figure 1 illustrates, public debts in the advanced economies have surged in recent years to levels not recorded since the end of World War II, surpassing previous peaks reached during World

**Figure 1. Gross Central Government Debt as a Percent of GDP: Advanced and Emerging-Market Economies, 1860–2010**




Sources: Reinhart and Rogoff (2011a) and sources cited therein.

**Figure 2. Cumulative Increase in Public Debt in the Three Years Following Systemic Banking Crisis: Selected Post–World War II Episodes**




Source: Reinhart and Rogoff (2008, 2009) and sources cited therein.
Notes: Each banking crisis episode is identified by country and the beginning year of the crisis. Only major (systemic) banking crisis episodes are included, subject to data limitations. The historical average reported does not include ongoing crisis episodes, which are omitted altogether, as these crises begin in 2007 or later, and debt stock comparison shown is three years after the beginning of the banking crisis.

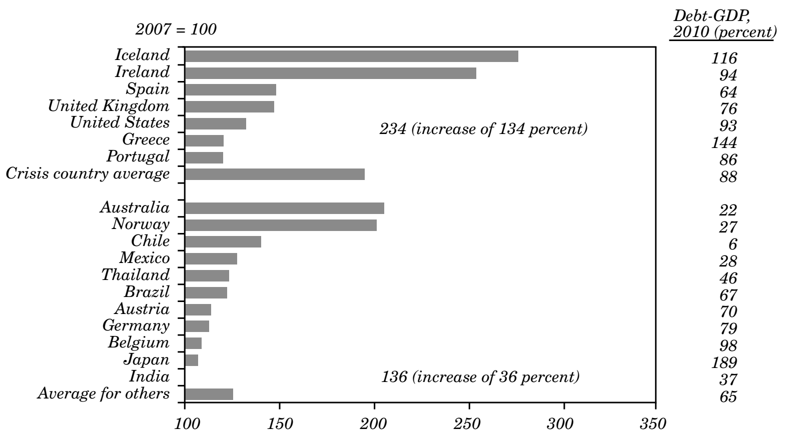
War I and the Great Depression. At the same time, private debt levels, particularly those of households, are simply in uncharted territory and are (in varying degrees) a contingent liability of the public sector in many countries, including the US. As we emphasize in Reinhart and Rogoff (2009, 2011b) and discuss further below, most governments find it difficult to avoid backstopping significant amounts of private credit during a financial crisis.

## 1.1 Financial Crises and Debt

Figure 2 takes advantage of newly unearthed historical data on domestic debt to show the rise in real government debt in the three years following severe banking crises of the 20th century.[7] A buildup in government debt has been a defining characteristic of the aftermath of banking crises for over a century, with government finances deteriorating to produce an average debt rise of 86 percent. This comparative exercise focuses on the percentage increase in

7. This analysis was first introduced in Reinhart and Rogoff (2008).

**Figure 3. Cumulative Increase in Real Public Debt since 2007, Selected Countries**




Sources: Prices and nominal GDP from International Monetary Fund, World Economic Outlook. For a complete listing of sources for government debt, see Reinhart and Rogoff (2009, 2011c).
Notes: Unless otherwise noted these figures are for central government debt deflated by consumer prices.

debt, rather than the debt-to-GDP ratio, because steep output drops sometimes complicate the interpretation of debt/GDP ratios. As we note in Reinhart and Rogoff (2008), the characteristic huge buildups in government debt are driven mainly by sharp falloffs in tax revenue, owing to the severe and protracted nature of postcrisis recessions. In some famous cases (notably Japan in the 1990s), this deterioration in fiscal balances also owes to surges in government spending to fight the recession. The much ballyhooed bank bailout costs are, in several cases, only a relatively minor contributor to post–financial crisis debt burdens.

More broadly, an examination of the aftermath of severe financial crises shows deep and lasting effects on asset prices, output, and employment. Unemployment rises and housing price declines extend out for five and six years, respectively. Even recessions sparked by financial crises do eventually end, albeit almost invariably accompanied by massive increases in government debt.

## 1.2. The 2007–10 Global Buildup in Public Debt

Figure 3 illustrates the increase in (inflation adjusted) public debt since 2007. For the countries with systemic financial crises and/or sovereign debt problems (Greece, Iceland, Ireland, Portugal, Spain, the United Kingdom, and the US), average debt levels are up by about 134 percent, surpassing by a sizable margin the three-year 86 percent benchmark that we find (Reinhart and Rogoff, 2009) for earlier deep postwar financial crises. The larger debt buildups in Iceland and Ireland are importantly associated not only with the sheer magnitude of the recessions/depressions in those countries but also with the scale of the bank debt buildup prior to the crisis—which is, as far as we are aware—without parallel in the long history of financial crises. Nor will 2010 (the third year of crisis for Iceland, Ireland, the United Kingdom, and the US and the second year for the others) be the last year in which rising debt will be recorded. At present, forecasts for the US show rising debt levels in the foreseeable future; f or several others, austerity programs notwithstanding, debts are likely to continue to mount as economic conditions remain subpar and debt servicing costs climb.

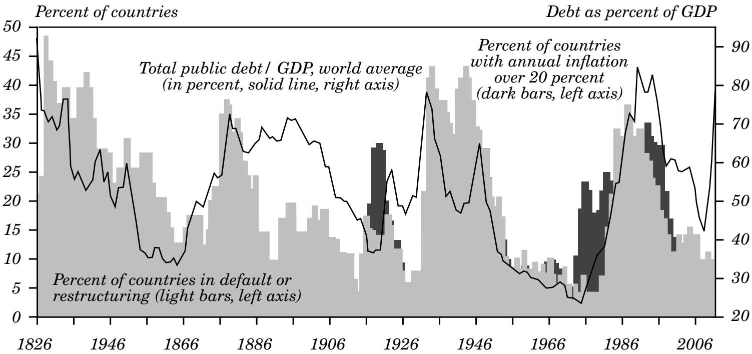
Even in countries that did not experience a major financial crisis, debt rose by an average of about 36 percent in real terms between 2007 and 2010.[8] Many economies adopted stimulus packages to deal with the global recession in 2008–09 and were hit by marked declines in government revenues. Moreover, some of the larger increases in debt loads of noncrisis countries (such as Norway, Australia, and Chile) relate to the cyclical downdraft in world commodity prices that accompanied the global recession.

## 2. The Financial Crash–Sovereign Debt Crisis Sequence

In this section, we summarize the main findings in Reinhart and Rogoff (2011b). Our approach in that paper was to illustrate each main result with both a "big picture" based on cross-country aggregation and a "representative country case study (or studies)"

8. Our focus on gross central government debt owes to the fact that time series of broader measures of government debt are not available for many countries. Of course, the true runup in debt is significantly larger than stated here, at least on a present value actuarial basis, due to the extensive government guarantees that have been conferred on the financial sector in the crisis countries and elsewhere, where for example deposit guarantees were raised in 2008.

**Figure 4. Sovereign Default on External Debt, Total (Domestic plus External) Public Debt, and Inflation Crises: World Aggregates, 1826–2010**




Sources: Prices and nominal GDP from International Monetary Fund, World Economic Outlook. For a complete listing of sources for government debt, see Reinhart and Rogoff (2009, 2011c).
Notes: Unless otherwise noted these figures are for central government debt deflated by consumer prices.

from country histories. Each of the main points highlighted in the figures is complemented by the pertinent debt/GDP-crisis indicator regressions reported at the bottom of each figure. We begin by discussing sovereign default on external debt (that is, when a government defaults on its own external or private-sector debts that were publicly guaranteed).

## 2.1. Public Debt Surges and Sovereign Default and Restructuring

Public debt follows a lengthy and repeated boom-bust cycle; the bust phase involves a markedly higher incidence of sovereign debt crises. Public-sector borrowing surges as the crisis nears. In the aggregate, debts continue to rise after default, as arrears accumulate and GDP contracts markedly.[9] Figure 4 plots the incidence of external default (lighter bars) from 1826, when the newly independent Latin American economies first entered the global capital market, through

9. See Reinhart and Rogoff (2009, 2011a) for evidence on output behavior before, during, and after debt crises.

**Table 1. Public Debt and Sovereign Default and Restructuring: All Countries, 1824–2009**

| *Dependent variable sample* | *World: Share of countries in default or restructuring 1824–2009* | |
|---|---|---|
| *Independent variables* | *OLS (robust errors)* | *Logit (robust errors)* |
| World: Public debt/GDP ($t$–1) | 0.346 | 0.008 |
| $p$-value | 0.000 | 0.000 |
| Number of observations | 184 | 184 |
| $R^2$ | 0.224 | 0.246 |

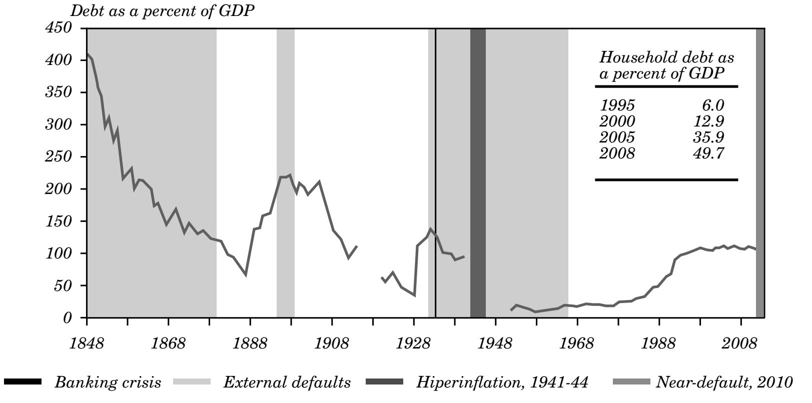
Sources: Reinhart and Rogoff (2011b), sources cited therein and authors' calculations.
OLS = ordinary least squares. Logit = logistic regression.
Notes: The debt aggregate for the world is a simple arithmetic average of individual countries' debt/ GDP ratios. For a few countries the time series on debt and exports are much longer dating back to the first half of the 19th century than for nominal GDP. In these cases (Brazil, Canada, Egypt, India, Nicaragua, Thailand, Turkey, and Uruguay) the debt/GDP series was spliced (with appropriate scaling) with the available debt/GDP data. The split between advanced and emerging economies is made along the present-day IMF classification.

2010 against an unweighted average debt/GDP ratio for all the countries for which such data are available. Upturns in the debt ratio usually precede the rise in default rates, as the regressions (shown in table 1) for the world aggregates confirm. Periods of higher indebtedness are also associated with a higher incidence of inflation crises (a more indirect form of default, highlighted as darker bars where the incidence of inflation exceeds that of default). Default through inflation has been more prevalent since World War I, as fiat money became the norm and links to gold severed.

Serial default is a widespread phenomenon across emerging markets and several advanced economies. The most compelling evidence on serial default comes from the individual country histories, shown here for Greece in figure 5. The 70 country histories presented in Reinhart and Rogoff (2011c), Ch. 2, provide broad-based evidence that serial default cut across regions and across time.

The "hallmark" surge in debt on the eve of a debt crisis, banking crisis, or both is quite evident in Greece's last two defaults in 1894 and in 1932—the latter default spell lasted about 33 years from beginning to its eventual resolution in 1964.

**Figure 5. Greece: Central Government (Domestic plus External) Debt, Default, Hyperinflation, and Banking Crises, 1848-2009**




Source: Reinhart and Rogoff (2011c), Ch. 2.

## 2.2 Hidden Debts—Private Debts that Become Public

The drama that has most notably engulfed Iceland and Ireland is novel only in the orders of magnitude of the debts, not in the causes and patterns of the crisis.[10] Writing about Chile's crises in the early 1980s, Carlos Díaz-Alejandro (1985) asks us to consider a country that had liberalized its domestic financial sector and was fully integrated into world capital markets.

> The recorded public sector deficit was nonexistent, minuscule, or moderate; the declining importance of ostensible public debt in the national balance sheet was celebrated by some observers.

The private sector was a different matter. Their spending

10. Gross external debts ten times the size of GDP (as the cases of Iceland and Ireland) are historically off the charts for both advanced and emerging-market economies. In effect, Reinhart, Rogoff, and Savastano (2003) calculate that more than half of all emerging-market defaults or restructuring episodes since World War II occurred at debt levels of 60 percent or less (which would satisfy the Maastricht criteria).

persistently exceeded their income, giving rise to large current account deficits. The current account deficit was financed by large and persistent capital inflows, which is a different way of saying that the domestic largesse was supported by borrowing heavily from the rest of the world. This abundance of foreign capital made it easy for domestic banks to lend liberally to businesses and households. During the credit boom, real estate and equity prices soared—so did debts. Growth seemed inevitable.

However, as Díaz-Alejandro explains, the pity of the boom is that

> little effort was spent on investigating the credentials of new entrants to the ever-growing pool of lenders and borrowers... practically no inspection or supervision of bank portfolios existed… One may conjecture, however, that most depositors felt fully insured and foreign lenders felt that their loans to the private sector were guaranteed by the State.

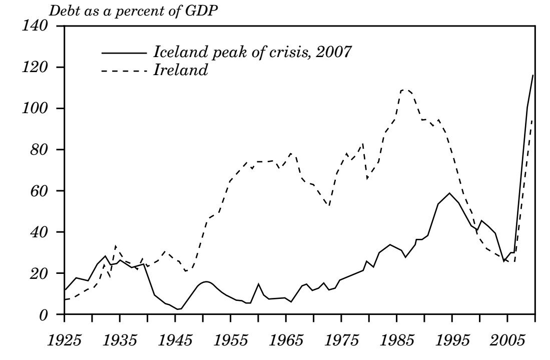
The two panels of figure 6, which plot the public debt/GDP ratios (top panel) and total gross external (public and private) debt (bottom panel) for Iceland and Ireland, faithfully mimic the pattern described by Díaz-Alejandro of "apparent" sound fiscal finances at the outset of the financial crisis.[11] The most onerous sign of future sovereign debt difficulties is shown in the bottom panel of figure 6, which highlights the scale of the buildup in mostly private external debts that carried implicit (or explicit) government guarantees.

After more than three years since the onset of the crisis, banking sectors remain riddled with high debts (of which a sizable share are nonperforming) and low levels of capitalization, while the household sector has significant exposures to a depressed real estate market. Under such conditions, the migration of private debts to the public sector and central bank balance sheets is likely to continue, especially in the prevalent environment of indiscriminate, massive bailouts.

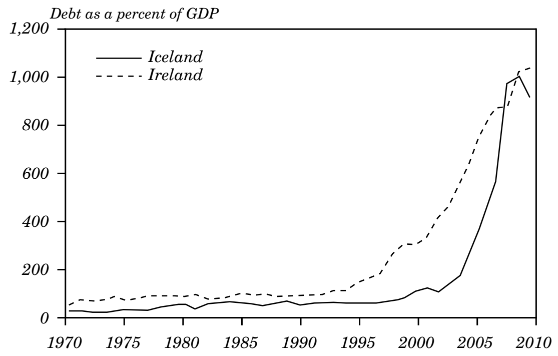
11. We would note that Iceland and Ireland (and also Spain), so often in the news for their present debt difficulties, were exemplary cases of successful public debt reduction up until the eve of the current crisis.

**Figure 6. Iceland and Ireland: Public Debt/GDP and External Debt**

*A. General government (domestic plus external) debt, 1925–2010*




*B. External (public plus private) debt, 1970–2010*

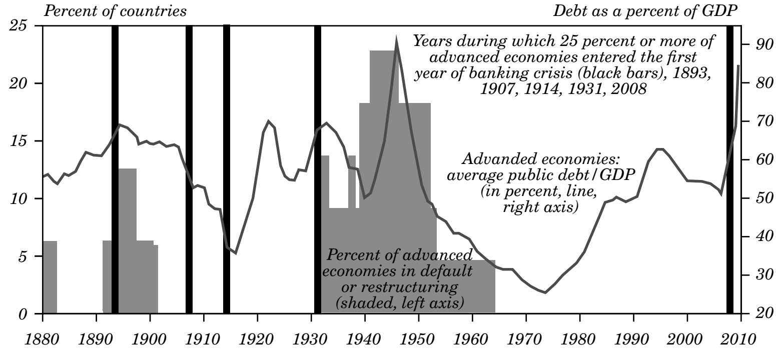



Source: Reinhart and Rogoff (2011c), Ch. 2.

## 2.3 Banking Crises as Predictors of Sovereign Debt Problems

Banking crises most often either precede or coincide with sovereign debt crises. The reasons for this temporal sequence may be the contingent liability story emphasized by Díaz-Alejandro (1985) and formalized in Velasco (1987), in which the government takes on massive debts from the private banks, thus undermining its own

**Figure 7. Sovereign Default on External Debt, Total (Domestic plus External) Public Debt, and Systemic Banking Crises: Advanced Economies, 1880–2010**




Source: Reinhart and Rogoff (2011).

solvency.[12] The currency crashes that are an integral part of the "twin crisis" phenomenon documented by Kaminsky and Reinhart (1999) would also be consistent with this temporal pattern. If, as they suggest, banking crises precede currency crashes, the collapsing value of the domestic currency that comes after the banking crisis begins may undermine the solvency of both private and sovereign borrowers who are unfortunate enough to have important amounts of foreign-currency debts. As figure 7 and table 2 highlight, this is not exclusively an "emerging-market issue," as a higher incidence of sovereign default has followed the major financial crises.

Even absent large-scale bailouts (and without counting postcrisis new government guarantees), we show that largely owing to collapsing revenues, government debts typically rise about 86 percent in the three years following a systemic financial crisis, setting the stage for rating downgrades and, in the worst scenario, default.

A causal chain from sovereign debt crisis to banking crisis, perhaps obscured in these simple graphs, cannot be dismissed lightly. Financial repression and international capital controls may give the government scope to coerce otherwise healthy banks to buy

12. See Arellano and Kocherlakota (2008) for a framework that is consistent with these dynamics.

**Table 2. Public Debt and Sovereign Default and Restructuring: Advanced Economies, 1880–2009**

| *Dependent variable sample* | *Advanced economies: Share of countries in default or restructuring 1880–2009* | |
|---|---|---|
| *Independent variables* | *OLS (robust errors)* | *Logit (robust errors)* |
| *Advanced economies* | | |
| Public debt/GDP ($t$–1) | 0.209 | 0.002 |
| $p$-value | 0.000 | 0.000 |
| Number of observations | 130 | 130 |
| $R^2$ | 0.176 | 0.167 |
| *Dependent variable sample* | *Advanced economies: Share of countries in systemic banking crises 1880–2009* | |
| *Independent variables* | *OLS (robust errors)* | *Logit (robust errors)* |
| *Advanced economies* | | |
| Public debt/GDP ($t$–1) | 0.057 | 0.002 |
| $p$-value | 0.002 | 0.006 |
| Number of observations | 130 | 130 |
| $R^2$ | 0.047 | 0.05 |

Sources: Reinhart and Rogoff (2011c), sources cited therein; and authors' calculations.
OLS = ordinary least squares. Logit = logistic regression.
Notes: The debt aggregates for the advanced economies and the world are simple arithmetic averages (not weighted by a country's share in world GDP) of individual countries' debt/GDP ratios. For a few countries the time series on debt and exports are much longer dating back to the first half of the 19th century than for nominal GDP. In these cases (Brazil, Canada, Egypt, India, Nicaragua, Thailand, Turkey, and Uruguay) the debt/GDP series was spliced (with appropriate scaling) with the available debt/GDP data. The split between advanced and emerging economies is made along the present-day IMF classification, even though several countries, such as New Zealand, were "emerging markets" during most of the pre-World War I period.

government debt in significant quantities. A government default, in those circumstances, would directly impact the banks' balance sheets. The two crises may be more or less simultaneous. But even if banks are not overly exposed to government paper, the "sovereign ceiling" in which corporate borrowers are rated no higher than their national governments may make banks' offshore borrowing very costly or altogether impossible. The result would be a sudden stop that could give rise to bank insolvencies either immediately or subsequently.

## 2.4. Common Fundamentals, Contagion, or Both?

In this subsection, we emphasize the fundamental distinction between international transmission that occurs due to common shocks (for example, the collapse of the technology boom in 2001 or the collapse of housing prices in the crisis of the late 2000s) to transmission that occurs primarily due to mechanisms that are really the result of cross-border contagion emanating from the epicenter of the crisis. We offer a rationale for understanding which factors make it more likely that a primarily domestic crisis fuels *fast and furious contagion* (box 2). We use these concepts to discuss the basis for contagion scenarios in Europe and elsewhere. The bunching of banking crises and sovereign debt difficulties across countries is so striking in the late-2000s crisis, where both common shocks and cross-country linkages are evident.

As we discussed in Reinhart and Rogoff (2009), the conjuncture of elements related to the current crisis is illustrative of the two channels of contagion: cross-linkages and common shocks. Without doubt, the US financial crisis of 2007 spilled over into other markets through direct linkages. For example, German and Japanese financial institutions (and others ranging as far as Kazakhstan) sought more attractive returns in the US subprime market,[13] perhaps owing to the fact that profit opportunities in domestic real estate were limited at best and dismal at worst. Indeed, after the fact, it became evident that many financial institutions outside the US had nontrivial exposure to the US subprime market. This is a classic channel of transmission or contagion through which a crisis in one country spreads across international borders. In the present context, however, contagion or spillovers are only part of the story.

The global nature of the crisis also owes significantly to the fact that many of the features that characterized the run-up to the subprime crisis in the US were present in many other advanced economies as well. Two common elements stand out. First, many countries in Europe and elsewhere had their own home-grown real estate bubbles (Reinhart and Rogoff, 2009). Second, the US was not alone in running large current account deficits and experiencing a sustained "capital flow bonanza." Bulgaria, Iceland, Ireland, Latvia, New Zealand, Spain, and the United Kingdom, among

13. Owing to the opaqueness of balance sheets in many financial institutions in these countries, the full extent of exposure is, as yet, unknown.

others, were importing capital from abroad, which helped fuel a credit and asset price boom (Reinhart and Reinhart, 2009). These trends, in and of themselves, made these countries vulnerable to the usual nasty consequences of asset market crashes and capital flow reversals irrespective of what may be happening in the US.

Are more fast and furious episodes or spillovers under way? Applying the criteria that typically characterize fast and furious contagion (box 2) to the current environment yields a mixed picture but one that, on the whole, would suggest contagion (and the more gradual spillover) threats still loom large. Surprise events are (by definition) always a distinct possibility. However, at the time of this writing the precarious nature of balance sheets in much of Europe and the US is more in the public eye than at the beginning on this crisis in the summer of 2007. This fact is plainly evident in the succession of ratings downgrades of several sovereigns in Europe as well as of Japan. Most recently, of course, Standard and Poor's has put the US on notice of a possible downgrade, echoing a similar warning by the International Monetary Fund. These sovereign downgrades have mirrored, to some extent, the general widening and greater heterogeneity in sovereign spreads. As to the capital inflow cycle and leverage, the inflow peaks and surges in fresh private borrowing are well behind us but public debts continue to climb (figure 1) and private deleveraging, especially in Europe, has been (at best) limited (Reinhart and Reinhart, 2011b). Highly leveraged public and private sectors has been historically a "contagion amplifier." So have been common creditors. Apart from the elevated levels of leverage in most advanced economies as discussed, the widespread presence of common creditors (most notable in the Euro area as well as the United Kingdom) is a second compelling factor indicating that the scope for fast and furious contagion remains high. This type of financial vulnerability is exacerbated by the lack of transparency in overall cross-border exposure, as highlighted in the extensive new database in Milesi-Ferretti, Strobbe, and Tamirisa (2010).

### Box 2 Contagion concepts

In defining contagion here, we follow Kaminsky, Reinhart, and Vegh (2003), who distinguish between two types: (1) the "slow-burn" spillover and (2) the kind of fast burn marked by rapid cross-border transmission that Kaminsky, Reinhart, and Vegh label "fast and furious." We refer to contagion as an episode in which there are significant immediate effects in a number of countries following an event—that is, when the consequences are fast and furious and evolve over a matter of hours or days. This "fast and furious" reaction is a contrast to cases in which the initial international reaction to the news is muted. The latter cases do not preclude the emergence of gradual and protracted effects that may cumulatively have major economic consequences.

We refer to these gradual cases as spillovers. Common external shocks, such as changes in international interest rates or oil prices, are also not automatically included in our working definition of contagion. We add to this classification that common shocks need not all be external. This caveat is particularly important with regard to the current episode. Countries may share common "domestic" macroeconomic fundamentals, such as the bursting of a housing bubble, capital inflow bonanzas, increasing private and (or) public leveraging, and so on.

The three pillars of fast and furious contagion are:

**1. Surprise crises and anticipated catastrophes** Fast and furious crises and contagion cases have a high degree of surprise associated with them, while their quieter counterparts are more broadly anticipated.

**2. Capital flow cycle and leverage** Fast and furious contagion episodes are typically preceded by a surge in capital inflows and rapidly rising leverage, which come to an abrupt halt or sudden stop in the wake of a crisis. The inflow of capital may come from banks, other financial institutions, or bondholders. The debt contracts typically have short maturities (that is, investors and financial institutions will have to make decisions about rolling over their debts or not doing so.) With fast and furious contagion, investors and financial institutions that are often highly leveraged are exposed to the crisis country. Such investors can be viewed as halfway through the door, ready to back out on short notice.

**3. Common creditors** The previous distinction appears to be critical when "potentially affected countries" have a common lender. If the common lender is surprised by the shock in the initial crisis country, there is no time ahead of the impending crisis to rebalance portfolios and scale back from the affected country. In contrast, if the crisis is anticipated, investors have time to limit the damage by scaling back exposure or hedging their positions.

## 3. Debt and Growth

The march from high public indebtedness to sovereign default or restructuring is usually marked by episodes of drama, punctuated by periods of high volatility in financial markets, rising credit spreads, and ratings downgrades. However, the economic impacts of high public indebtedness are not limited to such episodes of high drama, as rising public debts are not universally associated with rising interest rates and imminent expectations of sovereign default (see Gagnon and Hinterschweiger, 2011, for a thorough examination of this issue.) Serious public debt overhangs may also cast a shadow on economic growth, even when the sovereign's solvency is not called into question.

In this section we summarize our main findings in Reinhart and Rogoff (2010a, 2010b), elaborate on some methodology issues, and discuss some of the very recent literature that examines the debt and growth connection.

### 3.1 The Basic Exercise and Key Results

Our analysis of growth and debt was based on newly compiled data on 44 countries spanning about 200 years. This amounts to 3,700 annual observations and covers a wide range of political systems, institutions, exchange rate arrangements, and historic circumstances.

The main findings of Reinhart and Rogoff (2010a) are the following.

— First, the relationship between government debt and real GDP growth is weak for debt/GDP ratios below 90 percent of GDP.[14] Above the threshold of 90 percent, median growth rates fall by one percent, and average growth falls considerably more. The threshold for public debt is similar in advanced and emerging-market economies and applies for both the post–World War II period and as far back as the data permit (often well into the 1800s).

— Second, emerging markets face lower thresholds for total external debt (public and private)—which is usually denominated in a foreign currency. When total external debt reaches 60 percent of GDP, annual growth declines about 2 percent; for higher levels, growth rates are roughly cut in half.

— Third, there is no apparent contemporaneous link between inflation and public debt levels for the advanced countries as a group (some countries, such as the US, have experienced higher inflation when debt/GDP is high). The story is entirely different for emerging markets, where inflation rises sharply as debt increases.

Figure 8 can be used to summarize our main conclusions. The top panel applies to the 20 advanced countries in our 44-country sample (where much of the public debate is entered).[15] The remaining two panels of the figure present comparable results for emerging-market public debt and gross external debt.

In the figure, the annual observations are grouped into four categories, according to the ratio of debt/GDP during that particular year: years when debt-to-GDP levels were below 30 percent; 30 to 60 percent; 60 to 90 percent; and above 90 percent.[16] The bars show average and median GDP growth for each of the four debt categories.

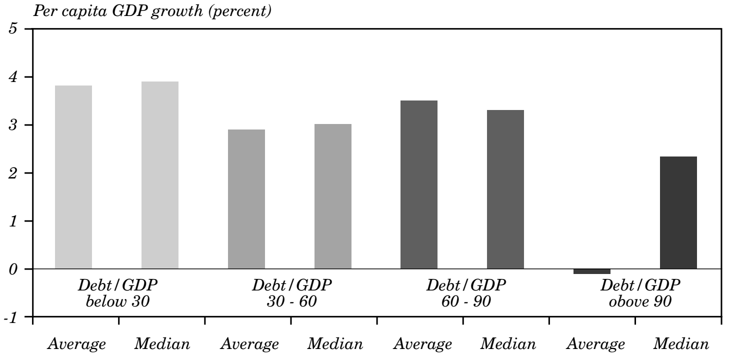
14. As noted previously, "public debt" here refers to gross central government debt. "Domestic public debt" is government debt issued under domestic legal jurisdiction. Public debt does not include obligations carrying a government guarantee. Total gross external debt includes the external debts of all branches of government as well as private debt issued by domestic private entities under a foreign jurisdiction.

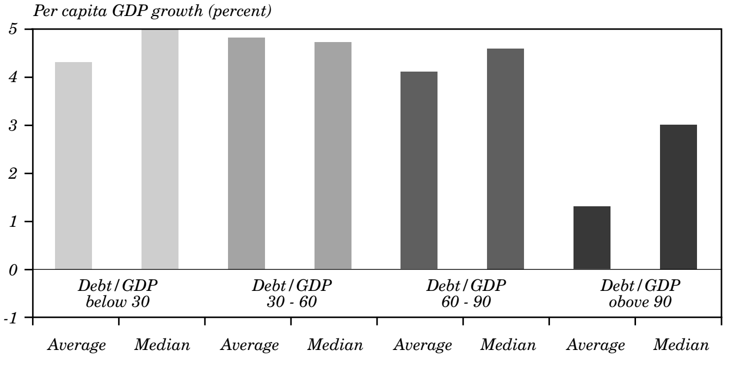
15. The comparable emerging-market exercises are presented in the original working paper (NBER Working Paper 15639, January 2010).

16. The four "buckets" encompassing low-, medium-low, medium-high, and high-debt levels are based on our interpretation of much of the literature and policy discussion on what are considered low, high debt levels. It parallels the World Bank country groupings according to four income groups. Sensitivity analysis involving a different set of debt cutoffs merits exploration, as do country-specific debt thresholds along the broad lines discussed in Reinhart, Rogoff, and Savastano (2003).

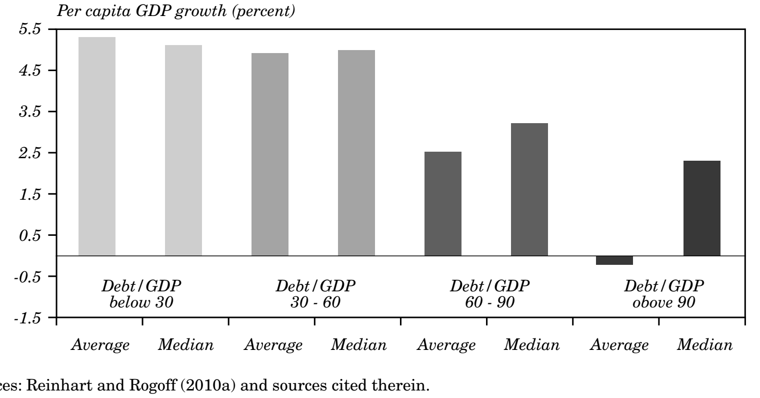
**Figure 8. Debt and Real Per Capita GDP Growth: Selected Advanced and Emerging-Market Economies, 1946–2009**

*A. Gross central government debt*




*B. Gross external (public plus private) debt*




Sources: Reinhart and Rogoff (2010a) and sources cited therein.

Note that of the 1,186 annual observations, there are a significant number in each category, including 96 above 90 percent (recent observations in that top bracket come from Belgium, Greece, Italy, and Japan.) From the figure, it is evident that there is no obvious link between debt and growth until public debt exceeds the 90 percent threshold. The observations with debt to GDP over 90 percent have median growth roughly one percent lower than the lower debt burden groups and mean levels of growth almost 4 percent lower (using lagged debt does not dramatically change the picture.)

## 3.2 High Debt Episodes in the Sample

The episodes that attract our interest are those where debt levels were historically high. As convenient as it is to focus exclusively on a particular country or a single episode for a single country (like the US around World War II, where the data are readily available, or an interesting ongoing case like Japan), the basis for an empirical regularity is multiple observations. Because our data span 44 countries with many going back to the 1800s or at least the beginning of the 19th century, our analysis is based on all the episodes of high (above 90 percent) debt for the post–World War II period; for the prewar sample it covers all those for which data are available. Table 3 is reproduced from Reinhart and Rogoff (2010a) and describes the coverage and the basic statistics for the various debt levels for the advanced economies.[17]

It is common knowledge that the US emerged after World War II with a very high debt level. But this also held for Australia, Canada, and most markedly the United Kingdom, where public debt/GDP peaked at near 240 percent in 1948. These cases from the aftermath of World War II are joined in our sample by a number of peacetime high-debt episodes: the 1920s and 1980s to the present in Belgium; the 1920s in France; Greece in the 1920s, 1930s, and 1990s to the present; Ireland in the 1980s; Italy in the 1990s; Spain at the turn of the last century; the United Kingdom in the interwar period and prior to the 1860s; and, of course, Japan in the past decade. As will be discussed, episodes where debt is above 90 percent are themselves rare, and as shown in table 3, a number of countries have never had debt entries above 90 percent.

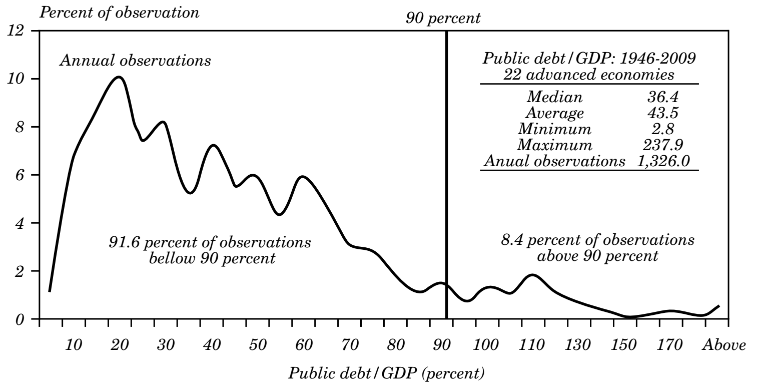
17. Again, the interested reader is referred to the original working paper version of Reinhart and Rogoff (2010a). See NBER Working Paper 15639 (January 2010).

**Table 3. Real GDP Growth as the Level of Government Debt Varies: Selected Advanced Economies, 1790–2009**
Annual percent change

| | | *Central (federal) government debt/GDP* | | | |
|---|---|---|---|---|---|
| *Country* | *Period* | *Below 30 percent* | *30 to 60 percent* | *60 to 90 percent* | *90 percent and above* |
| Australia | 1902–2009 | 3.1 | 4.1 | 2.3 | 4.6 |
| Austria | 1880–2009 | 4.3 | 3.0 | 2.3 | n.a. |
| Belgium | 1835–2009 | 3.0 | 2.6 | 2.1 | 3.3 |
| Canada | 1925–2009 | 2.0 | 4.5 | 3.0 | 2.2 |
| Denmark | 1880–2009 | 3.1 | 1.7 | 2.4 | n.a. |
| Finland | 1913–2009 | 3.2 | 3.0 | 4.3 | 1.9 |
| France | 1880–2009 | 4.9 | 2.7 | 2.8 | 2.3 |
| Germany | 1880–2009 | 3.6 | 0.9 | n.a. | n.a. |
| Greece | 1884–2009 | 4.0 | ***0.3*** | ***4.8*** | 2.5 |
| Ireland | 1949–2009 | 4.4 | 4.5 | 4.0 | 2.4 |
| Italy | 1880–2009 | ***5.4*** | ***4.9*** | 1.9 | 0.7 |
| Japan | 1885–2009 | 4.9 | 3.7 | 3.9 | 0.7 |
| The Netherlands | 1880–2009 | 4.0 | 2.8 | 2.4 | 2.0 |
| New Zealand | 1932–2009 | 2.5 | 2.9 | 3.9 | 3.6 |
| Norway | 1880–2009 | 2.9 | 4.4 | n.a. | n.a. |
| Portugal | 1851–2009 | 4.8 | 2.5 | 1.4 | n.a. |
| Spain | 1850–2009 | ***1.6*** | 3.3 | ***1.3*** | 2.2 |
| Sweden | 1880–2009 | 2.9 | 2.9 | 2.7 | n.a. |
| United Kingdom | 1830–2009 | 2.5 | 2.2 | 2.1 | 1.8 |
| United States | 1790–2009 | 4.0 | 3.4 | 3.3 | ***–1.8*** |
| Average | | 3.7 | 3.0 | 3.4 | 1.7 |
| Median | | 3.9 | 3.1 | 2.8 | 1.9 |
| Number of observations = 2,317 | | 866 | 654 | 445 | 352 |

Sources: There are many sources; among the more prominent are International Monetary Fund, World Economic Outlook; OECD; World Bank, Global Development Finance. Extensive other sources are cited in Reinhart and Rogoff (2009).
Notes: n.a. denotes no observations were recorded for that particular debt range. There are missing observations, most notably during World War I and II years; further details are provided in the data appendices to Reinhart and Rogoff (2009) and are available from the authors. Minimum and maximum values for each debt range are shown in bold italics.

**Figure 9. The 90 percent debt/GDP threshold: 1946–2009, advanced economies probability density function.**




Sources: Reinhart and Rogoff (2011c).
Notes: The advanced economy sample is the complete IMF grouping (Switzerland and Iceland were added). It includes Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Japan, Netherlands, New Zealand, Norway, Portugal, Spain, Sweden, Switzerland, the United Kingdom, and the US.

## 3.3 Debt Thresholds and Nonlinearities: The 90 Percent Benchmark

Thresholds and nonlinearities play a key role in understanding the relationship between debt and growth that should not be ignored in casual reinterpretations.

**Thresholds.** Anyone who has done any work with data is well aware that mapping a vague concept, such as “high debt” or “overvalued” exchange rates to a workable definition for interpreting the existing facts and informing the discussion requires making arbitrary judgments about where to draw lines. In the case of debt, we worked with four buckets: 0 to 30 percent, 30 to 60 percent, 60 to 90 percent, and over 90 percent. The last one turned out to be the critical one for detecting a difference in growth performance, so we single it out for discussion here.

Figure 9 shows the public debt to GDP ratio as well as pooled descriptive statistics (inset) for the advanced economies (to complement the countryspecific ones shown in table 3) over the post World War II period.[18] The median public debt/GDP ratio is

18. Our sample includes 24 emerging-market countries.

36.4 percent; about 92 percent of the observations fall below the 90 percent threshold (see figure 9). In effect, about 76 percent of the observations were below the 60 percent Maastricht criteria.

Put differently, our "high vulnerability" region for lower growth (the area under the curve to the right of the 90 percent line) comprises only about 8 percent of the sample population. The standard considerations about type I and type II errors apply here.[19] If we raise the upper bucket cutoff much above 90 percent, then we are relegating the high-debt analysis to case studies (the United Kingdom in 1946–50 and Japan in recent years). Only about 2 percent of the observations are at debt-to-GDP levels at or above 120 percent, and that includes the aforementioned cases.

If debt levels above 90 percent are indeed as benign as some suggest, one might have expected to see a higher incidence of these over the long course of history. Certainly our read of the evidence, as underscored by the central theme of our 2009 book *This Time Is Different: Eight Centuries of Financial Folly*, hardly suggests that politicians are universally too cautious in accumulating high debt levels. Quite the contrary, far too often they take undue risks with debt buildups, relying implicitly perhaps on the fact that these risks often take a very long time to materialize. If debt-to-GDP levels over 90 percent are so benign, then generations of politicians must have been overlooking proverbial money on the street.

We do not pretend to argue that growth will be normal at 89 percent and subpar (about one percent lower) at 91 percent debt/GDP any more than a car crash is unlikely at 54 miles per hour and near certain at 56 miles per hour. However, mapping the theoretical notion of *vulnerability regions* to bad outcomes by necessity involves defining thresholds, just as traffic signs in the US specify speed of 55 miles per hour.[20]

**Nonlinear relationship.** In Reinhart and Rogoff (2010a), we summarized our results thus:

> ...the relationship between government debt and real GDP growth is weak for debt/GDP ratios below a threshold of 90 percent of GDP. Above 90 percent, median growth rates fall by one percent, and average growth falls considerably more.

19. The null hypothesis is whatever "normal" growth is versus the alternative of lower growth.

20. These methodology issues are discussed in Kaminsky and Reinhart (1999).

Revisiting figure 8 is useful for illustrating the importance of nonlinearities in the debt-growth link. Simply put, for 92 percent of the observations in our sample there is no systematic link between debt and growth.[21] Thus, if one were to do a simple scatterplot of all the observations on debt/GDP and on growth one would expect to find a "clouded mess." We can highlight this general point with the US case. As we noted in the working paper version of Reinhart and Rogoff (2010a), for the period 1790–2009, there are a total of 216 observations of which 211 (or 98 percent) are below the 90 percent debt-to-GDP cutoff. It should be quite obvious that a scatterplot of the US data would not be capable of revealing a systematic pattern (as demonstrated in Iron and Bivens, 2010). Indeed, this example illustrates one of our main results: that there is no systematic relationship between debt and growth below a threshold of 90 percent of GDP.

## 3.4 Debt and Growth Causality

As discussed, we examine average and median growth and inflation rates contemporaneously with debt. Temporal causality tests are not part of the analysis. The application of many of the standard methods for establishing temporal precedence is complicated by the nonlinear relationship between growth and debt (more of this to follow) that we have alluded to.

But where do we place the evidence on causality? For low-to-moderate levels of debt there may or may not be one; the issue is an empirical one, which merits study. For high levels of debt the evidence points to bi-directional causality.

**Growth-to-debt:** As we discuss in section II, our analysis of the aftermath of financial crisis (Reinhart and Rogoff 2008) presents compelling evidence for both advanced and emerging markets over 1800–2008 on the fiscal impacts (revenue, deficits, debts, and sovereign credit ratings) of the recessions associated with banking crises (figure 2). There is little room to doubt that severe economic downturns, irrespective of whether their origins was a financial crisis or not, will, in most instances, lead to higher debt/GDP levels contemporaneously and/or with a lag. There is, of course, a vast literature on cyclically adjusted fiscal deficits making exactly this point.

21. Bruno and Easterly (1998) find similar nonlinearities in the inflation-growth relationship.

**Debt-to-growth:** A unilateral causal pattern from growth to debt, however, does not accord with the evidence. Public debt surges are associated with a higher incidence of debt crises (figure 4).[22] This temporal pattern is analyzed in Reinhart and Rogoff (2008) and in the accompanying country-by-country analyses cited therein (Reinhart and Rogoff, 2011b). In the current context, even a cursory reading of the recent turmoil in Greece and other European countries can be importantly traced to the adverse impacts of high levels of government debt (or potentially guaranteed debt) on country risk and economic outcomes. At a very basic level, a high public debt burden implies higher future taxes (inflation is also a tax) or lower future government spending, if the government is expected to repay its debts.

There is scant evidence to suggest that high debt has little impact on growth. Kumar and Woo (2010) highlight in their cross-country findings that debt levels have negative consequences for subsequent growth, even after controlling for other standard determinants in growth equations. For emerging markets, an older literature on the debt overhang of the 1980s frequently addresses this theme.

## 4. The Aftermath of High Debt: The 1930s and World War II

Up until very recently, financial markets and policymakers had all but forgotten that default and restructuring are not alien to the advanced economies. For instance, Reinhart, Rogoff, and Savastano (2003) and Reinhart and Rogoff (2009) document that several now-wealthy countries have a long history of serial default. This section does not attempt to review this rich sovereign debt crisis history; the focus is confined to the last two “global” debt spikes. These two high-debt episodes share some of the characteristics of the current debt spike, as they involve numerous advanced economies (accounting for an important share of world GDP).

The first part of the section presents a brief sketch of the last wave of sovereign defaults, restructurings, and forcible conversions in response to the debt overhang during the 1930s that engulfed the advanced economies while the second subsection outlines the more subtle debt restructuring that was facilitated by pervasive financial repression during the 1940s to the 1970s.

22. For a model where credit-financed government deficits lead to a currency crisis, see Krugman (1979).

## 4.1 Default, Restructurings, and Forcible Conversions in the 1930s

Table 4 lists the known "domestic credit events" of the Great Depression. Default on or restructuring of external debt (see the notes to the table) also often accompanied the restructuring or default of the domestic debt. All the allied governments, with the exception of Finland, defaulted on (and remained in default through 1939 and never repaid) their World War I debts to the US as economic conditions deteriorated worldwide during the 1930s.[23]

## 4.2 Financial Repression in 1940s–70s: The "Quiet" Restructuring

Apart from emerging markets, many of which have continued to openly periodically default or restructure their debts (usually at times of severe economic stress) through the present, the only explicit defaults (or restructurings) in advanced economies since World War II were confined to either those of the countries that lost the war (Austria, Germany, Italy, and Japan) or those that never reestablished their credit since slipping into default in the 1930s (Greece, for instance, was in default from 1932 until 1964).

Financial repression was the post-World War II "politically correct" replacement for the more open debt restructurings and defaults of the 1930s.

Generally, the aims of debt restructuring are (1) reducing the value of the stock of existing debts (haircut); (2) reducing debt servicing costs (by cutting or capping interest rates); and (3) minimizing rollover risk by lengthening maturities and/or shifting into nonmarketable debt. Financial repression achieves all three goals of debt restructuring— albeit that the first (reducing the value) is achieved more gradually than in open restructurings. Thus, as argued in Reinhart and Rogoff (2009), financial repression—a hallmark of the 1940s–70s—is nothing other than a more subtle form of debt restructuring. Legislation or "moral suasion" limiting the range and amounts of nongovernment debt domestic assets financial institutions can hold; limiting further (or outright forbidding)

23. Finland, being under continuous threat of Soviet invasion at the time, maintained payments on its debts to the US so as to maintain the best possible relationship.

**Table 4. Selected Episodes of Domestic Debt Default or Restructuring, 1920s–40s**

| *Country* | *Dates* | *Commentary* |
|---|---|---|
| *For additional possible domestic defaults in several European countries during the 1930s, see notes below.* | | |
| Australia | 1931/1932 | The Debt Conversion Agreement Act in 1931/32 appears to have done something similar to the later New Zealand induced conversion. See New Zealand entry.[a] |
| Bolivia | 1927 | Arrears of interest lasted until at least 1940. |
| Canada (Alberta) | April 1975 | The only province to default—which lasted for about 10 years. |
| China | 1932 | First of several "consolidations", monthly cost of domestic service was cut in half. Interest rates were reduced to 6 percent (from over 9 percent)—amortization periods were about doubled in length. |
| Greece | 1932 | Interest on domestic debt was reduced by 75 percent since 1932; domestic debt was about 1/4 of total public debt. |
| Mexico | 1930s | Service on external debt was suspended in 1928. During the 1930s, interest payments included "arrears of expenditure and civil and military pensions." |
| New Zealand | 1933 | In March 1933 the New Zealand Debt Conversion Act was passed providing for voluntary conversion of internal debt amounting to 113 million pounds to an interest rate of 4 percent for ordinary debt and 3 percent for tax-free debt. Holders had the option of dissenting but interest in the dissented portion was made subject to an interest tax of 33.3 percent.[a] |
| Peru | 1931 | After suspending service on external debt on May 29, Peru made "partial interest payments" on domestic debt. |
| Romania | February 1933 | Redemption of domestic and foreign debt is suspended (except for three loans). |
| Spain | Oct 1936 - Apr 1939 | Interest payments on external debt were suspended; arrears on domestic debt service accumulated. |
| United States | 1933 | Abrogation of the gold clause. In effect, the US refused to pay Panama the annuity in gold due to Panama according to a 1903 treaty. The dispute was settled in 1936 when the US paid the agreed amount in gold balboas. |

**Table 4. (continued)**

| *Country* | *Dates* | *Commentary* |
|---|---|---|
| United Kingdom | 1932 | Most of the outstanding World War I debt was consolidated into a 3.5 percent perpetual annuity. This domestic debt conversion was apparently voluntary. However, some of the World War I debts to the US were issued under domestic (UK) law (and therefore classified as domestic debt) and these were defaulted on following the end of the Hoover 1931 moratorium. |
| Uruguay | Nov 1, 1932 - Feb, 1937 | After suspending redemption of external debt on January 20, redemptions on domestic debt were equally suspended. |
| Austria | December 1947 | Restoration of schilling (150 limit per person); remainder placed in blocked accounts. In December 1947, large amounts of previously blocked schillings were invalidated and rendered worthless; temporary blockage of 50 percent of deposits. |
| Germany | June 20, 1948 | Monetary reform limiting 40 deutsche mark per person; partial cancellation and blocking of all accounts. |
| Japan | March 2, 1946 - 1952 | After inflation, exchange of all bank notes for new issue (1 to 1) limited to 100 yen per person; remaining balances were deposited in blocked accounts. |
| Russia | 1947 | The monetary reform subjected privately held currency to a 90 percent reduction. |
| | April 10, 1957 | Repudiation of domestic debt (about 253 billion rubles at the time). |

Sources: Reinhart and Rogoff (2011c).

a. See Schedvin (1970) and Prichard (1970), for accounts of the Australian and New Zealand conversions, respectively, during the Depression. Michael Reddell kindly alerted us to these episodes and references.

Notes: We have made significant further progress in sorting out the defaults on World War I debts to the US, notably by European countries. In all cases these episodes are classified as a default on external debts. However, in some cases—such as the United Kingdom—some of the World War I debts to the US were also issued under domestic law and, as such, would also qualify as a domestic default. The external defaults on June 15, 1934 included Austria, Belgium, Czechoslovakia, Estonia, France, Greece, Hungary, Italy, Latvia, Poland, the United Kingdom. Only Finland made payments. See New York Times, June 15, 1934.

**Table 5. Debt Liquidation through Financial Repression: Italy, United Kingdom, and US, 1945–55**

| | *Public debt / GDP* | | | *Annual average: 1946–1955* | |
|---|---|---|---|---|---|
| *Country* | *1945* | *1955 (actual)* | *1955 without repression savings (estimate)*[c] | *"Financial repression revenue" / GDP* | *Inflation* |
| Italy[a] | 79.2 | 38.1 | 129.3 | 9.1 | 10.8 |
| United Kingdom[b] | 215.6 | 138.2 | 182.9 | 4.5 | 5.9 |
| United States | 116.0 | 66.2 | 118.6 | 5.2 | 4.2 |

Source: Reinhart and Sbrancia (2011).
a. Italy was in default on its external debt 1940–46.
b. The savings from financial repression are a lower bound, as we use the "official" consumer price index for this period in the calculations and inflation is estimated to have been substantially higher than the official figure (see for example Friedman and Schwartz, 1963).
c. The simple cumulative annual savings without compounding.
Notes: The peaks in debt/GDP were: Italy 129.0 in 1943; United Kingdom 247.5 in 1946; United States 121.3 in 1946. An alternative interpretation of the financial repression revenue is simply as savings in interest service on the debt.

holdings of foreign assets; and requiring financial institutions to hold more government debt were all part of the "financially repressed landscape." A whole range of interest rate ceilings (for example, on deposits) made holding low-yielding government bonds also more palatable for individuals as well as institutions. Pension funds have historically provided the "captive audience par excellence" for placing vast sums of government debt at questionable rates of return (often negative ex post in real terms). It is worth noting that the real ex post interest rate on public debt (appropriately weighted by the type of debt instrument) was negative for US debt for 25 percent of the years during 1945–80, while the comparable share for the United Kingdom was nearly 50 percent, as Reinhart and Sbrancia (2011) document.

Table 5 illustrates, for the examples of Italy, the United Kingdom, and the US, the important role played by financial repression (combined with some inflation) in the crucial debt-reduction decade that followed World War II.[24] The savings range from an average of about 9 percent for Italy (which had higher inflation) to about 5 percent for the US and United Kingdom. In effect, the savings from financial repression are a lower bound for the United Kingdom, as we use the "official" consumer price index for this period in the calculations and inflation is estimated to have been substantially higher than the official figure (see, for example, Friedman and Schwartz, 1963). Also, other factors (such as the 1951 US conversion, which swapped marketable for nonmarketable debt) do not factor into these simple debt-reduction calculations. The simple fact is that ex post real interest rates were significantly lower in both advanced and emerging-market economies during the financial repression era that is sandwiched between World War II and the high real interest rates of the 1930s and the post-financial and capital account liberalization that has swept through financial markets since the mid-1980s.

## 4. Conclusion

One need look no further than the stubbornly high unemployment rates in the US and other advanced economies to be convinced of the importance of developing a better understanding of the growth prospects for the decade ahead. We have presented evidence

24. See Reinhart and Sbrancia (2011) for a full fledged analysis of the international role played by financial repression in reducing the World War II debt overhang.

suggesting that high levels of debt dampen growth. One can argue that the US can tolerate higher levels of debt more than other countries can without having its solvency called into question. That is probably so.[25] We have shown in our earlier work that a country's credit history plays a prominent role in determining what levels of debt it can sustain without landing on a sovereign debt crisis. More to the point of this analysis, however, we have no comparable evidence yet to suggest that the consequences of higher debt levels for growth will be different for the US than for other advanced economies.

Figure 10, which plots total (public and private) credit market debt outstanding for the US during 1916 to 2010.I, makes this point clear.[26] Despite considerable deleveraging by the private financial sector, total debt remains near its historic high in 2008. Total public-sector debt during the first quarter of 2010 is 117 percent of GDP; since 1916 (when this series begins) it has been higher only during a one-year stint at 119 percent in 1945. Perhaps soaring US debt levels will not prove to be a drag on growth in the decades to come. However, if history is any guide, that is a risky proposition, and overreliance on US exceptionalism may only prove to be one more example of the This Time is Different Syndrome.[27]

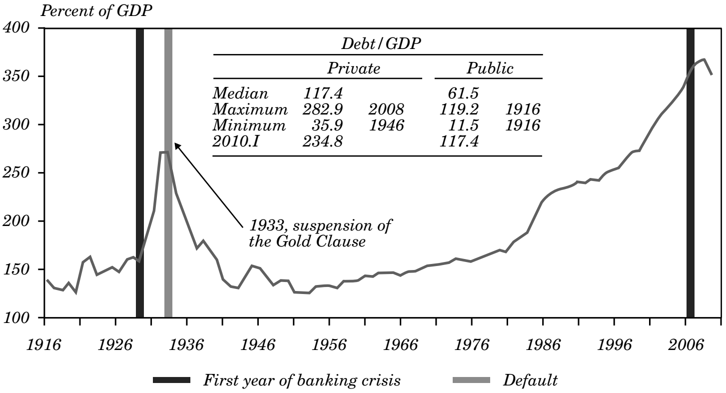
The sharp runup in public-sector debt will likely prove one of the most enduring legacies of the 2007–09 financial crises in the US and elsewhere. We examine the experience of 44 countries spanning up to two centuries of data on central government debt, inflation, and growth. Our main finding is that across both advanced countries and emerging markets, high debt/GDP levels (90 percent and above) are associated with notably lower-growth outcomes. Much lower levels of external debt/GDP (60 percent) are associated with adverse outcomes for emerging-market growth. Seldom do countries "grow" their way out of debts. The nonlinear response of growth to

25. Indeed, this is the central argument in Reinhart and Reinhart (2010), originally published on November 17, 2008.

26. The Flow of Funds data aggregate the private and public sectors, where the latter comprises federal (net), state, and local government enterprises. To reiterate, this is not the public debt measure used in our historical analysis; we use gross central government debt (which for the US is at present about 90 percent of GDP).

27. The This Time is Different Syndrome is rooted in the firmly held beliefs that (1) financial crises and negative outcomes are something that happen to other people in other countries at other times (these do not happen here and now to us); (2) we are doing things better, we are smarter, we have learned from the past mistakes; and (3) as a consequence, old rules of valuation are not thought to apply any longer.

**Figure 10. Total (Public and Private) Credit Market Debt Outstanding: US, 1916–2010.I**




Sources: Reinhart and Rogoff (2011c).
Notes: Beginning in 2010.I, almost all Fannie Mae and Freddie Mac mortgage pools are consolidated in Fannie Mae's and Freddie Mac's balance sheets and, thus, are included in the debt of government.

debt as debt grows toward historical boundaries is reminiscent of the "debt intolerance" phenomenon developed in Reinhart, Rogoff, and Savastano (2003). As countries hit debt intolerance ceilings, market interest rates can begin to rise quite suddenly, forcing painful adjustment.

For many if not most advanced countries, dismissing debt concerns at this time is tantamount to ignoring the proverbial elephant in the room. So is pretending that no restructuring will be necessary. It may not be called restructuring, so as not to offend the sensitivities of governments that want to pretend to find an advanced-economy solution for an emerging market style sovereign debt crisis. As in other debt crisis resolution episodes, debt buybacks and debt equity swaps are a part of the restructuring landscape. Financial repression is not likely to also prove a politically correct term—so prudential regulation will probably provide the aegis for a return to a system more akin to what the global economy had prior to the 1980s market-based reforms. The process where debts are being "placed" at below-market interest rates in pension funds and other more captive domestic financial institutions is already under way in several countries in Europe. Central banks on both sides of the Atlantic have become even bigger players in purchases of government debt, possibly for the indefinite future. For the US, fear of currency appreciation continues to drive central banks in many emerging markets to purchase US government bonds on a large scale. In other words, markets for government bonds are increasingly populated by nonmarket players, calling into question the information content of bond prices relative to their underlying risk profile—a common feature of financially repressed systems.

## References

Agenor, P.-R. and P.J. Montiel. 2008. *Development Macroeconomics*. Princeton University Press.

Arellano, C. and N. Kocherlakota. 2008. *Internal Debt Crises and Sovereign Defaults*. NBER Working Paper 13794. Cambridge, MA: National Bureau of Economic Research.

Beim, D.O., and C. W. Calomiris. 2001. *Emerging Financial Markets*. New York: McGraw-Hill/Irwin.

Bivens, J. and J. Irons. 2010. *Government Debt and Economic Growth*. Briefing Paper 271, Economic Policy Institute.

Brock, P. 1989. "Reserve Requirements and the Inflation Tax," *Journal of Money, Credit and Banking* 21(1): 106-121.

Bruno, M. and W. Easterly. 1998. Inflation Crises and Long-Run Growth. *Journal of Monetary Economics* 41(1): 3–26.

Campbell, J.Y. and K.A. Froot. 1994. "*International Experiences with Securities Transaction Taxes*," NBER Chapters in: *The Internationalization of Equity Markets*. National Bureau of Economic Research.

Cukierman, A. 1992, *Central Bank Strategy, Credibility, and Independence: Theory and Evidence*. MIT Press.

Díaz-Alejandro, C. 1985. Goodbye Financial Repression, Hello Financial Crash. *Journal of Development Economics* 19.

Easterly, W. 1989. Fiscal Adjustment and Deficit Financing During the Debt Crisis. In *Dealing with the Debt Crisis*, ed. I. Husain and I. Diwan. Washington: World Bank.

Fostel, A. and J. Geanokoplos. 2008. Leverage Cycles and the Anxious Economy. *American Economic Review* 98(4): 1211–44.

Friedman, M. and A.J. Schwartz. 1963. *A Monetary History of the US 1867–1960*. Princeton: Princeton University Press.

Gagnon, J. and M. Hinterschweiger. 2011. *The Global Outlook for Government Debt over the Next 25 Years: Implications for the Economy and Public Policy*. Policy Analyses in International Economics 94. Washington: Peterson Institute for International Economics.

Geanokoplos, J. 2009. The Leverage Cycle. In *NBER Macroeconomic Annual 2009*, volume 24, D. Acemoglu, K.S. Rogoff and M. Woodford, (eds.). Chicago: University of Chicago Press.

Giovannini, A. and M. de Melo. 1993. Government Revenue from Financial Repression. *American Economic Review* 83(4): 953–63.

Kaminsky, G.L. and C.M. Reinhart. 1999. The Twin Crises: The Causes of Banking and Balance of Payments Problems. *American Economic Review* 89(3): 473–500.

Kaminsky, G.L., C.M. Reinhart, and C.A. Vegh. 2003. The Unholy Trinity of Financial Contagion. *Journal of Economic Perspectives* 17(4): 51–74.

Krugman, P.R. 1979. A Model of Balance of Payments Crises. *Journal of Money, Credit and Banking* 11(August): 311–25.

Kindleberger, C.P. 1989. *Manias, Panics and Crashes: A History of Financial Crises*. New York: Basic Books.

Kumar, M. and J. Woo. 2010. *Public Debt and Growth*. IMF Working Paper 174 (July). Washington: International Monetary Fund.

Milesi-Ferretti, G.M., F. Strobbe, and N. Tamirisa. 2010. *Bilateral Financial Linkages and Global Imbalances: A View on The Eve of the Financial Crisis*. IMF Working Paper 257. Washington: International Monetary Fund.

McKinnon, R. 1973. *Money and Capital in Economic Development*. Brookings Institution.

Meltzer, A.H. 2003. *A History of the Federal Reserve, Volume 1: 1913-1951*, University of Chicago Press.

Prichard, M.F.L. 1970. *An Economic History of New Zealand to 1939*. Auckland: Collins.

Reinhart, C.M. and V.R. Reinhart. 2011 (forthcoming). After the Fall. Forthcoming in Federal Reserve Bank of Kansas City Economic Policy Symposium, *Macroeconomic Challenges: The Decade Ahead*, Jackson Hole, Wyoming, August 26–28, 2010.

Reinhart, C.M. and K.S. Rogoff. 2008. *This Time is Different: A Panoramic View of Eight Centuries of Financial Crises*. Working Paper 13882 National Bureau of Economic Research.

Reinhart, C.M. and K.S. Rogoff. 2009. *This Time is Different: Eight Centuries of Financial Folly*. Princeton: Princeton University Press (October).

Reinhart, C.M. and K.S. Rogoff. 2010a. Growth in a Time of Debt. *American Economic Review* 100(2): 573–78. Also published as NBER Working Paper 15639 (January 2010).

Reinhart, C.M. and K.S. Rogoff. 2010b. *Debt and Growth Revisited*. VoxEU, August 11, www.voxeu.org.

Reinhart, C.M. and K.S. Rogoff. 2011a (forthcoming). Domestic Debt: The Forgotten History. *Economic Journal* (May).

Reinhart, C.M. and K.S. Rogoff. 2011b (forthcoming). From Financial Crash to Debt Crisis. *American Economic Review*. Also published as NBER Working Paper 15795 (March 2010).

Reinhart, C.M. and K.S. Rogoff, 2011c, A Decade of Debt, Policy Analyses in International Economics 95, Peterson Institute for International Economics. Washington D.C.: USA.

Reinhart, C.M. and M.B. Sbrancia. 2011. *The Liquidation of Government Debt*. Working Paper 11–10. Washington: Peterson Institute for International Economics.

Reinhart, C.M., K.S. Rogoff, and M.A. Savastano. 2003. Debt Intolerance. *Brookings Papers on Economic Activity* 1(Spring): 1–74.

Shaw, E. 1973. *Financial Deepening in Economic Development*. Oxford University Press.

Schedvin, C.B. 1970. *Australia and the Great Depression*. Sydney: Sydney University Press.

Velasco, A. 1987. Financial and Balance-of-Payments Crises. *Journal of Development Economics* 27(1/2): 263–83.

# Tales of Two Recessions in Chile: Financial Frictions in 1999 and 2009

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During 2007-2009, the world underwent a deep economic crisis that has been termed the Great Recession, where total output is estimated to have decreased 0.6%. This event has had two salient characteristics: it was a financial shock that originated in advanced economies, and in the end, most of the economies of the world experienced negative rates of economic growth. The nature of the recession has renewed the interest of economists in studying the effects of financial shocks on aggregate economic activity. Understanding the precise mechanisms through which financial shocks spread to the rest of the economy has been at the center of the research agenda.

In this paper we aim to contribute to the studies that try to understand the propagation of financial shocks to the real economy. For this we use a unique database of non-financial Chilean firms that identify the banks that have extended loans to each of them. This firm-level database also indicates the amount of investment undertaken each year. We also have detailed balance-sheet information of the banks operating in Chile. Combining these two pieces of information, we are able to study the relationship between changes in the financial health of lenders, and the performance of the firms to which they have lent funds. In particular, we can analyze how banks financial characteristics—in particular their degree of

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leverage—affect their lending behavior and the investment decisions of firms to which they lend.

Another prominant feature of our paper is that we will conduct a comparative study of the recession experienced in Chile in 2009, with the previous economic contraction observed in the country. The last recession observed in Chile had occurred exactly ten years earlier in 1999. We adopt this comparative approach for several reasons. First, it is important to put an event in perspective that has been termed the *Great Recession*. How does the crisis of 2009 compare with other periods of economic distress? To what extent were developments observed in the banking sector in 2009 different from other recessions? Another important reason to make this comparison is to gauge the extent to which policy actions, during both events, might have had an impact on the observed performance during the crises. As we explain in section 1 between the two crises, there were important changes to the macroeconomic policy framework in Chile. Although it is no simple task to evaluate the contribution of each of these policy changes to observed changes in performance, the comparative study might shed some light on the benefits of adopting a "bundle" of reforms, which might be a valuable lesson for other developing economies.

Our empirical analysis is divided in two parts. First, we focus on the developments of the banking sector in Chile. We start by looking at the aggregate trends in bank loans in each episode, noticing that the recovery in lending was much faster after the 2009 recession. Another noticeable element that appears when one compares both episodes, is that the shift towards foreign assets (deposits abroad) was less intense in the more recent recession. Both of these differences in the reaction of banks in the two episodes could have been of importance for the real effects of the financial shocks. To shed more light on the reasons that could explain this different behavior, next we use the individual balance sheet data of banks operating in Chile in the period under study.

Our central aim when using the bank-level data is to examine the joint dynamics of leverage and asset growth, both in the buildup and the aftermath of each recession. As will be explained in more detail later, the extent to which leverage evolves over the business cycle is of central importance, both for the buildup of financial vulnerabilities and for the depth of the crises in the aftermath of a shock. Several important results emerge from the analysis of Chilean banks' leverage. First, and as documented by other economies, leverage appears to be strongly procyclical. Next, and related to this first result, even though banks reduced their leverage in both episodes, the intensity of the process was weaker in 2009 and was more intense for the smaller banks. Lastly we document a strong positive correlation at the bank level between the *decrease* in lending during the crises, and its leverage at the onset of the crises.

Having documented this important correlation between the dynamics of lending and leverage, we turn to our non-financial firms database to examine the implications that the developments in the banking sector could have for the real economy. As explained earlier, for each firm we can identify all the creditor banks for which, in turn, we have data on their leverage prior to each financial crisis under analysis. We are able then to build, for each firm in the sample, a measure of the *average leverage* of its bank debt. We then regress the amount of investment on these measure of leverage of creditors and find a negative association between these variables. This is another important finding of the paper, in the sense that it provides evidence that illustrates the channels through which financial shocks spill over to the real economy.

The remainder of the paper is organized as follows. The next section provides a brief description of macroeconomic development in Chile during the 1999 and 2009 recessions. Next, in section 2, we look at the performance of commercial banks operating in Chile in both recessions, using both aggregate and balance sheet data. In section 3 we study the evolution of banks' leverage, its behavior around crises and its effects on banks' post-crises lending. After that we turn to the dynamics of the corporate sector in section 4. Section 5 concludes.

## 1. Macroeconomic Developments in Chile during 1999 and 2009

The Chilean economy has experienced two recessions in the last 10 years. The first of these took place in 1999, when the economy fell 0.8%; while during the second one in 2009, total output decreased by 1.7%. Both of these events were associated with disruptions of different intensity in international markets. In this section we will provide a brief overview of the macroeconomic development in each event and the associated policy response.[1]

1. Along with the cited references, this section draws also from De Gregorio (2008, 2009).

The Asian Crisis that started unfolding in 1997 affected Chile's economy through several channels. As Caballero (2002) and Céspedes and others (2006) document, the reduction in foreign financing through lower capital inflows was a clear manifestation of the crisis. The decrease in the volume of capital flows to Chile was also accompanied by increases in both sovereign and corporate premiums. Taken together, this suggests that a negative shock to the supply of foreign funds was the main culprit for the decrease in capital inflows. Foreign income of the country also decreased as its terms of trade declined, led by the decrease in the price of copper, its main export.

On the domestic front the onset of the Asian Crisis found Chile at the peak of an expansionary cycle. Domestic demand had grown at a faster rate than GDP since 1995 and the Central Bank expected the current account deficit to reach 8% of GDP in 1998. The rapid increase in aggregate expenditure constituted a serious threat for the fulfillment of the inflationary target for 1998. The decrease in international financing, plus the anticipated real exchange rate adjustment needed to bring the current account to a more sustainable path, triggered expectations of nominal depreciation. Although the exchange rate band in place at the time would have accommodated a sizable nominal depreciation, the authorities were concerned that the depreciation of the currency would feed into domestic inflation. Faced with this policy dilemma and witnessing several speculative attacks on the Chilean peso during 1998, the Central Bank opted for non-sterilized interventions in the foreign exchange markets and several hikes of the monetary policy rate. The non-sterilized interventions proved to be particularly disruptive for the interbank market. As liquidity was drained, the interbank rate reached, on some days, levels of 60% in real terms (annual equivalent). This implied a complete halt of banking operations, as that rate was indeed higher than the maximum allowed by Chilean law in any credit operation.

Towards the end of June of 1998 the pressures on the currency intensified again, and the Central Bank responded with significant policy changes: the exchange rate band was considerably narrowed in an effort to contain the nominal depreciation, and the controls on capital inflows were loosened. Again the overnight interbank rate reached levels that were beyond the maximums allowed by law, dealing a significant blow to credit markets. This noticeable level of disarray in domestic financial markets that occurred in June of 1998, leads us to set the second quarter of 1998 as the initial date of the economic crises that would lead to the recession in 1999. The tightening of monetary policy continued over the course of 1998: in September, the monetary policy rate was increased to 14% in real terms, capital controls were completely eliminated, and new adjustments to the exchange rate band were made.

In contrast to the events observed 10 years earlier, the financial crisis that began in 2007 was initiated in advanced markets. As before, the financial channel also proved to be one of the main transmission mechanisms of the foreign shock. This was seen in the steady increase of the borrowing costs for domestic banks (García, 2009) since September of 2007 that would peak with the collapse of Lehman Brothers a year later.

At the onset of this crisis, Chile's economy was weathering the impact of the significant increase in the commodity prices that the world had experienced in previous years. As financial tensions in advanced markets gained momentum, inflation in Chile rose steadily and this prompted the Central Bank to implement a series of hikes in its policy rate. As a result of these developments, at the collapse of Lehman Brothers, the monetary policy rate in Chile was at its all time high since it was set in nominal terms, and year to year inflation was more than three times higher than the Central Bank's target. Given this conjunction of events and the intensity of the disruption observed in international financial markets in the weeks following the bankruptcy of Lehman Brothers, propmts us to set the third quarter of 2008 as the starting point of the 2008-2009 crisis.

The initial response of the Central Bank was to put several actions in place, aimed at increasing short-term liquidity in dollars and pesos. The monetary policy rate was held constant through the last quarter of 2008. As the scenario of a rapid and deep deterioration of the world economic outlook become more plausible, private agents adjusted their expectations of inflation and growth downwards quickly. The Central Bank followed this revision of expectations with massive cuts of 600 basis points of its policy rate in January and February of 2009. The reaction of the monetary authority in 2009 presents a stark contrast with the one observed 10 years earlier.

The different response of the Central Bank to an adverse shock can be framed within significant changes to the policy environment that took place after 1999. First, a fully fledged inflation targeting regime was adopted. The inflation target became the economy's nominal anchor, and the exchange rate band that prevailed in 1999 was formally abandoned. Along with this, the Central Bank took several steps to increase its transparency and communication with markets. Another important change was the removal of all the restrictions to transactions in the capital (financial) account which was accompanied by a significant increase in the depth of foreign exchange forward markets. A final important element that was significantly different in 2009, was the perceived coefficient of pass-through from nominal exchange rate depreciation, to domestic inflation. At the time of the Asian Crisis, this coefficient was estimated to be between 50% and 70%. This element was a key consideration in the decision to opt for interventions in the foreign exchange market and increases in the domestic interest rate (Céspedes and others, 2006). In contrast, the consensus at the onset of the *Great Recession,* was that the pass-through coefficient was significantly lower—in the neighborhood of 30% (De Gregorio and Tokman, 2004). Taken together, all these elements indicate that the Central Bank of Chile enjoyed a much higher degree of monetary independence in 2009, and could implement the aggressive monetary expansion observed from the beginning of that year.

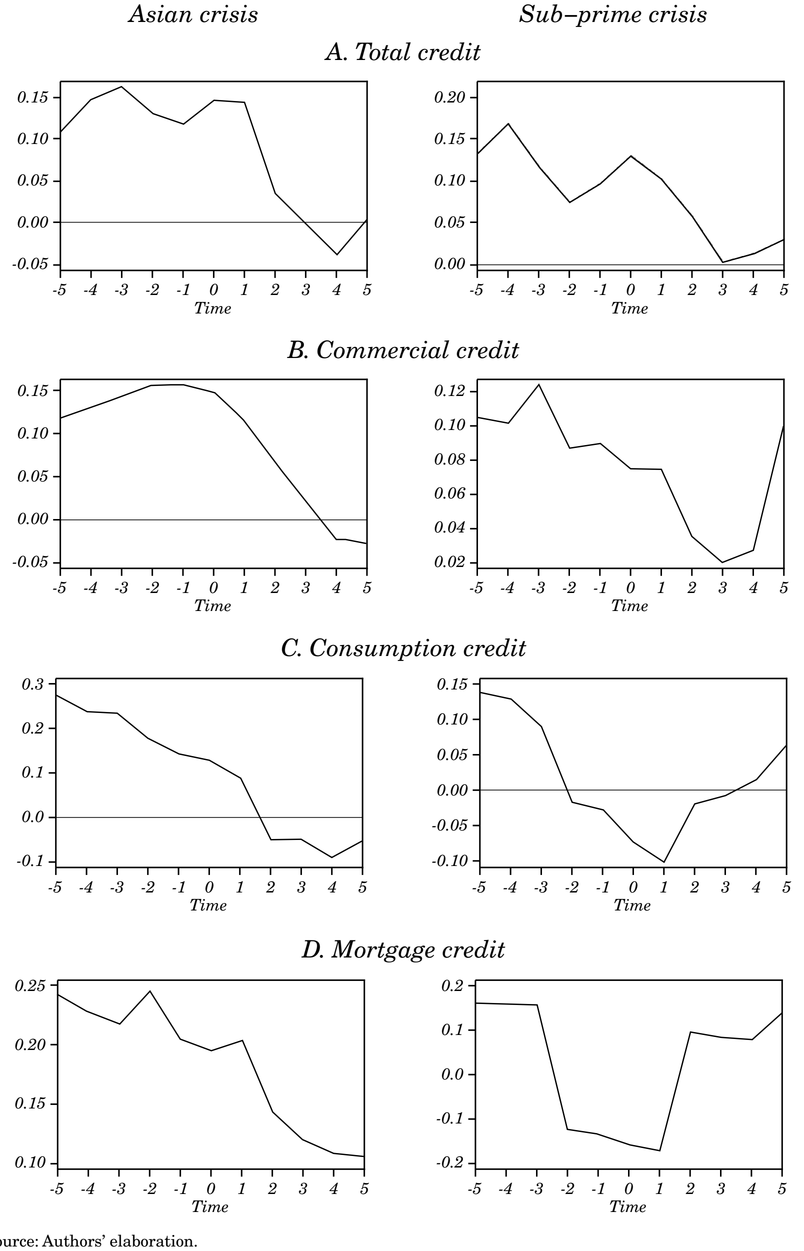
Isolating the effects of the monetary policy followed in both events, from the ones derived from the crises itself, is a difficult task that we do not pursue here. However, in the following sections we will relate some of our findings to the policy environment, but recognizing that we are not able to take definitive conclusions from our exercises in this respect.

## 2. Chile's Banking Sector during the 1999 and 2009 Recession

In this section we describe the behavior of banks in reaction to the crises that hit the Chilean economy in 1998 and 2008. We focus the analysis on banks' lending evolution, their leverage, and on the interaction between these variables looking at event studies and regression analysis. In the event studies the "0" in the figures corresponds to the quarter when the crises were identified that correspond to the second quarter in 1998 and the third quarter in 2008. The axis measures the quarters from these. All the data we use in this section comes from publicly available information from all the commercial banks operating in Chile from 1989 to 2010.

As can be seen in figure 1, the yearly growth rate of total credit diminished in both crises; although, it did so more pronouncedly in the Asian crisis reaching negative growth rates. The graph also

**Figure 1. Credit Growth**
Yearly growth




Source: Authors' elaboration.

shows that the recovery began one quarter earlier after the crisis in 2008, than in 1998. The deceleration in credit growth began before the identification of the crisis in 2008, a phenomenon that looks less evident in the 1998 crisis. Looking at the decomposition of credit growth we can see that commercial loans, consumption and mortgages did not show the same patterns. In the Asian crisis, the reduction in commercial loans' growth began before consumption loans. In the Sub-prime crisis, the anticipation of commercial and consumption credit growths is more difficult to distinguish.

The quicker recovery in total credit in the 2008 crisis may have been the consequence of the more expansive policies adhered to in this opportunity.

Next we turn to the evolution of the same variables as in the previous paragraph, but considering heterogeneity between banks.

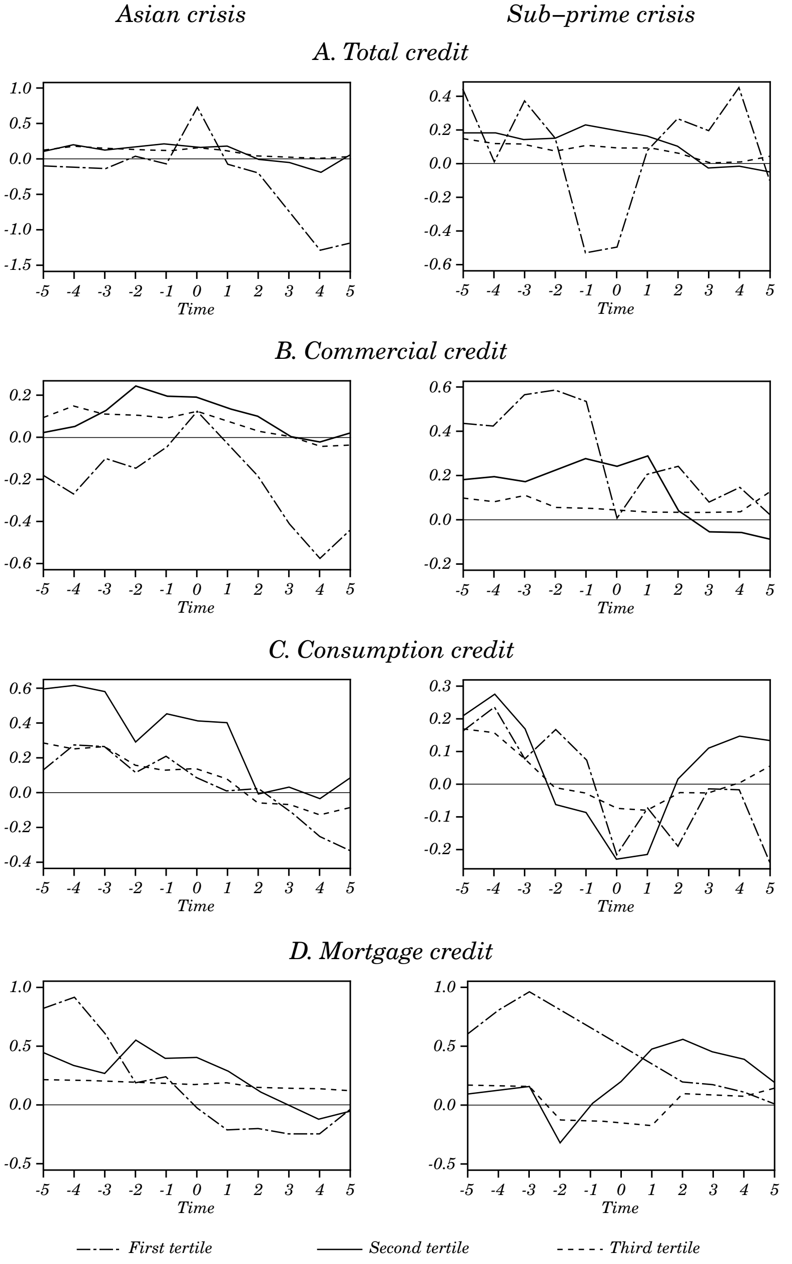
Figure 2 presents the same information as previous graphs, but classifying banks by size. To do this, we divide banks into three sets according to the size of their total assets. In general, the graphs suggest that banks in the highest tier show less relative variation than banks in the other two groups. The comparison between the middle and lowest group is more ambiguous. It depends on the type of credit, and whether the crisis is the Asian, or the Sub-prime.

Credit behavior according to nationality is shown in figure 3. In general foreign-banks' credit growth rate has been below the one corresponding to Chilean banks. Comparing total credit growth, the behavior in both categories was more similar in the 2008 crisis than in the 1998, where the decline of the credit growth rate was higher for foreign banks.

Looking at the short-term deposits that banks hold abroad (in figure 4) it can be seen that in 1998 there was a significant increase in these deposits, two quarters after the crisis was identified. In the 2008 crisis the effect exists especially for Chilean banks, but in a lower magnitude. Liquidity in a crisis becomes especially valuable. In monetary policy expansive phases, Central Banks provide liquidity to the system. A risk is that banks hold this liquidity instead of injecting it into the system. This may be particularly undesirable if banks translate liquidity abroad in middle of a crisis. As explained in section 1, monetary policy responses were different in both crises. While in 1998 the Central Bank raised interest rates before and after the crisis hit, that is a contractionary monetary policy (for example, Céspedes and others, 2006), in the Sub-prime crisis the Central Bank implemented an expansionary policy that included unconventional

**Figure 2. Credit Growth by Size**

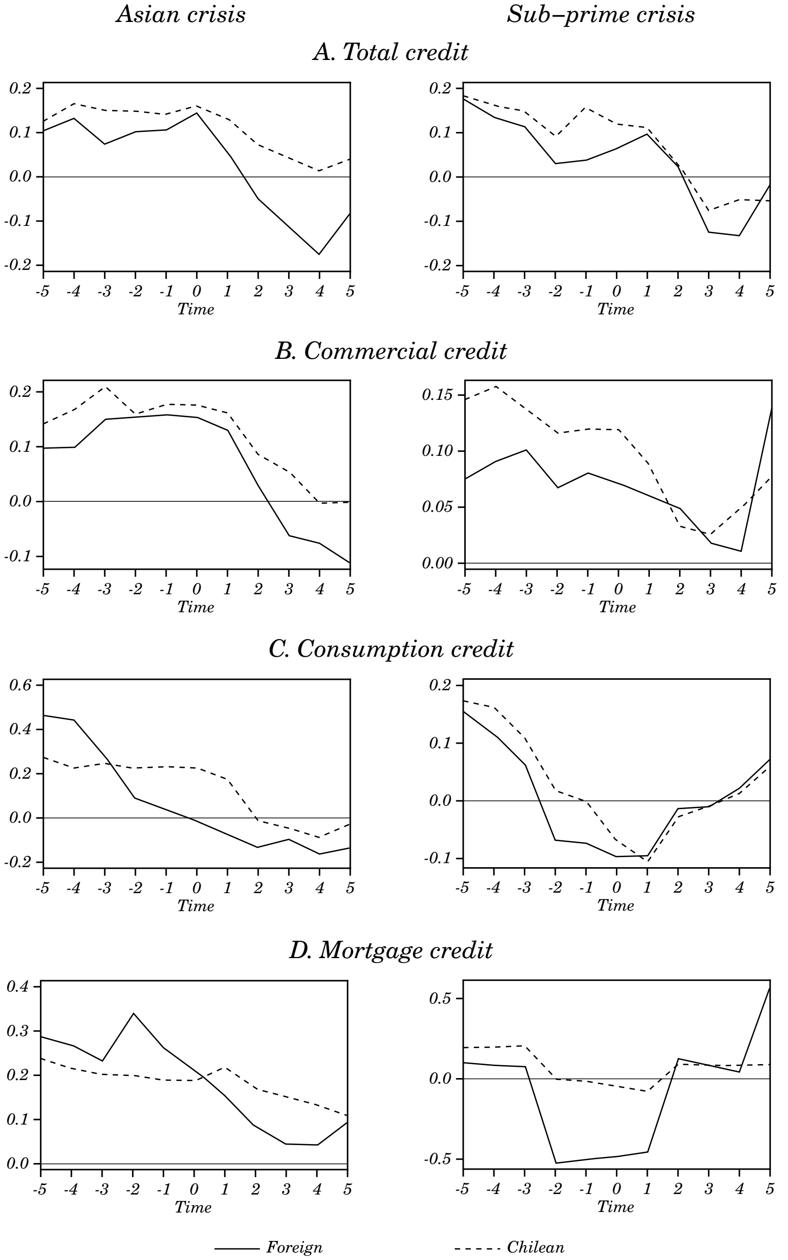
Yearly growth




Source: Authors' elaboration.

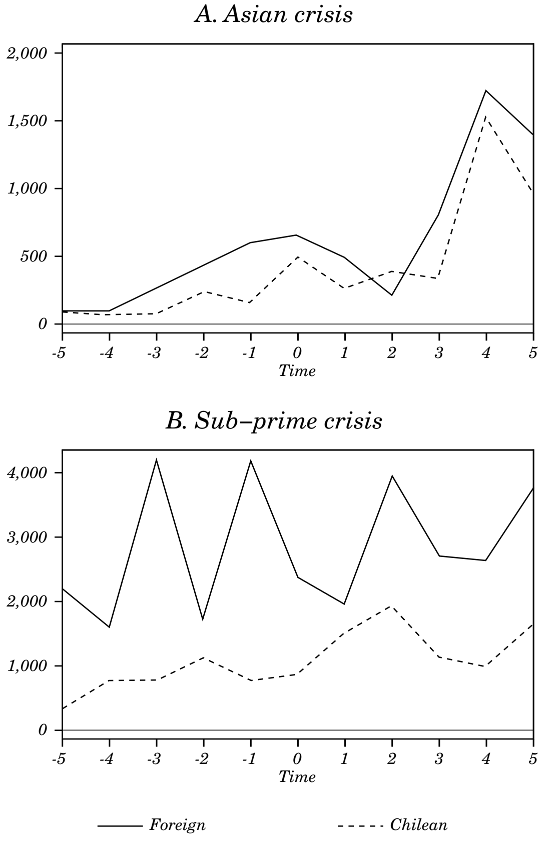
## Figure 3. Credit Growth by Nationality

Yearly growth




Source: Authors' elaboration.

**Figure 4. Short-Term Deposits Abroad**
Millions of US dollars




Source: Authors' elaboration.

liquidity provision. Thus, these graphs suggest that the increase in the deposits abroad in 1998 was not done with liquidity provided by the Central Bank. In 2008, however, the increase in deposits abroad may have been financed in part by the expansionary monetary policy. Along with this, given the significant distress in international financial markets that was observed in 2008, especially the perceived increase in counterparty risk after Lehman's collapse, it is possible that domestic banks felt reluctant to increase the share of foreign deposits in their portfolios.

## 3. Evolution and Effects of Banks' Leverage

In this section we study the evolution of banks' leverage, its behavior around crises and its effects on banks' post-crises lending.

First, we start with an overview of the related literature.

Crises in developing countries have usually been preceded with periods of capital inflows and credit expansion (Reinhart and Rogoff, 2008, 2009). Recently, some works have focused on risk-taking of financial intermediaries during periods of high liquidity, which may result in being the seed of the next crisis. Acharya and Naqvi (2011) showed that when financial intermediaries are awash of liquidity they are more prone to excessive risk-taking behavior derived from moral hazard issues, which end up in an asset bubble. Adrian and Shin (2010b) highlight a connection between liquidity and risk-taking actions derived from an active management of the balance sheet expansions, inherent to financial intermediation activities, and not from agency problems. In periods of low short-term interest rates (high liquidity) the term spread, which determines the profitability of the marginal loan added to the balance sheet, increases. This boosts the future value of capital of financial intermediaries. This, in turn, triggers new lending, given the higher risk-bearing from the banks. Adrian and Shin (2010b) analysis is motivated by the transmission channel of monetary policy, but the reasoning could be applied to periods of high liquidity in general.

Some recent works present evidence on the relationship between credit behavior, financial intermediaries' leverage, business cycles and crises. For example, in a recent contribution, Schularick and Taylor (2012) use historical data from 1870 to 2008 for fourteen developed countries. They note that banks' balance sheets have become bigger and riskier over time and that banks' leverage increased notably in the period after World War II. They find support to the view that the financial system itself creates instability through endogenous lending booms and an increase in banks' leverage. This is especially the case in post-war crises. Thus their evidence supports other works' hypotheses that crises are "credit booms that went wrong" (for example, Reinhart and Rogoff, 2008, 2009).

In a related work Jordà, Schularick, and Taylor (2011) find that the effects of leverage are particularly pronounced when the recession coincides with a financial crisis, but that there are similar effects in normal recessions. The aftermath of leveraged booms is associated with somewhat slower growth, investment spending, and credit growth than usual. They also show that the economic costs of crises depend on the run-up in leverage during the preceding boom, and that the increase in leverage during the boom heightens the vulnerability of the economies to shocks. The preceding discussion suggests that leverage is important for macroeconomic *instability*. There seems to be a leverage build-up before crises and a deleveraging after them. Schularick and Taylor (2012) noted that this delivering is lower after the post-war crises. This delivering process is likely to be costly, and an amplifier of the original shock.

Given the connection between boom and bust cycles, liquidity and financial intermediates behavior, and given the important role that banks play in the intermediation of credit in economies like Chile: studying the strength of their balance sheets during boom and bust periods is an important issue.

The evidence for the Chilean economy indicates that banks' leverage is procyclical. Thus, leverage would act as an amplifier for the shocks that hit the economy (see, for example, Adrian and Shin, 2010a).[2] The initial reduction in the value of the assets caused by the shock would be amplified as banks reduce debt and sell securities in order to reduce their leverage. An active management of leverage would affect the transmission of shocks to the economy.

Figure 5 presents raw data showing the relationship between quarterly increases in banks' total assets and the quarterly increase in leverage, which is defined, from here on, as the ratio of total assets to net worth. As can be seen, there is a positive correlation between these two variables for the whole period 1990 to 2010, and for the years where the crises were present.

Figure 6 shows that there is a deleveraging process in the quarters following the crises. In the case of the Asian crisis, one quarter before the quarter identified as the crisis, the average leverage for the system was 13.6 percentage points while two quarters later, this magnitude decreased to approximately 12.5 percent.

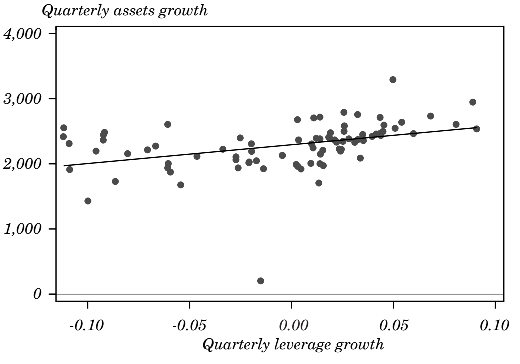
The middle panel in figure 6 presents the evolution of average leverage, dividing the sample by size, with the same criteria as before.[3] In both cases, bigger banks show less proportional

2. Adrian and Shin (2010a) show evidence that leverage prociclality is present in investment banks and security dealers in the US but not in US banks whose leverage is acyclical.

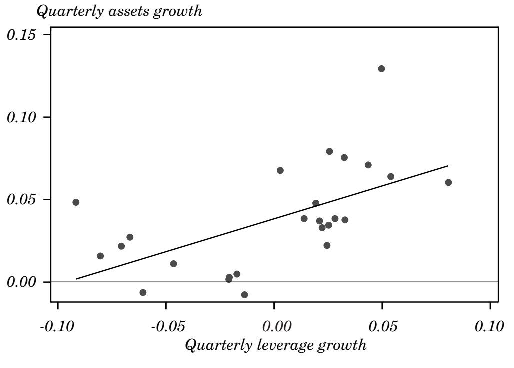
3. We normalize the value of leverage at 100, five quarters before the crisis for the three categories.

## Figure 5. Leverage Procyclicality

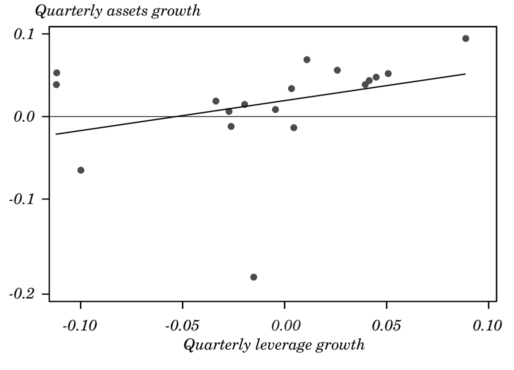
*A. All sample*




*B. Asian crisis*

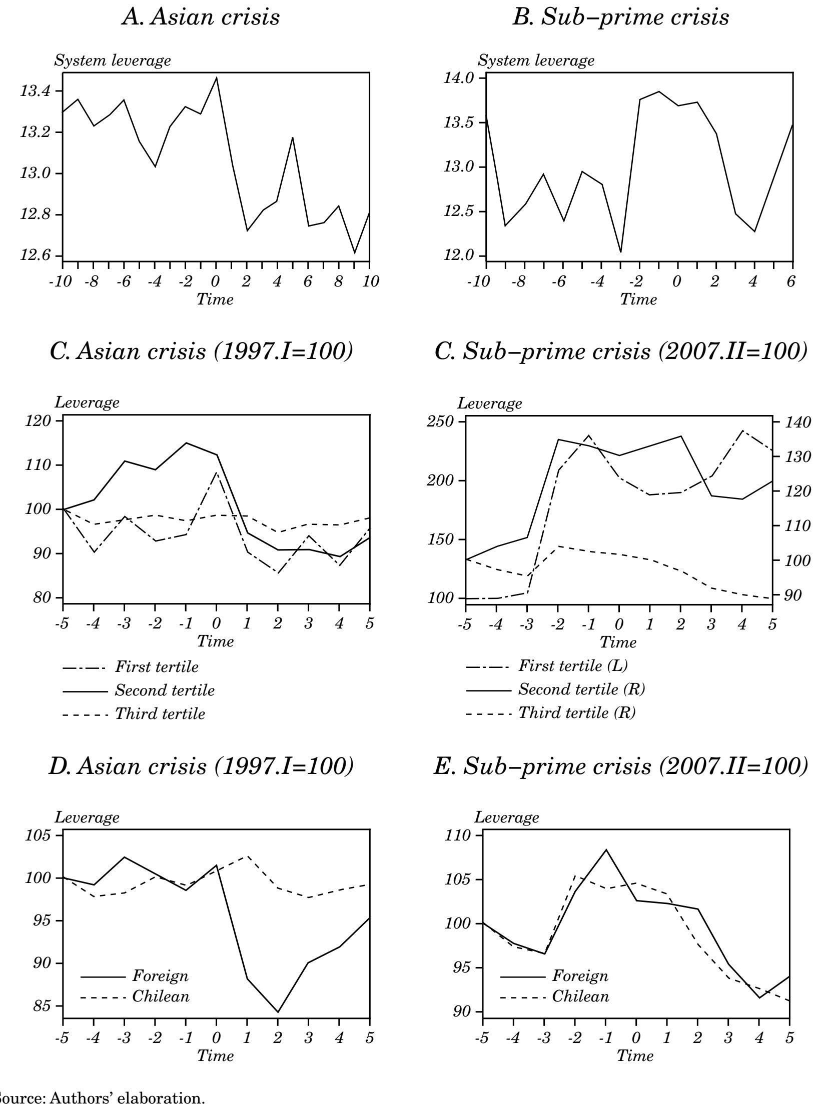



*C. Sub–prime crisis*




Source: Authors' elaboration.

## Figure 6. System Leverage, Leverage by Size and Leverage by Nationality




Source: Authors' elaboration.

**Table 1. Procyclicality of Leverage, Regression 1**
Dependent variable: Quarterly leverage growth

| | *All sample* | *1997.I-1999.III* | *2007.II-2009.IV* |
|---|---|---|---|
| Quarterly assets growth | 0.277*** | 0.904*** | 0.107*** |
| | (0.010) | (0.030) | (0.021) |
| Fusion dummy | -0.041* | -0.117*** | -0.029 |
| | (0.021) | (0.034) | (0.173) |
| Constant | 0.003 | -0.016*** | 0.035** |
| | (0.003) | (0.006) | (0.018) |
| No. of observations | 2,566 | 337 | 280 |
| $R^2$ | 0.229 | 0.744 | 0.094 |
| No. of banks | 45 | 31 | 27 |

Source: Authors' elaboration.
Standard errors in parentheses.
*** $p<0.01$, ** $p<0.05$, * $p<0.10$.

variation than the other two groups. In Chile, bigger banks present higher levels of leverage. The average level of leverage is 14.5 percentage points for the highest tier, 10.3 for the middle one, and 5 for the smallest one. Thus, these differences in the magnitude of proportional variation would be due to differences in levels to begin with. Bigger banks have higher levels of leverage and lower percentage variation.

Looking at the evolution of leverage around crisis, in the last row of figure 6, we can see that in 1998 most variation came from foreign banks, while in 2008 the evolution of foreign and Chilean banks was much more similar than in the previous case.

We next turn to the panel-regression analysis to see procyclicality of leverage and the effects of leverage on bank lending. Our database consists of balance sheet information at an individual bank level for the period from 1989 to 2010. The number of banks varies in the sample as, although some have disappeared, new ones are created and there are some acquisitions. The average number of banks is 31; the highest number is 39, in 1989; and the lowest is 25, in 2010.

In table 1 we present the regression using the increase in leverage as the left-hand side variable and the increase in total assets in the right-hand side; this is following Adrian and Shin

(2010a).[4] In the first column we report the results for the whole sample, while in the second and third columns we report the results for the Asian and Sub-prime crises. As suggested by the graphs discussed above: leverage is procyclical. An increase of one percentage point in total assets translates into an increase of twenty seven percentage points in leverage. The magnitude is economically significant; an increase of one standard deviation in total assets, which is thirty six percentage points, translates into an increase of leverage of ten percentage points. A relevant effect given that the mean of the increase in leverage is one percentage point, and the standard deviation, eighteen percent.

Although the sign is the same for both crises, the magnitude is different. A shock of one standard deviation in both sub-samples translates into an increase of sixteen percentage points in the Asian crisis, and ten percentage points in the Sub-prime crisis. These magnitudes are close to the standard deviations in both cases.

The findings in the previous paragraph indicates that, in the last crisis, the process of leverage reduction, after it, was slower than after the previous one. This also could have been a consequence of the expansive monetary policy that was followed. By having access to cheaper funds, banks have less incentives to reduce their leverage, using same reasoning as Adrian and Shin (2010b), mentioned above.

Table 2 presents results discriminating by size, using the same classification as above. We estimate the regression using an interaction term between the increase in total assets, and the variable indicating the tier to which a bank bellows. This variable can take the value of *one*, if the bank belongs to the smallest group; a value of *two*, if it is in the middle group; or *three*, if it is in the group with highest assets.

The results suggest that size matters. However, the effects obtained for both crises differ. For the whole sample, and in the case of the Sub-prime crisis, the results indicate that the bigger a bank is—in terms of total assets—the higher is its procyclicality. However the opposite is true in the case of the Asian crisis. For the Sub-prime crisis, the effective coefficient indicates that an increase

4. Throughout the regressions we use a dummy variable indicating whether a bank was involved in a merge or acquisition since in these periods there would be a discrete jump in assets.

**Table 2. Procyclicality of Leverage, Regression 2**
Dependent variable: Quarterly leverage growth

| | *All sample* | *1997.I-1999.III* | *2007.II-2009.IV* |
|---|---|---|---|
| Quarterly assets growth | -0.368*** | 1.321*** | -0.817*** |
| | (0.025) | (0.085) | (0.045) |
| Fusion dummy | -0.077*** | -0.098*** | -0.083 |
| | (0.019) | (0.033) | (0.103) |
| Bank size | -0.019** | 0.052* | 0.058 |
| | (0.008) | (0.028) | (0.081) |
| Bank size change | 0.526*** | -0.259*** | 0.836*** |
| | (0.019) | (0.049) | (0.039) |
| Constant | 0.028* | -0.117** | -0.143 |
| | (0.016) | (0.057) | (0.181) |
| No. of observations | 2.566 | 337 | 280 |
| $R^2$ | 0.407 | 0.767 | 0.683 |
| No. of banks | 45 | 31 | 27 |

Source: Authors' elaboration.
Standard errors in parentheses.
*** $p<0.01$, ** $p<0.05$, * $p<0.10$.

**Table 3. Procyclicality of Leverage, Regression 3**
Dependent variable: Quarterly leverage growth

| | *All sample* | *1997.I-1999.III* | *2007.II-2009.IV* |
|---|---|---|---|
| Quarterly assets growth | 0.229*** | 0.894*** | 0.075*** |
| | (0.009) | (0.029) | (0.018) |
| Fusion | -0.040* | -0.120*** | -0.065 |
| | (0.021) | (0.029) | (0.130) |
| Nationality dummy | 0.007 | -0.012 | -0.020 |
| | (0.008) | (0.012) | (0.035) |
| Bank size | -0.002 | -0.005 | -0.004 |
| | (0.005) | (0.007) | (0.022) |
| Constant | 0.006 | 0.000 | 0.060 |
| | (0.009) | (0.014) | (0.054) |
| No. of observations | 2,566 | 337 | 280 |
| $R^2$ | 0.407 | 0.767 | 0.683 |
| No. of banks | 45 | 31 | 27 |

Source: Authors' elaboration.
Standard errors in parentheses.
*** $p<0.01$, ** $p<0.05$, * $p<0.10$.

of one standard deviation, in total assets, increases leverage by almost 5% if the bank is in the smallest group, by 82% if it is in the middle group, and 160% in the highest. In the Asian crisis these magnitudes are 190%, 140% and 97% respectively.

Table 3 includes, in the regression, a dummy variable that takes the value of *one* if the bank is Chilean and *zero* otherwise. This dummy does not yield any significant effect in procyclicality. Thus, we are not able to find a relationship between increases in assets and leverage, although, we have seen graphically that the level of leverage varies differently, according to nationality, around crises.

We turn next to the effects that leverage has on bank lending. This is important because the relevance of studying leverage relies on the effect that this variable has on the economy, and bank lending is at the heart of the effects that banks may have in real variables.

In the following regressions, we use the annual growth of credit as the dependent variable and the leverage level, in the quarter before a crisis hit the economy.

In column 1 of table 4, we estimate the regression for the whole sample; in column 2 and column 3, for the quarters immediately before and after the Asian crisis; and in column 4 and 5, we run the same exercise but for the Sub-prime crisis. We can see that for the whole sample there is no significant effect of leverage on lending. However, around crises, conclusions change. For both crises we find that the higher the level of leverage that a bank brings to a crisis, the larger the reduction on its lending; this can be inferred from columns 2 and 4. The effect disappears in the regressions following the crisis (columns 3 and 5).

Above we have seen that, on average, banks reduce their leverage after a crisis. The results of this regression complement that finding; banks would be reducing their lending, in order to strengthen the *liability side* of the balance sheet, by reducing their leverage.

Also, as shown above, banks' leverage reduction was lower in the Sub-prime crisis, but the negative effect of leverage on credit growth was lower in this crisis. Both results together imply that, for some reason, leverage was less harmful in the last episode and, thus, banks needed a lower reduction in leverage.

**Table 4. Procyclicality of Leverage, Regression 4**

Dependent variable: Total credit growth (yearly)

| | *All sample* | *1998.I-1998.II* | *1998.III-1998.IV* | *2008.I-2008.II* | *2008.III-2008.IV* |
|---|---|---|---|---|---|
| Leverage$_{t-1}$ | -0.012 | -1.014* | 0.004 | -0.423*** | 0.003 |
| | (0.034) | (0.584) | (0.319) | (0.144) | (0.537) |
| Fusion dummy | 0.135** | -0.027 | | | |
| | (0.060) | (0.407) | | | |
| Bank size | -0.005 | 1.189*** | -0.072 | | 0.081 |
| | (0.027) | (0.306) | (0.311) | | (0.341) |
| Constant | 0.112 | -0.252 | 0.083 | 0.933*** | -0.119 |
| | (0.087) | (1.544) | (1.123) | (0.300) | (1.306) |
| No. of observations | 2,383 | 62 | 61 | 46 | 46 |
| $R^2$ | 0.002 | 0.478 | 0.003 | 0.282 | 0.003 |
| No. of banks | 43 | 31 | 31 | 23 | 23 |

Source: Authors' elaboration.
Standard errors in parentheses.
*** $p<0.01$, ** $p<0.05$, * $p<0.10$.

## 4. Financial Frictions and Firm Performance

In this section we examine the extent to which financial frictions might have had an impact on the performance of Chilean firms in the aftermath of the financial shocks, which ultimately led to the recessions of 1999 and 2009. To do this we will use firm level data for a sample of Chilean firms. This database contains detailed information on the firms' financial statements. With that information we are able to test specific mechanisms through which financial conditions may affect the performance of the economy during a recession. Our evidence suggests that after a period of financial distress, maturity mismatches constitute a drag on investment. We also find evidence that relates the financial health of the banks that lend to each corporation, with the intensity of the effect of maturity mismatches on firms' investment.

The source of our data is the *Ficha Estadística Codificada Uniforme* (FECU) that a subsample of Chilean corporations must submit to the *Superintendencia de Valores y Seguros* (SVS), the government agency in charge of overseeing the domestic financial market. Only firms in Chile, issuing stocks and debt instruments in open markets, are required to submit FECU. In practice this means that the firms in our sample are, in all likelihood, the ones with more ample financial access. This is a desirable characteristic for our research purposes since we aim to study the behavior of firms after a financial shock, focusing on the potential changes to its access to external financing. Nevertheless, our sample does not include the smallest firms in the economy, which should be considered when interpreting our results.

We begin our analysis of the effects of financial disruption on firms performance, looking at the impact of maturity mismatches on investment. This has been one channel previously explored in the literature to try explaining the fall in real outcomes after financial shocks. The mechanism to be explored states that firms with a greater gap, between their short-term liabilities and assets, will experience a larger contraction of investment in the aftermath of a decrease in the aggregate supply of financing. In a scenario where payments due, in the short term, exceed the amount of liquid assets of the firm, and new financing is not available, firms will be forced to scale back their purchases of fixed capital.

To test this mechanism we ran the following cross section regressions for each year's recession, 1999 and 2009:

$$Investment_i = \beta \times \left( \frac{Short\text{-}term\ Liabilities - Short\text{-}term\ Assets}{Total\ Assets} \right)_i + \varepsilon_i \quad (1)$$

The dependent variable is the amount of investment reported by firm *i* in a recession year. It is calculated as the annual change in the stock of fixed capital normalized by initial total assets of the firm. The right-hand side variable is the measure of maturity mismatch commonly used in the literature, and it is measured in the year before the crisis. To save on notation, the short-term mismatch that appears in parenthesis in the right hand side of (1), will be denoted by $ST$. $\varepsilon_i$ is a random error.

We acknowledge that investment has many other determinants that do not appear in equation (1). Yet, in this study we are interested in testing whether financial characteristics of firms affect investment in periods of economic distress. To correctly identify this effect it needs to be the case that the other determinants of investment are uncorrelated with our measure of maturity mismatch. This assumption of no correlation is likely to hold in practice, since in traditional models of investment, financial variables play no role at all. Moreover, it is important to remember that in equation (1) the variable *ST* is measured the year *before* the recession, so problems of reverse causality are unlikely to bias the estimation of $\beta$.[5]

The results of the estimation of (1), for years 1999 and 2009, are presented in table 5. As can be seen in columns (a) and (c) the coefficient associated with the maturity mismatch variable enters with a negative, and significant, sign. This suggests that financial frictions in the balance sheet of firms contributed to the decrease in investment observed in each of the recessions. To provide further support to our identification strategy, we estimate regression (1) the years before and after each recession, which is in the spirit of a falsification strategy: if the mechanism we are trying to identify is relevant only in recessions, then the estimated $\beta$ in non crisis years should be not statistically significant. The results show that this is precisely the case, which lends additional support to the importance of maturity mismatches. Our findings contradict the results of Bleakley and Cowan (2010) that support the view that maturity mismatches are irrelevant for investment during episodes

5. This identification strategy for $\beta$ is essentially the same argument given by Bleakley and Cowan (2010) to estimate.

**Table 5. Maturity Mismatches and Firm Level Investment**
Dependent variable: Investment

| | *1999* | | *2009* | |
|---|---|---|---|---|
| Maturity mismatch (ST) | -0.164* | 0.371 | -0.137* | 0.36 |
| | (0.10) | (0.24) | (0.08) | (0.31) |
| Bank leverage | | -0.0397** | | -0.026* |
| | | (0.0171) | | (0.016) |
| ST × Bank leverage | | 0.159 | | 0.086 |
| | | 0.111 | | 0.122 |
| Constant | 0.0283* | 0.0931** | 0.0224* | 0.086** |
| | (0.016) | (0.036) | (0.012) | (0.040) |
| No. of observations | 155 | 104 | 187 | 187 |
| $R^2$ | 0.017 | 0.053 | 0.015 | 0.035 |

Source: Authors' elaboration.
Standard errors in parentheses.
*** $p<0.01$, ** $p<0.05$, * $p<0.10$.

of contractions in the foreign supply of credit. One possible way to reconcile both results, is to consider that our sample is broader than the one in Bleakley and Cowan (2010).[6]

Our next exercise takes advantage of the great level of detail of the information in the FECU database for exploring the link between the financial conditions of banks and the performance of its debtors. Specifically, firms are required to inform the amount of debt and currency that they owe to each bank. We use this information to build a measure of the average leverage of the banks that have extended loans to each firm. For this, first we compute $\alpha_j$ which corresponds to the share of bank's $j$ in firm's $i$ total short-term debt with all banking institutions. Next, from the banks balance sheet (the same data that we described earlier) we compute the leverage measure $L_j$. With these two pieces of information we can therefore build $l_{ij}$ which is a weighted average of the firm's creditors' leverage:

$$l_{ij} = \sum_j \alpha_j \cdot L_j, \tag{2}$$

6. Our sample consists of 155 and 187 for 1999 and 2009 respectively. Bleakley and Cowan (2010) include approximately 100 firms and all of them are listed in the stock market so they are probably the ones with best access to alternative (that is, other than banks) sources of funding.

which we use to extend our regression (1) in the following way:

$$Investment_i = \beta \cdot ST_i + \phi ST_i \cdot l_{ij} + \gamma \cdot l_{ij} + \varepsilon_i. \tag{3}$$

We estimate equation 3, for each of the recession years. Our results reported in table 5 tend to support the view that the financial health of banks does affect the performance of the firms they have lent money to, in a way that tends to amplify the financial shocks in the banking sector. For both episodes we observe that the average leverage of the banks that have provided short-term funding, has a negative impact on firms' investment; and the magnitude of these effects is similar in both events. As was described in section 2, banks with higher leverage are the ones that exhibit the larger drops in lending activity during periods of economic distress. Therefore one would expect that firms that have contracted debt with more leveraged institutions, will exhibit larger declines in investment, which is precisely what we find. Following this same reasoning, one would expect that the interaction term would also show up with a negative coefficient in the regressions. This result is only obtained for the 1999 episode, although the statistical significance is not high ($p$-value is 0.15).

To summarize, there appears to be evidence that links characteristics of financial institutions to its creditors during times of economic turbulence. This suggests that the identity of creditor institutions, and their leverage levels, should be of interest to policy makers since it may shed light on the expected behavior of the corporate sector when banks undergo difficulties.

## 5. Conclusions

In this paper we present micro-evidence on Chilean banks' and firms' behavior around the Asian and Sub-prime crises. We find that, in Chile, banks' leverage is procyclical which may be a shock amplifier. The evidence shows that banks that had a higher leverage level at crises time, were the ones that reduced their credits more, after the crises. Banks' leverage procyclicality was lower in the Sub-prime crisis than in the Asian crisis, as was the sensibility of credits. Consequently, the evidence suggests that in the last crisis, banks reduced their leverage less, but this behavior did not reduce credits in the same magnitude, as would have been the case if the credit elasticity to changes in leverage were as high as the one in the Asian crisis.

Using information in firms' financial statements, we were able to know which banks lend to them. The evidence shows that firms that borrow from more leveraged banks are the ones that reduce their investment more after a crisis. This is in accordance with the discussion about the relationship between banks' leverage, and credit activity in crisis, presented in the paper. The higher a bank's leverage the higher the reduction in its credits. Thus, firms having relationships with banks having high leverage would find their supply of credit reduced, and this is likely to affect their investment.

We also find that firms' maturity mismatch affects their investment, and the magnitude of this effect was very similar in both crises.

## References

Acharya, V.V. and H. Naqvi. 2011. "*The Seeds of a Crisis: A Theory of Bank Liquidity and Risk-Taking Over the Business Cycle*." SSRN eLibrary.

Adrian, T. and H.S. Shin. 2010a. "Liquidity and Leverage." *Journal of Financial Intermediation* 19(3): 418–437.

Adrian, T. and H.S. Shin. 2010b. "*Financial Intermediaries and Monetary Economics*." in B. M. Friedman and M. Woodford (eds.), *Handbook of Monetary Economics*, Chapter 12, pp. 601–650.

Bleakley, H. and K. Cowan. 2010. "Maturity Mismatch and Financial Crises: Evidence from Emerging Market Corporations." *Journal of Development Economics* 93(2): 189–205.

Caballero, R. 2002. "*Economic Growth: Sources, Trends and Cycles*." in N. Loayza and R. Soto (eds.), *Coping with Chile's External Vulnerability: A Financial Problem*, Central Bank of Chile.

Céspedes, L.F., I. Goldfajn, P. Lowe, and R.O. Valdés. 2006. "*Policy Responses to External Shocks: The Experiences of Australia, Brazil, and Chile*." in R. Caballero, C. Calderón and L.F. Céspedes (eds.), *External Vulnerability and Preventive Policies*, Central Bank of Chile.

De Gregorio, J. 2008. "*Price Stability and Financial Stability: Some Thoughts on the Current Global Financial Crisis.*" Economic Policy Paper 28, Central Bank of Chile.

————. 2009. "Chile and the Global Recession of 2009." Economic Policy Paper 30, Central Bank of Chile.

De Gregorio, J. and A. Tokman. 2004. "*Overcoming Fear of Floating: Exchange Rate Policies in Chile*." Working Paper 302, Central Bank of Chile.

García, P. 2009. "*Financial Turmoil, Illiquidity and the Policy Response The Case of Chile.*" Economic Policy Paper 29, Central Bank of Chile.

Jordà, Ò, M. Schularick, and A.M. Taylor. 2011. "Financial Crises, Credit Booms, and External Imbalances: 140 Years of Lessons." *IMF Economic Review* 59(2): 340–378.

Reinhart, C.M. and K.S. Rogoff. 2008. "*This Time is Different: A Panoramic View of Eight Centuries of Financial Crises*." NBER Working Paper 13882, National Bureau of Economic Research.

Reinhart, C.M. and K.S. Rogoff. 2009. "*The Aftermath of Financial Crises*." NBER Working Paper 14656, National Bureau of Economic Research.

Schularick, M. and A.M. Taylor. 2012. "Credit Booms Gone Bust: Monetary Policy, Leverage Cycles, and Financial Crises, 1870-2008." *American Economic Review* 102(2): 1029–1061.

# An Anatomy of Credit Booms and their Demise

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Episodes in which credit to the private sector rises significantly above its long-run trend (that is, "credit booms") are often associated with periods of economic turbulence. Until recently, however, efforts at developing methodologies for identifying credit booms and characterizing the economic fluctuations that accompany them often produced mixed results (see, for example, Gourinchas, Valdés, and Landerretche, 2001). In addition, little was known about the association between economy-wide credit booms and the financial conditions of individual firms and banks, and about whether the characteristics of credit booms differ across industrial and emerging economies. This changed with the growing literature on credit booms developed over the last five years. In particular, in Mendoza and Terrones (2008) we proposed a new methodology for measuring and identifying credit booms and showed that it was successful at identifying credit booms with a clear cyclical pattern in both macro and micro data.

The method we proposed is a *thresholds method.* This method works by first splitting real credit per capita in each country into its cyclical and trend components, and then identifying a credit boom as an episode in which credit exceeds its long-run trend by more

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than a given “boom” threshold, defined in terms of a tail probability event. The duration of the boom is similarly set with “starting” and “ending” thresholds. The defining feature of this method is that the thresholds are proportional to each country’s standard deviation of credit over the business cycle. Hence, credit booms reflect country-specific “unusually large” cyclical credit expansions.

In this paper, we apply this method to data for 61 countries (21 industrial countries, ICs; and 40 emerging market economies, EMs) over the 1960-2010 period. We found a total of 70 credit booms, 35 in ICs and 35 in EMs, including 16 credit booms that peaked in the critical period surrounding the recent global financial crisis between 2007 and 2010 (again with about half of these recent booms in ICs and EMs each), for comparison, see Mendoza and Terrones (2008) where we had data for 48 countries over the 1960-2006 period and found 27 credit booms in ICs and 22 in EMs.[1]

We then take the peak dates of all credit booms and construct seven-year event windows around them to examine the dynamics of macro aggregates in the upswing and downswing of credit booms. This exercise is similar to the one conducted in our 2008 paper, but the extension of the sample period to include 2007-2010 is a critical addition because it adds key evidence from the credit booms that collapsed with the 2008 global financial crisis.

The results show that credit booms are associated with periods of economic expansion, rising equity and housing prices, real appreciation, and widening external deficits in the upswing phase of the booms, followed by the opposite dynamics in the downswing. Moreover, credit booms tend to be synchronized internationally, and centered on “big events” like the 1980s debt crisis, the 1992 ERM crisis, the 1990s Sudden Stops, and the 2008 Global Financial Crisis. In addition, splitting our sample into financial crisis vs. non-crisis cases, we find that booms in the crisis group were larger.

A major deviation in the evidence reported here relative to our previous findings in Mendoza and Terrones (2008) is that adding the data from the recent credit booms and crises, we find that, in fact, credit booms in ICs and EMs are more similar than different. In contrast, in our earlier work, we found differences in the magnitude of credit booms, the size of the macro fluctuations associated with them, and the likelihood that they are followed by banking or currency crises.

1. For comparison, in Mendoza and Terrones (2008) we had data for 48 countries over the 1960-2006 period and found 27 credit booms in ICs and 22 in EMs.

Credit booms across EMs and ICs are similar in three key respects: First, although credit booms are larger in EMs (with real credit per capita peaking at about 30 percent above trend in the median of all EM credit booms versus 12 percent for IC credit booms), normalizing by each country's cyclical standard deviation of credit, credit booms are remarkably uniform in size. The normalized peak of credit booms is about 2 standard deviations for EMs, and 2.1 for ICs. A similar observation applies to the magnitude of the fluctuations that macro aggregates display during credit booms. These fluctuations are larger in EMs, but since EMs also display higher cyclical standard deviations in these variables, normalized fluctuations associated with credit booms are actually similar in size.[2]

The second similarity is that, while not all credit booms end in crisis, the peaks of credit booms are often followed by banking crises, currency crises or Sudden Stops. The frequency with which this happens is about the same for EMs and ICs (20 to 25 percent for banking and currency crises, 14 percent for Sudden Stops). This is a critical change from our previous findings, because lacking the substantial evidence from all the recent booms and crises, we had found only 9 percent frequency of banking crises after credit booms for EMs, and zero for ICs; and 14 percent frequency of currency crises after credit booms for EMs versus 31 percent for ICs. Clearly, the larger sample of credit boom events used here yields a different picture indicating that in the aftermath of credit booms, both groups of countries suffer (with about the same frequency) both types of crises; and also Sudden Stop crises.

The third similarity relates to the factors that can act as potential triggers of credit booms. In particular, surges in capital inflows, gains in total factor productivity (TFP), policy reforms in the financial system, and managed exchange rates, all play a role in both ICs and EMs. There are some differences across the two groups because the frequency of credit booms in EMs is 47 percent, when preceded by periods of large capital inflows (versus 33 percent in ICs); and 30 percent for financial reforms (versus 22 percent for ICs); while TFP gains precede credit booms with a frequency of 42 percent for ICs (versus 20 percent for EMs). But the overall message is that these three factors precede the

2. Mendoza (1995) documents a similar finding for regular business cycle indicators in a sample of 23 developing countries and 7 ICs. Standard deviations of cyclical components of macro aggregates are significantly higher for developing countries than for ICs, but normalized by the standard deviation of the terms of trade, the variability of macro variables is similar across all countries.

peak of credit booms with a frequency of roughly 1/5 to 1/2. Moreover, credit booms in both ICs and EMs are far more frequent in the presence of fixed or managed exchange rates (with a frequency of about 2/3 for all countries), than in under floating or dirty floating regimes (with frequencies ranging from 3 to 20 percent).

Our work is related to the empirical literature that identifies booms in macro variables, using threshold methods and event-study techniques. Montiel's (2001) analysis of consumption booms was one of the first studies in this vein. Gourinchas, Valdés, and Landerretche (2001) introduced threshold methods to the analysis of credit booms, followed by several other studies including: Cottarelli, Dell'Ariccia, and Vladkova-Hollar (2003), International Monetary Fund (2004), Hilbers and others (2005), and Ottens, Lambregts, and Poelhekke (2005).[3] Threshold methods have also been widely used in related studies of Sudden Stops and the boom-bust cycle of capital inflows. Reinhart and Reinhart (2009) survey this literature and conduct a detailed cross-country analysis of the macroeconomic dynamics associated with surges in capital inflows. In line with our findings, they also find that booms in capital inflows are associated with periods of economic expansion, and booming credit and asset prices.

Before our 2008 working paper provided a new methodology to measure credit booms, the standard practice in empirical studies on this topic followed the method proposed by Gourincha, Valdés, and Landerretche (2001). There are three important differences between their method and ours: (1) we use real credit per capita instead of the credit-output ratio as the measure of credit; (2) we construct the trend of credit using the Hodrick-Prescott (HP) filter in its standard form, instead of using an "expanding HP trend" (see Mendoza and Terrones, 2008, for details); and (3) we use thresholds that depend on each country's cyclical variability of credit, instead of a threshold common to all countries.[4]

These differences have important implications. As shown in Mendoza and Terrones (2008), an example of both methods applied to Chilean data shows that the method of Gourinchas, Valdés, and Landerretche (2001) is not robust in the choice of credit measure, and

3. There are also other studies that examine linkages between credit and macro variables without measuring credit booms (for example, Collyns and Senhadji, 2002, Borio, Furfine, and Lowe, 2001, and Kraft and Jankov, 2005).

4. Our study also differs in that we examine credit booms in industrial countries, and study differences in the dynamics of the tradables versus non-tradables sectors.

that it treats each period's credit observation as unduly representative of its trend (because it models the long-run trend of credit as a smoothed, lagged approximation of the actual data). Moreover, the two methods yield sharply different predictions about the association between macro variables and credit booms. In particular, we find that output, consumption, and investment rise significantly above trend during the expansionary phase of credit booms, and fall below trend during the contractionary phase. In contrast, they found weak evidence of cycles, in output and absorption, associated with credit booms. We also find a clear association between credit booms and financial crises, while they found that the likelihood of financial crises does not increase significantly when credit booms are present.

Our work is also related to the analysis of the credit transmission channel in twin banking-currency crises by Tornell and Westermann (2005).[5] These authors document that twin crises are preceded by rising credit-GDP ratios, increases in output of non-tradables relative to tradables, and real appreciations, followed by declines in all of these variables. In addition, they used the World Bank's World Business Economic Survey (WBES) to document asymmetries in the access to credit markets of firms in the tradables vs. non-tradables sectors. We also look at sectoral differences in the evolution of output dynamics, but our approach differs in that we examine these dynamics as conditional on credit boom episodes, rather than conditional on a twin-crises event.

Our frequency analysis of the association of credit booms with capital inflows, financial reforms, and TFP gains is related to theoretical and empirical studies on the mechanisms that drive credit booms. These include theories in which excessive credit expansion is due to herding behavior by banks (Kindleberger, 2000); information problems that lead to bank-interdependent lending policies (Rajan, 1994; Gorton and He, 2008), the underestimation of risks (Boz and Mendoza, 2010; Borio, Furfine, and Lowe, 2001) and the lowering of lending standards (Dell'Ariccia and Márquez, 2006); the presence of explicit or implicit government guarantees (Corsetti, Pesenti, and Roubini, 1999); or limited commitment on the part of borrowers (Lorenzoni, 2008). Similarly, our analysis of the connection between credit booms and macroeconomic activity is related to the literature

5. Tornell and Westermann also study the extent financial market imperfections influences the cycle in the middle income countries during tranquil times. See also Scheneider and Tornell (2004).

on business cycle models that incorporate "financial accelerators," by which shocks to asset prices and relative good prices are amplified through balance sheet effects (see, for example, Fisher, 1933; Bernanke and Gertler, 1989; Bernanke, Gertler, and Gilchrist, 1999; Kiyotaki and Moore, 1997; and Mendoza, 2005, 2010).

The rest of the paper is organized as follows: Section 1 describes our method for identifying credit booms, implements it using our cross-country sample, and examines the main characteristics of credit booms in industrial and emerging economies. Section 2 studies the credit-boom dynamics of the cyclical components of macro aggregates. Section 3 concludes.

## 1. Credit Booms: Methodology and Key Features

### 1.1 Methodology

A credit boom is defined in general as an episode in which credit to the private sector grows by more than during a typical business cycle expansion. In Mendoza and Terrones (2008) we formalized this definition as follows. Denote the deviation from the long-run trend in the logarithm of real credit per capita in country $i$, date $t$ as $l_{it}$, and the corresponding standard deviation of this cyclical component as $\sigma(l_i)$. The long-run trend is calculated using the Hodrick-Prescott (HP) filter with the smoothing parameter set at 100, as is typical for annual data. Country $i$ is defined to have experienced a credit boom when we identify one or more contiguous dates for which the credit boom condition $l_{i,t} \geq \phi\sigma(l_i)$ holds, where $\phi$ is the boom threshold factor. Thus, during a credit boom the deviations from trend in credit exceed the typical expansion of credit over the business cycle by a factor of $\phi$ or more. The baseline value of $\phi$ is set at 1.65, because the 5 percent tail of the standardized normal distribution satisfies $\text{Prob}(l_{i,t}/\sigma(l_i) \geq 1.65) = 0.05$. We also conducted sensitivity analysis for $\phi = 1.5$ and 2 and confirmed that our main results are robust to the value of $\phi$.

The date of the peak of the credit boom $(\hat{t})$ is the date that shows the maximum difference between $l_{it}$ and $\phi\sigma(l_i)$ from the set of contiguous dates that satisfy the credit boom condition. Given $\hat{t}$, the starting date of the credit boom is a date $t^s$ such that $t^s < \hat{t}$ and $t^s$ yields the smallest difference $\mid l_{i,t} - \phi^s\sigma(l_i) \mid$, and the ending date $t^e$ is a date $t^e > \hat{t}$ that yields the smallest difference $\mid l_{i,t} - \phi^e\sigma(l_i) \mid$, where $\phi^s$ and $\phi^e$ are the start and end thresholds.[6] We use baseline values $\phi^s = \phi^e = 1$, and we also tried other values including 0, 1/4, 1/2 and 3/4.[7] Once the starting and ending dates are set, the duration of the credit boom is given by the difference $t^e - t^s$.

## 1.2 Credit boom episodes and their main features

We use credit data from the financial sector to the private non-financial sector obtained from the IMF's *International Financial Statistics* for a sample of 61 countries, 21 industrial and 40 emerging economies (appendix 1), for the 1960-2010 period. Our measure of credit is the sum of claims on the private sector by deposit money banks (*IFS* line 22d) plus, whenever available for the entire sample period for a given country, claims on the private sector by other financial institutions (*IFS* line 42d). Real credit per capita is calculated as the end-of-year observations of nominal credit per capita, deflated by their corresponding end-of-year consumer price index. Data sources for these, and all other variables used in this paper are listed in appendix 2.

We identified 70 credit booms in our data, 35 in ICs and 35 in EMs.[8] Figure 1 provides a summary view of these credit booms by plotting the cross-country mean and median of the cyclical components of real credit per capita in seven-year event windows centered at the peak of credit booms for the two groups of countries. These graphs show that credit booms in EMs are larger than those in industrial countries in absolute terms: At the peak of the booms, the average expansion in real credit per capita reached about 30 percent above trend in EMs, twice what is observed in ICs. Normalized by the standard deviation of the cyclical component of credit in each country, however, credit booms in the two groups of countries show a similar distribution, with medians of 2 and 2.1 for ICs and EMs respectively (see figure 2). Thus, normalized by the variability of

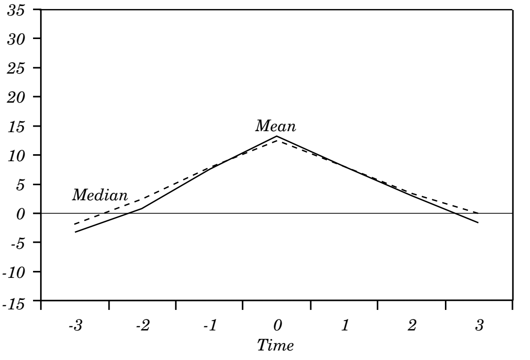
6. These threshold conditions are set to minimize the absolute values of differences of lit relative to targets because the data are discrete, and hence in general lit does not match the targets with equality.

7. We use thresholds such that $\phi^s = \phi^e < \phi$, but notice that in principle $\phi^s$ and $\phi^e$ could differ, and one or both could be set equal to $\phi$.

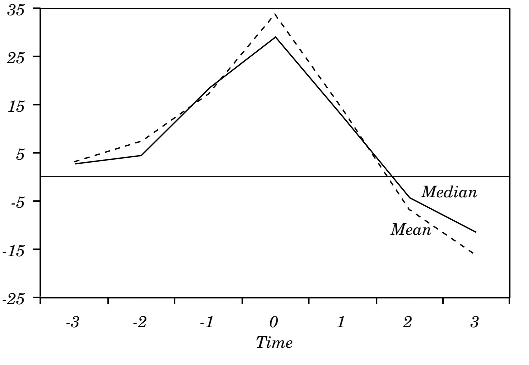
8. There is also one emerging economy (Hong Kong) identified as experiencing credit booms in 2010, the end of the sample period. We excluded it from the event analysis because this boom has yet to be completed (that is, the ending threshold has not been crossed yet).

**Figure 1. Credit Booms: Seven-Year Event Windows**
Deviations from HP-trend in real credit per-capita

*A. Industrial countries*




*B. Emerging economies*



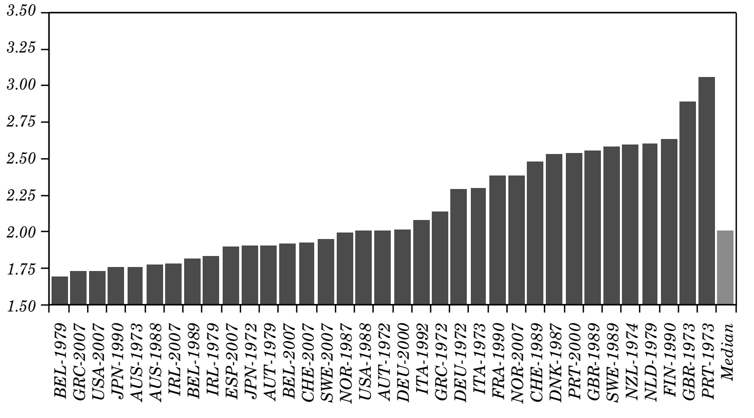

Source: Authors' elaboration.

credit, the magnitude of credit booms does not differ significantly across EMs and ICs.

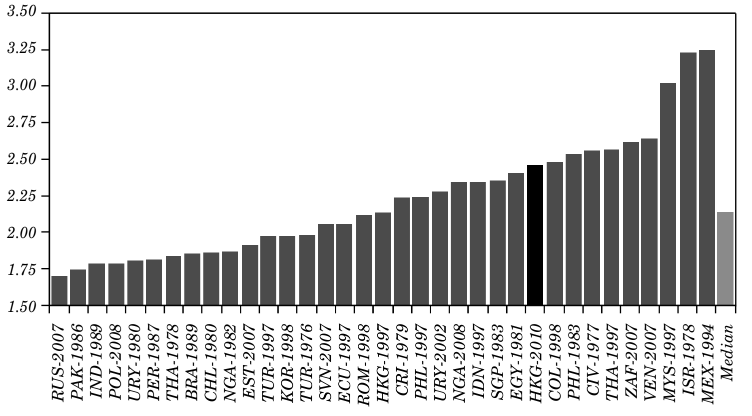
Table 1 shows the duration of credit booms for different starting and ending thresholds, and the length of the corresponding upswing and downswing phases. In general, the results based on medians indicate that EMs and ICs show booms with similar durations of about 3-6 years, and the fraction of the boom spent in the upswing and downswing phases with the duration thresholds, set at 1, is about the same. Using means, however, EMs seem to show longer and more asymmetric booms.

**Figure 2. Relative Credit Booms**
Deviation from trend at peak of credit boom as a ratio of the standard deviation of credit

*A. Industrial countries*




*B. Emerging market economies*[a]



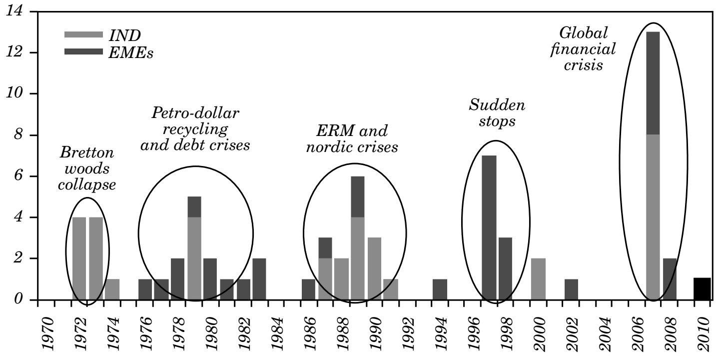

Source: Authors' elaboration.
a. Ongoing credit booms are shown in black.

**Table 1. Credit Booms: Duration**

| | *Emerging market economies* | | | *Industrial countries* | | |
|---|---|---|---|---|---|---|
| | | *Fraction spent in* | | | *Fraction spent in* | |
| *Starting and ending thresholds* | *Duration* | *Upswing* | *Downturn* | *Duration* | *Upswing* | *Downturn* |
| *A. Mean* | | | | | | |
| 0.00 | 5.60 | 0.45 | 0.37 | 5.64 | 0.39 | 0.43 |
| 0.25 | 4.86 | 0.46 | 0.34 | 4.92 | 0.38 | 0.42 |
| 0.50 | 4.40 | 0.41 | 0.36 | 4.36 | 0.35 | 0.42 |
| 0.75 | 3.63 | 0.35 | 0.37 | 3.89 | 0.34 | 0.41 |
| 1.00 | 5.60 | 0.45 | 0.37 | 3.44 | 0.30 | 0.41 |
| *B. Median* | | | | | | |
| 0.00 | 6.00 | 0.50 | 0.33 | 5.50 | 0.36 | 0.45 |
| 0.25 | 5.00 | 0.40 | 0.20 | 5.00 | 0.40 | 0.40 |
| 0.50 | 5.00 | 0.20 | 0.20 | 4.00 | 0.25 | 0.50 |
| 0.75 | 4.00 | 0.25 | 0.25 | 4.00 | 0.25 | 0.50 |
| 1.00 | 3.00 | 0.33 | 0.33 | 3.00 | 0.33 | 0.33 |

Source: Authors' elaboration.

**Figure 3. Frequency of Credit Booms[a]**




Source: Authors' elaboration.
a. Ongoing credit booms are shown in black.

Credit booms tend to be clustered geographically and not limited to a single region: 40 percent of the booms experienced by emerging economies were observed in East Asia and 32 percent in Latin America. Likewise, 33 percent of the credit booms in industrial countries were observed in the G7 and 18 percent in the Nordic countries (Denmark, Finland, Norway, and Sweden). In addition, figure 3 shows that credit booms tend to be synchronized internationally, and centered around big events—for example, the Bretton Woods collapse of the early 1970s, the petro-dollars boom in the prelude to the 1980s debt crisis, the ERM and Nordic country crises of the early 1990s, the 1990s Sudden Stops, and the recent Global Financial Crisis. It is interesting to note that, excluding the recent crisis, the figure would have misleadingly suggested that the frequency of credit booms in ICs had declined over time. Adding the turbulent period of the past few years it is clear that this is not the case. Still, it is possible that the credit measure from *IFS* misses important elements of the securitization boom occurring via non-bank financial intermediaries, and thus leads us to underestimate the magnitude and frequency of credit booms in countries with more developed financial systems.[9]

9. For example, Rajan (2005) argues that technical change, deregulation, and institutional change have resulted in an increasing number of arm's length transactions away from banks in the financial system. Indeed, the growing securitization of sub-prime mortgages in the US in recent years was accompanied by an increase in the off-balance sheet operations of bank entities.

## 2. Credit Booms and Macroeconomic Dynamics

This section examines the business cycle behavior of the economy during credit boom events, and conducts a frequency analysis of the association between credit booms and financial crises, and between credit booms and some of their potential determinants.

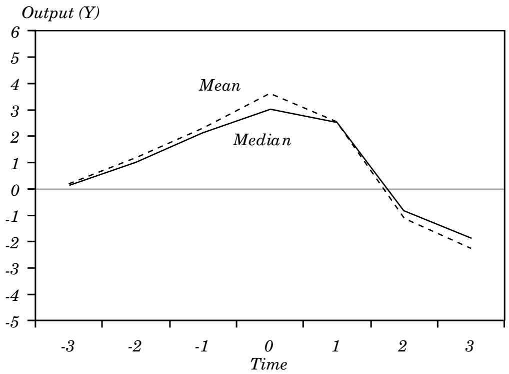
### 2.1 Event analysis

We construct seven-year event windows of the cyclical components of macro aggregates centered on the peak of credit booms (that is $\hat{t}$ is normalized to date $t = 0$). The windows show the cross-country means and medians of output ($Y$), private consumption ($C$), public consumption ($G$), investment ($I$), the output of non-tradables ($YN$), the real exchange rate ($RER$), the current account-output ratio ($CAY$) and total capital inflows as share of output ($KI$). All these variables are at constant prices, expressed in per-capita terms and detrended with the HP filter setting the smoothing parameter at 100, except for *RER* (which is not in per-capita terms) and the current account-output and capital inflows-output ratios (which are at current prices and not expressed in per capita terms).

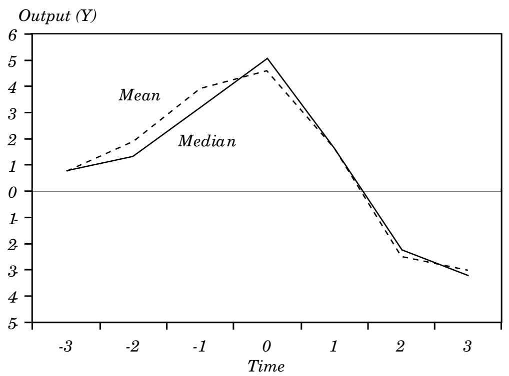
Figures 4-8 illustrate business cycle dynamics around credit boom episodes in EMs and ICs. Except for *RER* in the EMs group, there is little difference in the dynamics produced by country means and medians, indicating that the results are not driven by outliers. Consider first the plots for EMs in the right side of the figures. $Y$, $C$ and $G$ rise 2 to 5 percentage points above trend in the build-up phase of the credit boom, and drop to between 2 to 3.5 percent below trend in the recessive phase. $I$, $YN$ and $RER$ follow a similar pattern, but display significantly larger expansions and recessions. Investment rises up to about 20 percent above trend at the peak of credit booms, and drops below trend by a similar amount by $t = 2$. $YN$ rises to about 5.5 percent above trend by $t = 0$ and then drops to almost 4 percent below trend by $t = 3$. The median $RER$ appreciates 7 percent above trend at date $t$, and drops to a low of about 4 percent below trend when the credit boom unwinds. $CAY$ displays the opposite pattern: it declines to a deficit of about 2 percentage points of GDP in the expanding phase of the boom, and then rises to a surplus of 1 percentage point of GDP in the declining phase. In line with these current account dynamics, the median $KI$ rises by up to 2 percentage points of GDP by $t = -1$ and then drops by 1 percentage point of GDP by $t = 2$.

**Figure 4. Credit Booms and Economic Activity**
Cross-country means and medians of cyclical component of real GDP

*A. Industrial countries*



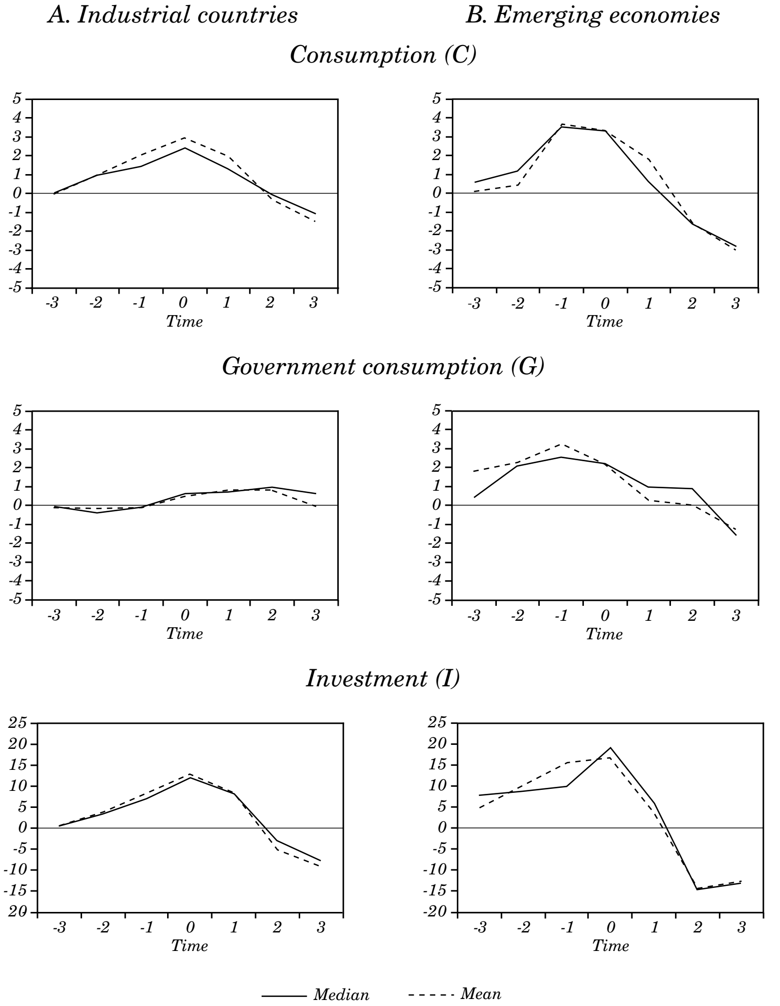

*B. Emerging economies*




Source: Authors' elaboration.

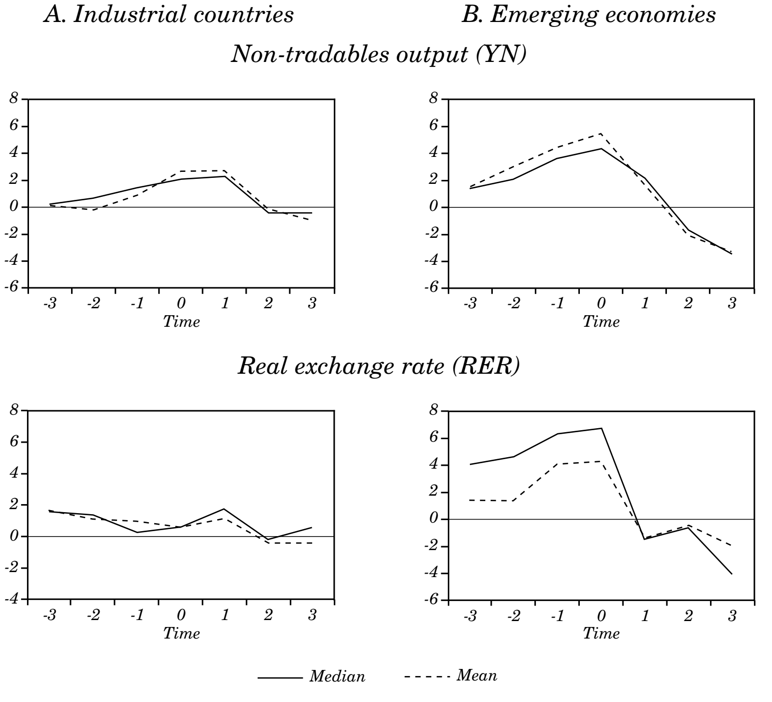
The plots for industrial countries in the left-side panels of figures 4-8 show several similarities with those of emerging economies, but also some important differences. Output, expenditures and the current account in the industrial countries follow a cyclical pattern similar to that observed in the emerging economies, but the amplitude of these fluctuations is smaller (particularly for *YN* and *RER*), and government consumption shows a different pattern (just about at trend in the expanding phase and slightly above trend in

**Figure 5. Credit Booms and Domestic Demand**
Cross-country means and medians of cyclical components




Source: Authors' elaboration.

**Figure 6. Credit Booms and the Non-tradables Sector**
Cross-country means and medians of cyclical components

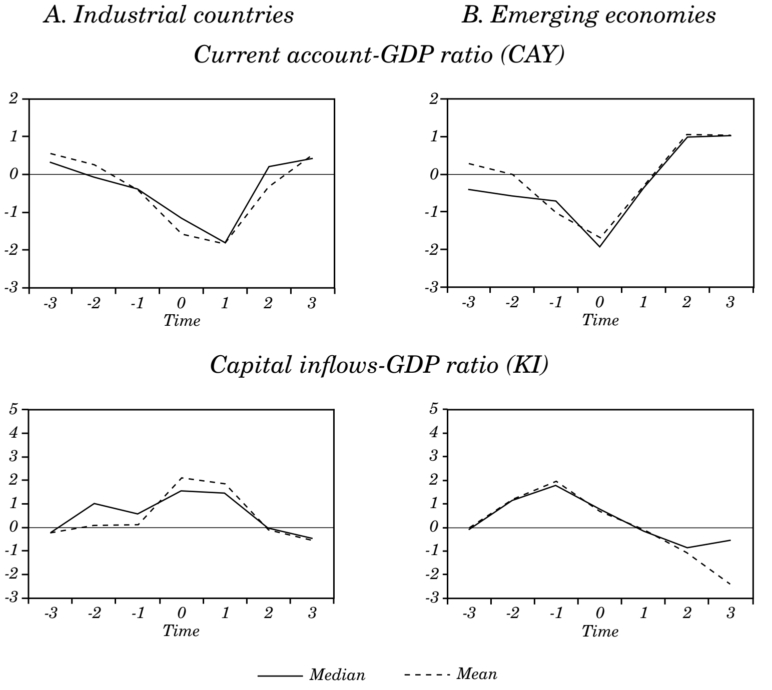



Source: Authors' elaboration.

the contraction phase). However, if we were to normalize the macro data using standard deviations of cyclical components, and take into account that EMs display higher business cycle variability in all their macro-aggregates (see, for example, Mendoza, 1995), we would see again that credit booms display similar features across EMs and ICs.

Two important caveats apply to the event study graphs of macro dynamics. First, they illustrate the cyclical dynamics of macro variables, but do not show if these variables are undergoing a boom themselves (that is, an unusually large expansion as defined by our thresholds method). Table 2 provides evidence to examine this issue by listing the fraction of credit booms associated with booms in output, and expenditures that occur at any time inside the seven-year window of the credit boom events. The results show that between 30 to 60 percent of the credit booms are associated with booms in $Y$,

**Figure 7. Credit Booms, Current Account, and Capital Inflows**
Cross-country means and medians of cyclical component

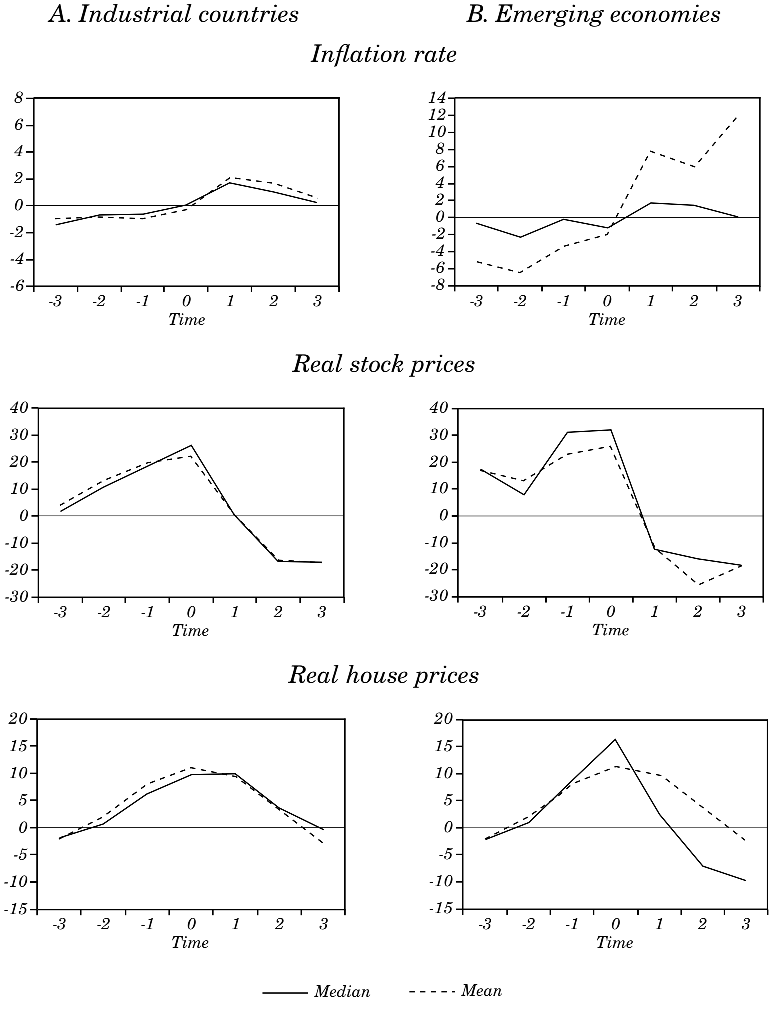



Source: Authors' elaboration.

*YN*, *C*, *I*, and *G*, and this holds for EMs and ICs separately, and for all the countries together. For output, in particular, close to half of the observed credit booms are associated with output booms, with little difference across EMs and ICs.

The second caveat is that the macro event windows show point estimates of measures of central tendency (means and medians), but do not demonstrate if these moments are statistically significant. To explore this issue, we run cross-section regressions of each macro variable for each date of the event window on a constant. The standard error for the median (mean) is obtained using quintile (OLS) regressions. As table 3 shows, most of the mean and median estimates shown in the event study plots for *Y*, *YN*, *C*, and *I* are statistically significant. For *G*, *RER* and *CA*/*Y*, however, many of the coefficients have large standard errors.

**Figure 8. Credit Booms and Prices**
Cross-country means and medians of cyclical components




Source: Authors' elaboration.

**Table 2. Coincidence of Credit Booms with Output and Demand Booms[a]**
Frequency

| | *Industrial countries* | *Emerging market economies* | *All* |
|---|---|---|---|
| Output | 0.49 | 0.46 | 0.46 |
| Non-tradable output | 0.31 | 0.46 | 0.40 |
| Consumption | 0.49 | 0.46 | 0.47 |
| Investment | 0.60 | 0.34 | 0.47 |
| Government expenditures | 0.29 | 0.34 | 0.30 |

Source: Authors' elaboration.
a. The figures reported in this table are fractions of credit booms that coincide with output/demand boom, within the seven-year window of the credit boom.
The output/demand boom has been determined using a similar method to the one employed to determine credit booms, with a boom threshold factor of 1.65.

We now study the behavior of inflation, equity prices and housing prices during credit booms (figure 8). Using medians, there is only a week association between credit booms and inflation in both EMs and ICs, with below-trend inflation in the upswing and above-trend inflation in the downswing.[10] Hence, credit booms are generally *not* associated with sharp changes in inflation. In contrast, housing and equity prices show a clear pattern of rising prices in the upswing and declining prices in the downswing. Equity prices rise to 25-30 percent at the peak of credit booms, and housing prices rise to 10-15 percent in both EMs and ICs. The downswing of credit booms leads to significant equity price collapses of about 20 percent in real terms, in both groups of countries. These movements in asset prices are important because they are consistent with theoretical explanations of credit booms and busts that rely on financial accelerators and balance sheet effects.

Real M2 money balances also expand during the upswing and contract during the downswing of credit booms (figure 7). This

10. The mean inflation in EMs does show a shift from sharply below-trend inflation to sharply above-trend inflation but that reflects outliers driven by a few hyperinflation episodes in Latin America.

**Table 3. Credit Booms: Statistical Significance of Event-Window Coefficients**

| | Industrial countries | | | | | | |
|---|---|---|---|---|---|---|---|
| | *t-3* | *t-2* | *t-1* | *t* | *t+1* | *t+2* | *t+3* |
| *1. Mean values* | | | | | | | |
| Real credit | -0.031** | 0.011 | 0.079*** | 0.137*** | 0.085*** | 0.031** | 0.020 |
| | (0.009) | (0.011) | (0.01) | (0.01) | (0.011) | (0.01) | (0.013) |
| Output | 0.002 | 0.012*** | 0.023*** | 0.036*** | 0.025*** | -0.011* | -0.023*** |
| | (0.003) | (0.003) | (0.004) | (0.004) | (0.004) | (0.005) | (0.004) |
| Non-tradable output | 0.001 | -0.002 | 0.009 | 0.026*** | -0.01 | 0.030*** | 0.042*** |
| | (0.007) | (0.005) | (0.005) | (0.005) | (0.004) | (0.005) | (0.005) |
| Consumption | 0.000 | 0.010** | 0.021*** | 0.029*** | 0.019*** | 0.004 | -0.015*** |
| | (0.003) | (0.003) | (0.004) | (0.003) | (0.004) | (0.004) | (0.004) |
| Government consumption | 0.001 | 0.001 | 0.001 | 0.005 | 0.007 | 0.007 | 0.001 |
| | (0.003) | (0.003) | (0.003) | (0.003) | (0.004) | (0.004) | (0.005) |
| Investment | 0.007 | 0.038*** | 0.083*** | 0.130*** | 0.081*** | -0.052** | -0.094*** |
| | (0.01) | (0.009) | (0.013) | (0.014) | (0.013) | (0.018) | (0.018) |
| REER | 0.016 | 0.007 | 0.005 | 0.001 | 0.011 | 0.005 | 0.000 |
| | (0.026) | (0.015) | (0.012) | (0.01) | (0.009) | (0.009) | (0.012) |
| Current account balance | 0.560* | 0.249 | 0.421 | -1.582*** | -1.741*** | 0.264 | 0.571 |
| | (0.259) | (0.334) | (0.376) | (0.385) | (0.398) | (0.285) | (0.33) |

**Table 3. (continued)**

| | Emerging market economies | | | | | | |
|---|---|---|---|---|---|---|---|
| | *t-3* | *t-2* | *t-1* | *t* | *t+1* | *t+2* | *t+3* |
| *1. Mean values* | | | | | | | |
| Real credit | 0.029 | 0.071 | 0.167*** | 0.332*** | 0.139*** | 0.068 | -0.164*** |
| | (0.027) | (0.037) | -0.041 | -0.03 | -0.03 | (0.039) | (0.042) |
| Output | 0.009 | 0.020** | 0.037*** | 0.044*** | 0.016 | -0.025** | -0.030** |
| | (0.007) | (0.007) | -0.008 | -0.011 | -0.012 | (0.008) | (0.009) |
| Non-tradable output | 0.052*** | 0.017 | -0.021 | -0.033** | | | |
| | (0.007) | (0.007) | (0.008) | (0.011) | (0.014) | (0.013) | (0.011) |
| Consumption | 0.002 | 0.005 | 0.035*** | 0.033* | 0.018 | 0.016 | -0.030** |
| | (0.007) | (0.013) | (0.009) | (0.013) | (0.012) | (0.009) | (0.01) |
| Government consumption | 0.017 | 0.022 | 0.032** | 0.022 | 0.003 | 0.000 | 0.013 |
| | (0.012) | (0.012) | (0.01) | (0.016) | (0.011) | (0.013) | (0.011) |
| Investment | 0.050* | 0.100** | 0.151*** | 0.164*** | 0.037 | -0.144*** | -0.126*** |
| | (0.022) | (0.028) | (0.028) | (0.035) | (0.042) | (0.031) | (0.031) |
| REER | 0.005 | 0.002 | 0.021 | 0.036* | 0.011 | 0.035 | 0.024 |
| | (0.015) | (0.024) | (0.021) | (0.017) | (0.028) | (0.032) | (0.036) |
| Current account balance | 0.328 | 0.081 | -1.066* | -1.764* | 0.333 | 1.047 | 1.027 |
| | (0.776) | (0.714) | (0.511) | (0.662) | (0.762) | (0.681) | (0.579) |

**Table 3. (continued)**

| | *Industrial countries* | | | | | | |
|---|---|---|---|---|---|---|---|
| | *t-3* | *t-2* | *t-1* | *t* | *t+1* | *t+2* | *t+3* |
| *2. Median values* | | | | | | | |
| Real credit | -0.02 | 0.027** | 0.078*** | 0.125*** | 0.084*** | 0.037*** | -0.004 |
| | (0.01) | (0.009) | (0.013) | (0.015) | (0.008) | (0.009) | (0.011) |
| Output | 0.002 | 0.010* | 0.021*** | 0.030*** | 0.024*** | -0.009* | -0.019*** |
| | (0.004) | (0.004) | (0.005) | (0.005) | (0.003) | (0.004) | (0.003) |
| Non-tradable output | 0.002 | 0.007 | 0.014** | 0.021** | 0.022*** | 0.001 | 0.004 |
| | (0.003) | (0.007) | (0.005) | (0.006) | (0.003) | (0.006) | (0.004) |
| Consumption | 0.000 | 0.010 | 0.014** | 0.024*** | 0.013*** | 0.002 | -0.012** |
| | (0.003) | (0.005) | (0.005) | (0.005) | (0.003) | (0.004) | (0.004) |
| Government consumption | 0.001 | 0.004 | 0.001 | 0.006 | 0.007*** | 0.007* | 0.001 |
| | (0.003) | (0.004) | (0.004) | (0.005) | (0.002) | (0.003) | (0.003) |
| Investment | 0.006 | 0.034*** | 0.070*** | 0.121*** | 0.083*** | -0.045* | -0.078*** |
| | (0.009) | (0.007) | (0.016) | (0.013) | (0.017) | (0.021) | (0.011) |
| REER | 0.009 | 0.009 | 0.000 | 0.002 | 0.015 | 0.005 | 0.003 |
| | (0.006) | (0.008) | (0.009) | (0.013) | (0.012) | (0.007) | (0.009) |
| Current account balance | 0.354 | 0.074 | 0.473 | -1.186* | -1.802*** | 0.228 | 0.525 |
| | (0.31) | (0.291) | (0.529) | (0.515) | (0.485) | (0.276) | (0.394) |

**Table 3. (continued)**

| | *Emerging market economies* | | | | | | |
|---|---|---|---|---|---|---|---|
| | *t-3* | *t-2* | *t-1* | *t* | *t+1* | *t+2* | *t+3* |
| *2. Median values* | | | | | | | |
| Real credit | 0.028 | 0.044 | 0.164*** | 0.289*** | 0.128*** | -0.044 | -0.127* |
| | (0.017) | (0.036) | (0.04) | (0.047) | (0.013) | (0.023) | (0.058) |
| Output | 0.011 | 0.015 | 0.032*** | 0.050*** | 0.008 | -0.023** | 0.029 |
| | (0.011) | (0.01) | (0.008) | (0.01) | (0.02) | (0.006) | (0.014) |
| Non-tradable output | 0.018 | 0.023 | 0.025 | 0.044* | 0.018 | 0.021 | 0.032 |
| | (0.012) | (0.013) | (0.014) | (0.017) | (0.019) | (0.015) | (0.016) |
| Consumption | 0.006 | 0.019* | 0.035** | 0.025* | 0.011 | -0.019* | -0.029* |
| | (0.013) | (0.008) | (0.012) | (0.011) | (0.012) | (0.009) | (0.013) |
| Government consumption | 0.004 | 0.019 | 0.023 | 0.022** | 0.008 | 0.008 | -0.015* |
| | (0.01) | (0.01) | (0.012) | (0.006) | (0.008) | (0.01) | (0.006) |
| Investment | 0.077* | 0.088* | 0.096* | 0.187*** | 0.055 | -0.144*** | -0.129* |
| | (0.029) | (0.033) | (0.042) | (0.027) | (0.041) | (0.034) | (0.05) |
| REER | 0.007 | 0.008 | 0.039 | 0.066* | 0.013 | 0.031 | 0.028 |
| | (0.024) | (0.03) | (0.025) | (0.025) | (0.031) | (0.026) | (0.023) |
| Current account balance | 0.380 | 0.312 | 0.773 | -1.937** | 0.342 | 1.028 | 1.110 |
| | (0.545) | (0.583) | (0.557) | (0.563) | (0.949) | (0.6) | (0.546) |

Source: Authors' elaboration.
Note: Standard errors are in parenthesis. The coefficients are obtained by regressing each macroeconomic aggregate on a constant.
The symbols *, **, and *** indicate statistical significance at the 10%, 5%, and 1% respectively.

suggests that monetary policy may play a role in fueling credit booms, inasmuch as real M2 moves along with credit during credit boom episodes.[11]

The event windows for industrial and emerging economies mask important variations across country regions. In ICs, the Nordic countries show larger fluctuations in credit and macro variables than the G7 (table 4, panel A). In addition, some of the macro variables in the Nordic countries peak earlier than credit. In the case of EMs (table 4, panel B), credit expansions and the associated surge in consumption are much larger in Latin America. In contrast, the current account reversals when the credit booms revert are larger in Asia.

In summary, the macro event study shows that credit booms across emerging and industrial economies are associated with a well-defined pattern of economic expansion in the build-up phase of the booms, followed by contraction in the declining phase. Output, expenditures, stock prices, housing prices, and the real exchange rate move above trend in the first phase, and drop below trend in the second phase, and the current account falls first and then rises. All of this happens without major changes in inflation in most countries.

There are interesting differences in the dynamics around credit boom events across EMs and ICs in terms of the amplitude of macro fluctuations in levels (that is, without some form of normalization) and in the dynamics of government expenditures. These differences are consistent with three well-known facts in international business cycle studies: First, as noted earlier, the larger amplitude of the fluctuations displayed by EMs is in line with well-established evidence showing that business cycles are larger in developing countries (see Mendoza, 1995, Kose, Prasad, and Terrones, 2003, Neumeyer and Perri, 2005). Second, the striking difference in the behavior of government purchases is consistent with the evidence produced in the literature on the procyclicality of fiscal policy in EMs (see Kaminski, Reinhart, and Vègh, 2005). Third, the widening current account deficits followed by reversals, and the larger booms followed by collapses in the price and output of the non-tradables sector, are consistent with observations highlighted in the Sudden

11. There is the impression that central banks in developing countries often loosen (tighten) monetary policy in good (bad) times. However, a systemic characterization of this regularity has been elusive because of lack of good indicators of the monetary policy stance (see, for instance, Kaminsky, Reinhart and Vègh, 2005).

**Table 4. Credit Booms: Regional Features**
Cross-country median of cyclical components

| | | Date | | | | | | |
|---|---|---|---|---|---|---|---|---|
| *Variable* | *Region* | *t-3* | *t-2* | *t-1* | *t* | *t+1* | *t+2* | *t+3* |
| *1. Industrial countries: G7 vs nordic countries* | | | | | | | | |
| Real credit | G7 | 0.132 | 2.827 | 7.029 | 8.421 | 6.515 | 1.750 | 0.163 |
| | Nordic | -4.839 | 1.185 | 12.221 | 19.280 | 12.035 | 10.358 | 4.603 |
| Output (Y) | G7 | 0.028 | 1.177 | 1.846 | 2.886 | 1.799 | -0.435 | -1.773 |
| | Nordic | 0.044 | 2.086 | 3.850 | 3.679 | 1.289 | -1.739 | -2.227 |
| Non-tradable output (YN) | G7 | 0.194 | 0.662 | 1.436 | 2.011 | 1.882 | 0.626 | -0.723 |
| | Nordic | 0.792 | 1.293 | 1.885 | 2.533 | 1.128 | -1.362 | -1.070 |
| Consumption (C) | G7 | 0.393 | 1.402 | 1.430 | 2.380 | 1.756 | 0.253 | -1.069 |
| | Nordic | 0.033 | 2.034 | 4.479 | 3.306 | 0.828 | -1.362 | -1.765 |
| Investment (I) | G7 | 1.750 | 4.125 | 7.695 | 9.988 | 5.743 | -7.319 | -6.516 |
| | Nordic | 0.159 | 5.174 | 15.572 | 16.522 | 10.458 | -3.644 | -8.669 |
| Real exchange rate (RER) | G7 | 0.420 | 1.281 | 0.004 | -3.049 | -3.314 | -0.190 | -1.292 |
| | Nordic | 0.639 | 0.944 | 0.736 | 3.600 | 1.933 | -0.315 | 1.327 |
| Current account-GDP ratio (CAY) | G7 | 0.138 | -0.314 | -0.871 | -1.161 | -0.655 | 0.310 | 0.053 |
| | Nordic | 0.477 | 0.665 | -0.730 | -0.598 | -0.642 | -0.829 | -1.729 |

**Table 4. (continued)**

| | | *Date* | | | | | | |
|---|---|---|---|---|---|---|---|---|
| *Variable* | *Region* | *t-3* | *t-2* | *t-1* | *t* | *t+1* | *t+2* | *t+3* |
| *2. Emerging economies: Latin America (LA) vs Asia vs transition* | | | | | | | | |
| Real credit | LA | 15.741 | 22.270 | 36.815 | 51.891 | 27.723 | -6.820 | -21.593 |
| | Asia | 3.705 | 5.789 | 14.747 | 24.175 | 12.379 | -3.907 | -4.425 |
| | Transition | -4.764 | -1.356 | 5.570 | 23.218 | 10.393 | -6.697 | -25.947 |
| Output (Y) | LA | 0.430 | 2.906 | 5.841 | 7.729 | 5.892 | -2.737 | -6.010 |
| | Asia | 3.839 | 4.092 | 4.088 | 5.727 | -3.547 | -3.108 | -0.945 |
| | Transition | 2.126 | 4.807 | 3.224 | 7.081 | 4.672 | -5.464 | -6.303 |
| Non-tradable output (YN) | LA | 1.027 | 2.320 | 5.650 | 10.031 | 2.702 | -5.020 | -5.144 |
| | Asia | 3.780 | 4.897 | 4.714 | 4.387 | 0.444 | -2.741 | -1.487 |
| | Transition | 3.210 | 4.016 | 1.982 | 4.632 | 5.668 | -4.388 | -5.755 |
| Consumption (C) | LA | -1.876 | 0.974 | 4.398 | 8.541 | 5.862 | -2.292 | -6.391 |
| | Asia | 3.596 | 2.904 | 2.780 | 2.230 | -2.214 | -2.821 | -2.065 |
| | Transition | 0.543 | 3.080 | 2.227 | 2.381 | 2.713 | -2.306 | -6.604 |
| Investment (I) | LA | 8.836 | 8.773 | 13.374 | 20.947 | 15.871 | -18.896 | -18.177 |
| | Asia | 10.040 | 14.465 | 9.830 | 18.064 | -7.154 | -11.401 | -3.363 |
| | Transition | 1.254 | 1.581 | 15.281 | 20.471 | 18.703 | -16.581 | -23.255 |
| Real exchange rate (RER) | LA | 0.519 | -1.900 | 1.855 | 9.238 | 8.883 | 2.437 | -5.766 |
| | Asia | 4.774 | 6.040 | 8.654 | 6.725 | -3.976 | -0.348 | -4.624 |
| | Transition | -1.997 | -0.567 | -1.168 | 6.582 | 1.270 | 1.248 | -1.469 |
| Current account-GDP ratio (CAY) | LA | -0.889 | -0.253 | 0.211 | -2.299 | -0.585 | 0.631 | 1.159 |
| | Asia | -1.497 | -3.338 | -3.316 | -2.233 | 1.566 | 1.367 | 0.065 |
| | Transition | -0.293 | 0.619 | -0.464 | -1.789 | -0.832 | 1.605 | 1.611 |

Source: Authors' elaboration.

Stops literature (for example, Calvo, 1998, Mendoza, 2005, Caballero and Krishnamurty, 1998). However, it is important to note that these facts have been generally documented by examining macroeconomic data *without* conditioning for credit booms. In contrast, our results apply specifically to fluctuations associated with credit boom episodes. This is particularly relevant for the Sudden Stop facts (that is, the reversals in *CAY* and the boom-bust cycles in *RER* and *YN*), because most of the Sudden Stops literature emphasizes the role of credit transmission mechanisms in explaining Sudden Stops.

Our finding that credit booms are associated with a well-defined cyclical pattern in output and expenditures contrasts sharply with the findings of Gourinchas, Valdés, and Landerretche (2001), showing only ambiguous evidence of this association. Figure 6 in their paper shows a small cycle in GDP, a decline in GDP growth below trend for the entire duration of credit booms, and no cycle in consumption.

## 2.2 Frequency analysis

Next, we conduct a frequency analysis to examine three issues: (1) the association between credit booms and financial crises; (2) the role of capital inflows, TFP gains, financial reforms and exchange rate regimes as preconditions of credit booms; and (3) the probability of experiencing a credit boom once the starting threshold is crossed.

Credit booms are often cited as the culprit behind financial crises, particularly in emerging economies (Eichengreen and Arteta, 2002). If this is the case, credit booms should be closely associated with financial crises. Table 5 shows the percent of banking crises, currency crises and Sudden Stops that occurred during the seven-year window of the credit boom events in EMs, ICs and all countries combined. The percent of crises that occurred before, at, and after the peak of the credit booms are listed in separate columns. The dates identifying the occurrence of these crises were obtained from sources in the empirical literature (Demirguic-Kunt and Detragiache, 2005, for banking crises, Eichengreen and Bordo, 2002, for currency crises, and Calvo, Izquierdo, and Mejía, 2004, for Sudden Stops).

Table 5 yields an important result: Credit booms in both EMs and ICs are often associated with currency crises, banking crises, and Sudden Stops, although the first two are observed more often than the third. Banking crises are observed in 44 percent of all credit booms, in about a third of IC credit booms, and half of EM credit booms. Currency crises are observed in 54 percent of all credit booms,

**Table 5. Credit Booms and Crises[a]**
Frequency

| | *Banking crises*[b] | | | | *Currency crises*[c] | | | | *Sudden stops*[d] | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | *Before* | *Peak boom* | *After* | *Total* | *Before* | *Peak boom* | *After* | *Total* | *Before* | *Peak boom* | *After* | *Total* |
| All countries | 0.11 | 0.08 | 0.24 | 0.44 | 0.23 | 0.08 | 0.23 | 0.54 | 0.04 | 0.06 | 0.14 | 0.24 |
| Industrial countries | 0.06 | 0.06 | 0.25 | 0.36 | 0.17 | 0.03 | 0.25 | 0.44 | 0.00 | 0.00 | 0.14 | 0.14 |
| Emerging market economies | 0.17 | 0.11 | 0.23 | 0.51 | 0.29 | 0.14 | 0.20 | 0.63 | 0.09 | 0.11 | 0.14 | 0.34 |

Source: Authors' elaboration.
a. Coincidence of credit booms and financial crises in the seven-year window around the boom.
b. A banking crisis is defined by Demirguic-Kunt and Detragiache (2006) as a situation in which at least one of the following conditions holds: (1) the ratio of nonperforming assets to total assets of the banking system exceeds 10 percent; (2) the cost of banking system bailouts exceeds 2 percent of GDP; (3) there is large scale bank nationalization as result of banking sector problems; or (4) there are bank runs or new important depositor protection measures.
c. A currency crisis is defined by Eichengreen and Bordo (2002) as a period in which a country experiences a forced change in parity, abandons a currency peg or receives a bailout from an international organization, and at the same time an index of exchange rate market pressure (a weighted average of the depreciation rate, change in short-term interest rate, and percentage change in reserves) rises 1.5 standard deviations above its mean.
d. A sudden stop is defined by Calvo, Izquierdo and Mejía (2004) as a year-on-year fall in capital flows that exceeds 2 standard deviations relative to the mean.

in 44 percent of IC credit booms, and two-thirds of EM credit booms. Sudden Stops are observed in about one-quarter of all credit booms, in 14 percent of IC credit booms and third of EM credit booms.

It is also worth noting that, within the seven-year window of credit boom events, the incidence of the three types of crises is at its highest after credit booms peak, and this holds true again for EMs, ICs and all countries combined. Moreover, the frequency with which each type of crisis is observed after the peak of credit booms is also very similar across EMs and ICs (23 versus 25 percent for banking crises, 20 versus 25 percent for currency crises, and a common 14 percent for Sudden Stops). Thus, clearly not all credit booms end in crisis; but odds are about 1 out of 4 that once a country enters a credit boom it will end with a currency or a banking crisis, and a little less that it will end in a Sudden Stop.

These findings are broadly consistent with those reported in Schularick and Taylor (2012). They examined whether credit growth is a significant predictor of banking crises for a sample of fourteen developed countries over the 1870 to 2008 period, and found that indeed credit growth helps predict these crises. However, their analysis only provides indirect evidence of the credit boom-bust cycle because using credit growth, per-se, as an explanatory variable, does not identify whether this credit growth is the result of financial deepening or a credit boom.

Our findings are at odds with the conclusion in Gourinchas, Valdés, and Landerretche (2001), which noted that there is virtually no association between credit booms and financial crises in EMs. They are also sharply different from the findings in Mendoza and Terrones (2008), where lacking the data from 2007-2010 we found that credit booms in ICs were rarely associated with banking and currency crises, and there was no association with Sudden Stops.

We also constructed seven-year event windows that compare the fluctuations in credit and macro aggregates of countries that experienced a crisis (that is, banking crisis, currency crisis, or Sudden Stop) with those that did not. The results (available from the authors on request) show clearly that the macro fluctuations in the countries that experienced crisis are larger and display more abrupt declines than those of the non-crisis countries. In particular, the dynamics of credit are more pronounced, and with more drastic downswings in the case of the crisis countries, than in the non-crisis countries. In addition, the behavior of capital inflows is different across the two groups of countries. While capital inflows rise in the upswing of the crisis episodes and fall abruptly in the downswing, they seem more stable in the case of the non-crisis episodes.

Consider now the frequency analysis of the association between credit booms and large capital inflows, financial reforms, and TFP gains. Capital inflows are measured as the total net inflows (that is, net foreign direct investment, net portfolio flows, and other net investments liabilities) in percent of GDP, using data from IFS (appendix 2). We define a state of large capital inflows as of date *t* when the preceding three-year average of net capital inflows ranked on the top quartile of its respective country group (that is, EMs, ICs, or both) over the 1975-2010 period. Domestic financial reforms are measured using the index produced by Abiad, Detragiache, and Tressel (2007). This index takes values between 0 and 21, and includes information on reserve requirements and credit controls, interest rate controls, barriers to entry, state ownership, policies on securities markets, banking regulation, and capital account restrictions. We identify a country undertaking significant financial reforms as of date *t* if the preceding three-year change in this index ranks on the top quartile of its respective country group over the 1975-2005 period. Our measure of TFP is based on standard growth accounting methods (see, for instance, Klenow and Rodríguez-Clare, 1997, and Kose, Prasad, and Terrones, 2009), using labor and investment data from PWT 7.0, and educational attainment levels from Barro and Lee (2010). A country is identified to have experienced high TFP growth as of date *t* if the preceding three-year average of TFP growth ranked on the top quartile of its respective group over the 1975-2010 period.

Table 6 shows the fraction of credit booms preceded by large capital inflows, large TFP gains and domestic financial reforms. In the case of ICs, 42 percent of the credit booms followed large TFP gains, 33 percent followed large capital inflows, and 22 percent followed significant financial reforms. In contrast, in EMs we find that almost 1/2 of credit booms were preceded by large capital inflows and 30 percent by financial reforms, while TFP gains play a smaller role than in ICs, with a frequency of 20 percent. These results indicate that surges in capital inflows are a good predictor of credit booms in both ICs and EMs,[12] while in ICs large TFP gains are also a good predictor

12. In terms of the composition of the inflows, net portfolio and debt inflows stand out as the most important for ICs, while net foreign direct investment and net bank flows are the most significant for EMs.

## Table 6. Credit Booms: Potential Triggering Factors[a]

Frequency distribution

| | *Industrial countries* | *Emerging market economies* | *All* |
|---|---|---|---|
| Large capital inflows (A)[b] | 0.33 | 0.47 | 0.36 |
| Significant productivity gains (B)[c] | 0.42 | 0.20 | 0.18 |
| Large financial sector changes (C)[d] | 0.22 | 0.30 | 0.27 |
| *Memo items:* | | | |
| (A) and (B) | 0.17 | 0.10 | 0.07 |
| (A) and (C ) | 0.06 | 0.15 | 0.09 |
| (B) and (C ) | 0.17 | 0.04 | 0.04 |

Source: Authors' elaboration.

a. Because of data availability we have used the 1975-2010 period only. Frequencies have been adjusted for non-available data.

b. The three-year average of net capital inflow before the peak of the boom ranks in the top quartile of their corresponding country group.

c. The three-year average of the annual growth rate of TFP before the peak of the boom ranks in the top quartile of their corresponding country group.

d. The three-year change before the peak of the boom in the financial reform index ranks in the top quartile of their corresponding country group. The financial reform index is available till 2005.

## Table 7. Credit Booms and Exchange Rate Regimes

Frequency distribution

| | *Industrial countries* | *Emerging market economies* | *All* |
|---|---|---|---|
| Fixed and managed[a] | 0.71 | 0.62 | 0.67 |
| Dirty floating[b] | 0.11 | 0.21 | 0.16 |
| Floating[c] | 0.06 | 0.03 | 0.06 |
| Mixed | 0.11 | 0.15 | 0.12 |

Source: Authors' elaboration.

a. Fixed and managed includes the following regimes from the Reinhart and Rogoff (2004) classification: no separate legal tender, pre-announced peg or currency board arrangement, pre-announced horizontal band that is narrower than or equal to +/- 2%, de facto peg, pre-announced crawling peg, pre-announced crawling band that is narrower than or equal to +/-2%, de facto crawling peg, and de facto crawling band that is narrower than or equal to +/-2%.

b. Dirty floating includes the following regimes from the Reinhart and Rogoff (2004) classification: pre-announced.

c. Freely floating regimes from the Reinhart and Rogoff (2004) classification.

but financial reforms less so, and the opposite holds true for EMs.

Table 7 shows the results of a similar frequency analysis, but now, aimed at examining the association between the peak of credit booms and the exchange rate regimes in place the preceding three years. We use Reinhart and Rogoff's (2004) classification of exchange rate regimes to create the following four regime groupings: fixed and managed, dirty floating, floating, and mixed (see the footnote to table 7 for details). The mixed regime includes countries that switched across the other regimes in any of the three years prior to the peak of the credit boom. The results shown in table 7 are striking: about 70 percent of the credit booms occur in countries with managed or fixed exchange rate regimes, and this holds true for ICs, EMs, and all countries combined.[13]

Finally, we use frequency analysis to determine the probability that a country will experience a credit boom once it has crossed the starting threshold. This probability can be a useful "early warning" indicator for surveillance of credit market conditions. We considered starting thresholds of one-half, and one standard deviation of the cyclical component of our credit measure, and computed the probabilities for ICs, EMs and all countries combined. Once a starting threshold of one (one-half) standard deviation of the cyclical position of credit is crossed, the probability of a credit boom is 13 (8) percent for EMs, 23 (14) percent for ICs, and 17 (10) percent for all countries combined. Naturally, these probabilities are lower with the lower starting threshold, as it is less likely that the cyclical expansion of credit turns into a credit boom. The probabilities are higher for ICs than for EMs, indicating that having crossed the starting threshold is a more precise predictor of credit booms in the former, than in the latter.

## 3. Conclusions

This paper used a thresholds method to identify and measure credit booms in industrial and emerging economies, and conducted an event study analysis of the dynamics of macro aggregates during

13. In a related paper, Magud, Reinhart, and Vesperoni (2011), study the effects of exchange rate flexibility on credit expansions during episodes of large capital inflows in the emerging economies. They report evidence suggesting that countries with less flexible exchange rates often experience significant credit expansions during surges in capital inflows; thus, becoming more vulnerable to capital flow reversals.

credit booms. We identified 70 credit booms in a sample of 61 countries with data for the 1960-2010 period, with half of the credit booms in industrial countries and half in emerging economies. The upswing of these booms is associated with economic expansions, rising equity and housing prices, real currency appreciation, and widening external deficits, followed by the opposite dynamics in the downswing. Moreover, credit booms tend to be synchronized internationally and centered on "big events" like the 1980s debt crisis, Sudden Stops in emerging economies, and the 2008 Global Financial Crisis.

Credit booms display three striking similarities across industrial and emerging economies: (1) credit booms normalized by the cyclical variability of credit are similar in magnitude across both groups of countries; (2) banking crises, currency crises or Sudden Stops often follow credit booms, and the frequencies with which they do are similar across industrial and emerging economies; and (3) credit booms often follow surges in capital inflows, TFP gains, and financial reforms, and are far more common with managed, rather than flexible, exchange rates. These results differ significantly from previous findings in the literature on credit booms, suggesting an ambiguous relationship between credit booms and economic expansions, and little or no association between financial crises and credit booms (see Gourinchas, Valdés, and Landerretche, 2001). They are also different from the findings of our previous work (Mendoza and Terrones, 2008), which used data until 2006 and reported differences across industrial and emerging economy booms in the above three characteristics that we now find similar.

The results of our study have important implications for the analysis of macro-finance linkages, and for surveillance of financial systems and their macroeconomic effects. From the policy perspective, the thresholds method we proposed provides a tractable framework for measuring and identifying credit booms that are closely associated with cyclical fluctuations in macro aggregates and key financial indicators of corporations and banks. Our results show that credit booms can be identified by the size of a credit expansion relative to trend, and that this information can be supplemented with other indicators of excessive credit growth: such as, booms in output and expenditures, excessive real appreciation and/or expansion of the non-tradables sector, large inflows of foreign capital and fast TFP growth or domestic financial reforms. Moreover, our results also highlight the importance of using corrective policy actions to prevent credit booms, because the declining phase of credit booms is associated with recessions and a higher incidence of financial crises.

From the perspective of research on macro-finance linkages, our results provide a set of robust empirical regularities that can guide research on models of "credit transmission" by providing the set of facts that these models should aim to explain. These empirical regularities are reflected in a strong association of credit booms, with booms in: output and expenditures, rising asset prices, widening external deficits and sharp real appreciations.

APPENDIX 1

## Sample of Countries

The sample of countries we studied includes the 21 industrial countries and 40 emerging economies listed below. The dates of the peaks of credit booms identified for each country are shown in parenthesis.

## Industrial countries

Australia (AUS, 1973 and 1988), Austria (AUT, 1972 and 1979), Belgium (BEL, 1979, 1989, and 2007), Canada (CAN), Denmark (DNK, 1987), Finland (FIN, 1990), France (FRA, 1990), Germany (DEU, 1972 and 2000), Greece (GRC, 1972 and 2007), Ireland (IRL, 1979 and 2007), Italy (ITA, 1973 and 1992), Japan (JPN, 1972 and 1990), Netherlands (NLD, 1979), New Zealand (NZL, 1974), Norway (NOR, 1987 and 2007), Portugal (PRT, 1973 and 2000), Spain (ESP, 2007), Sweden (SWE, 1989 and 2007), Switzerland (CHE, 1989 and 2007), United Kingdom (GBR, 1973 and 1989), and United States (USA,1988 and 2007).

## Emerging market economies

Algeria (DZA), Argentina (ARG), Brazil (BRA, 1989), Bulgaria (BGR), Chile (CHL, 1980), China (CHN), Colombia (COL, 1998), Costa Rica (CRI, 1979), Côte d'Ivoire (CIV, 1977), Czech Republic (CZE), Ecuador (ECU, 1997), Egypt (EGY,1981), Estonia (EST, 2007), Hong Kong (HKG, 1997 and *), Hungary (HUN), India (IND,1989), Indonesia (IDN, 1997), Israel (ISR, 1978), Jordan (JOR), Korea (KOR, 1998), Latvia (LVA), Lithuania (LTU), Malaysia (MYS, 1997), Mexico (MEX, 1994), Morocco (MAR), Nigeria (NGA, 1982 and 2008), Pakistan (PAK, 1986), Peru (PER, 1987), Philippines (PHL, 1983 and 1997), Poland (POL, 2008), Romania (ROM, 1998), Russia (RUS, 2007), Singapore (SGP, 1983), Slovak Republic (SVK), Slovenia (SVN, 2007), South Africa (ZAF, 2007), Thailand (THA, 1978 and 1997), Turkey (TUR, 1976 and 1997), Uruguay (URY, 2002), and Venezuela (VEN, 2007).

(*) Ongoing credit booms.

## Appendix 2

## Description and definition of main variables

| *Variable* | *Variable definition* | *Source* |
|---|---|---|
| *A. Macroeconomic and financial data.* | | |
| Credit to the non-financial private sector | Sum of claims on the private sector by deposit money banks (IFS line 22d) plus, whenever available for the entire sample period by other financial institutions (IFS line 42d and sub-items). | IFS. In some industrial country cases data were completed using data from the OECD, Datastream, and Heaver. |
| M2 | Sum of money and quasimoney. | WDI and IFS. |
| Consumer price index | Consumer price index (both average and end-of-period). | IFS |
| Nominal GDP | GDP in current prices, local currency. | WDI |
| Population | Population | WDI |
| Real GDP | Real GDP per-capita, in international prices | PWT 7.0 |
| Private consumption | Real private consumption per-capita, in international prices | PWT 7.0 |
| Government consumption | Real government consumption per-capita, in international prices | PWT 7.0 |
| Investment | Real investment per-capita, in international prices | PWT 7.0 |
| Non-tradable GDP | Sum of the value added in services plus the value added in industry minus manufacture. | WDI |
| Current account balance | Current account balance as percent of GDP | WDI |
| Real exchange rate | Real effective exchange rate, index | INS (IMF) |
| Net capital inflows | Net capital inflows (proxied as the difference between the flow of total external liabilities and external assets) as percent of GDP. | IFS |
| Real stock prices | Equity price indices deflated using consumer price indices. | Authors' calculation with data from IFS. |
| Real house prices | House price indices deflated using consumer price indices. | Authors' calculation with data from several country sources, Haever Analytics, and OECD. |
| Total factor productivity | Total factor productivity calculated using the PWT 7 dataset and the new dataset on Educational Attainment (Barro and Lee, 2010). | Authors calculations following Kose, Prasad, and Terrones (2009). |

| *Variable* | *Variable definition* | *Source* |
|---|---|---|
| ***B. Crises definitions*** | | |
| Banking crises | A situation in which at least one of the following conditions holds: (1) the ratio of non-performing assets to total asses of the banking sector exceeds 10 percent; (2) the cost of banking system bailouts exceeds 2 percent of GDP; (3) there is a large scale bank nationalization as result of banking sector problems; and (4) there are bank runs or new important depositor protection measures. | Demirguic-Kunt and Detragiache (2005). Data for 2007 on has been taken from Laeven and Valencia (2011). |
| Currency crises | A situation in which a country experiences a forced change in parity, abandons a currency peg or receives a bailout from an international organization, and at the same time an index of exchange market pressure (a weighted average of the depreciation rate, change in short-term interest rate, and percentage change in reserves) rises 1.5 standard deviation above its mean. | Eichengreen and Bordo (2002). |
| Sudden stops | A situation in which a country experiences a year-on-year fall in capital flows that exceeds 2 standard deviations relative to the mean. | Calvo, Izquierdo, and Mejía (2004) Data for 2005 on has been calculated by the authors. |
| ***C. Other variables*** | | |
| Financial reform index | The index captures changes in seven financial policy dimensions: (1) credit controls and reserve requirements; (2) Interest rate controls; (3) Entry barriers; (4) State ownership in the banking sector; (5) Capital account restrictions; (6) Prudential regulations and supervision of the banking sector; and (7) Securities market policy. The index is just the sum of these seven dimensions (each of wich can take values between 0 and 3) and takes values between 0 (the lowest) and 21 (the highest). | Abiad, Detragiache, and Tressel (2007). |

## References


Abiad, A., E. Detragiache, and T. Tressel. 2007. "A New Database of Financial Reforms." Research Department. Washington: International Monetary Fund.

Barro, R. and J.-W. Lee. 2010. "A New Data Set of Educational Attainment in the World, 1950–2010," Working Paper 15902. Cambridge, Mass.: National Bureau of Economic Research.

Bernanke, B. and M. Gertler. 1989. "Agency Costs, Net Worth, and Business Fluctuations." *American Economic Review* 79(1): 14–31.

————. and S. Gilchrist. 1999. "The Financial Accelerator in a Quantitative Business Cycle Framework." In *Handbook of Macroeconomics*, Vol. 1C, edited by J.B. Taylor and M. Woodford, pp. 1531–1614. Amsterdam: North-Holland.

Borio, C., C. Furfine, and P. Lowe. 2001. "Procyclicality of Financial Systems and Financial Stability." BIS Papers 1, Basel: Bank for International Settlements.

Boz, E. and E.G. Mendoza. 2010. "Financial Innovation, the Discovery of Risk and the US Credit Crisis." Working Paper 16020. Cambridge, Mass.: National Bureau of Economic Research.

Caballero, R. and A. Krishnamurthy. 1998. "Emerging Market Crises: An Asset Markets Perspective." Working Paper 6843. Cambridge, Mass.: National Bureau of Economic Research.

Calvo, G.A., 1998, "Capital Flows and Capital-market Crises: The Simple Economics of Sudden Stops." *Journal of Applied Economics* 1: 35–54.

Calvo, G.A., A. Izquierdo, and L. Mejía. 2004. "On the Empirics of Sudden Stops: The Relevance of Balance-Sheet Effects." Working Paper 10520. Cambridge, Mass.: National Bureau of Economic Research.

Collyns, C. and A. Senhadji. 2002. "Lending Booms, Real Estate Bubbles, and the Asian Financial Crisis." IMF Working Paper 20. Washington: International Monetary Fund.

Corsetti G., P. Pesenti, and N. Roubini. 1999. "What Caused the Asian Currency and Financial Crisis?" *Japan and the World Economy* 11(3): 305–373.

Cottarelli, C., G. Dell'Ariccia, and I. Vladkova-Hollar. 2003. "Early Birds, Late Risers, and Sleeping Beauties: Bank Credit Growth to the Private Sector in Central and Eastern Europe and the Balkans." IMF Working Paper 213. Washington: International Monetary Fund.

Dell'Ariccia, G. and R. Márquez. 2006. "Lending Booms and Lending Standards." *Journal of Finance* 51(5): 2511–2546.

Demirguc-Kunt, A. and E. Detragiache. 2005. "Cross-Country Empirical Studies of Systemic Bank Distress: A Survey." IMF Working Paper 96. Washington: International Monetary Fund.

Eichengreen, B. and M.D. Bordo. 2002. "Crises Now and Then: What Lessons from the Last Era of Financial Globalization?" Working Paper 8716. Cambridge, Mass: National Bureau of Economic Research.

Eichengreen, B. and C. Arteta. 2002. "Banking Crises in Emerging Markets: Presumptions and Evidence." In *Financial Policies in Emerging Markets*, edited by M. Blejer and M. Skreb. Cambridge, Mass.: The MIT Press.

Fisher, I. 1933. "The Debt-Deflation Theory of the Great Depressions." *Econometrica* 1(4): 337–357.

Gourinchas, P.O., R. Valdés, and O. Landerretche. 2001. "Lending Booms: Latin America and the World." *Economia* (Spring): 47–99.

Gorton, G. and P. He. 2008. "Bank Credit Cycles." *Review of Economic Studies* 75(4): 1181–1214.

Hilbers, P., I. Otker-Robe, C. Pazarbasioglu, and G. Johnsen. 2005. "Assessing and Managing Rapid Credit Growth and the Role of Supervisory and Prudential Policies." IMF Working Paper 05/151. Washington: International Monetary Fund.

International Monetary Fund. 2004. "Are Credit Booms in Emerging Markets a Concern?" *World Economic Outlook*, pp. 148–166.

Kaminsky, G., C. Reinhart, and C. Vègh. 2005. "When it Rains it Pours: Procyclical Capital Flows and Macroeconomic Policies." In *NBER Macroeconomic Annual*, edited by M. Gertler and K. Rogoff, pp. 11–53, Cambridge, Mass.: National Bureau of Economic Research.

Kindleberger, C. 2000. *Manias, Panics, and Crashes: A History of Financial Crises*. New York: Harcourt, Brace and Company.

Kiyotaki, N. and J. Moore. 1997. "Credit Cycles." *Journal of Political Economy* 105(2): 211–248.

Klenow, P. and A. Rodríguez-Clare. 1997. "The Neoclassical Revival in Growth Economics: Has It Gone Too Far?." In *NBER Macroeconomics Annual*, edited by B. Bernanke and J. Rotemberg, pp. 73–102. Cambridge, MA: National Bureau of Economic Research.

Kose, A., E. Prasad, and M. Terrones. 2003. "Financial Integration and Macroeconomic Volatility." *IMF Staff Papers* 50: 119–143.

————. 2009. "Does Opennes to International Financial Flows Raise Productivity Growth?" *Journal of International Money and Finance* 28(4): 554–580.

Kraft, E. and L. Jankov. 2005. "Does Speed Kill? Lending Booms and their Consequences in Croatia." *Journal of Banking and Finance* 29(1): 105–121.

Laeven, L. and F. Valencia. 2011. "The Real Effects of Financial Sector Interventions During Crises," IMF Working Paper 45. Washington: International Monetary Fund.

Lorenzoni, G. 2008. "Inefficient Credit Booms." *Review of Economic Studies* 75(3): 809–833.

Magud, N.E., C.M. Reinhart, and E. Vesperoni. 2011. "Capital Inflows, Exchange Rate Flexibility, and Credit Booms." Working Paper 17670. Cambridge, Mass.: National Bureau of Economic Research.

Mendoza, E.G. 1995. "The Terms of Trade, the Real Exchange Rate, and Economic Fluctuations." *International Economic Review* 36(1): 101–137.

————. 2005. "Real Exchange Volatility and the Price of Non-Tradables in Sudden-Stop Prone Economies." *Economia* (Fall): 103–148.

————. and M.E. Terrones. 2008. "An Anatomy of Credit Booms: Evidence from Macro Aggregates and Micro Data." Working Paper 14049. Cambridge, Mass.: National Bureau of Economic Research.

————. 2010. "Sudden Stops, Financial Crises and Leverage." *American Economic Review* 100(5): 1941–1966.

Montiel, P. 2001. "What Drives Consumption Booms?" *The World Bank Review* 14(3): 457–480.

Neumeyer, P. and F. Perri. 2005. "Business Cycles in Emerging Economies: The Role of Interest Rate." *Journal of Monetary Economics* 52: 345–380.

Ottens, D., E. Lambregts, and S. Poelhekke. 2005. "Credit Booms in Emerging Market Economies: A Recipe for Banking Crises?" De Nederlandsche Bank.

Rajan, R.G. 1994. "Why Bank Credit Policies Fluctuate: A Theory and Some Evidence." *Quarterly Journal of Economics* 109(2): 399–441.

————. 2005. "Has Financial Development Made the World Riskier?" In *The Greenspan Era: Lessons for the Future*, pp. 313–369. Kansas: Federal Reserve Bank of Kansas City.

Reinhart, C.M. and K.S. Rogoff. 2004. "The Modern History of Exchange Rate Arrangements: A Reinterpretation." *Quarterly Journal of Economics* 119(1): 1–48.

Reinhart, C.M. and V. Reinhart. 2009. "Capital Flow Bonanzas: An Encompassing View of the Past and Present." In *NBER International Seminar on Macroeconomics 2008*, edited by

J. Frankel and C. Pissarides. Chicago, Illinois: University of Chicago Press.

Scheneider, M. and A. Tornell. 2004. "Bailout Guarantees, Balance Sheet Effects and Financial Crises." *Review of Economic Studies* 71(4): 883–913.

Schularick, M. and A.M. Taylor. 2012. "Credit Booms Gone Bust: Monetary Policy, Leverage Cycles, and Financial Crises, 1870–2008." *American Economic Review* 102(2): 1029–1061.

Tornell, A. and F. Westermann. 2005. *Boom-Bust Cycles and Financial Liberalization.* Cambridge, Mass.: The MIT Press.

# Capital Controls and Foreign Exchange Policy

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The question of whether capital controls should be part of the tool box for policymakers to deal with capital flows has become one of the central issues in the international economic policy debate. It was one of the key policy issues in the G20 under the French Presidency in 2011, and it has been covered extensively by the International Monetary Fund (IMF) and other international institutions and fora. However, despite a G20 commitment to arrive at "coherent conclusions" on capital flow management, only limited progress has been made so far.

One reason for the slow progress is that few policy issues have been as controversial as the desirability of capital controls. One side of the debate argues that financial liberalization and integration are a key foundation for global prosperity and growth, with capital mobility and access to foreign capital being an important source for investment and the diversification of risk. In contrast, policymakers of some emerging market economies emphasize the risks stemming from unfettered capital flows for the macroeconomic and financial stability objectives of their countries.

An analysis of all these arguments in favor and against capital controls reveals four overarching motives for the use of capital controls have emerged in the recent policy debate: a foreign exchange policy objective; a capital flow management goal; a financial stability aim; and a macroeconomic policy objective. First, authorities may pursue capital controls with a foreign exchange policy objective in mind, that is, to maintain a stable exchange rate that is not overvalued and thus does not impinge on the competitiveness of the domestic economy. Critics of capital

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controls and those pointing to the presence of "competitive devaluations" have gone a step further, arguing that capital controls have in some cases been actively used to achieve or maintain undervalued exchange rates. Second, policymakers' goal in pursuing capital controls may be related to capital flows, that is, to reduce both the volume and volatility of capital flows and to lower the share of relatively more risky portfolio flows. A third objective discussed in the policy debate is that of financial stability: policymakers may maintain or implement capital controls in order to shield the domestic economy and financial institutions from volatile capital flows and to avoid an overheating and overreliance on foreign capital. Under the fourth objective, capital controls may reflect a country's concerns about the real economy (namely, growth, growth volatility, inflation or public debt) or external vulnerability (that is, the current account or external debt).

This paper tests the empirical validity of these four hypotheses. Which of these four objectives is the primary motive for capital controls? The paper starts by identifying the characteristics of countries with high levels of capital controls and the ways in which these countries differ from those with free capital mobility. The paper uses a broad set of macroeconomic and financial variables, covering a broad set of 79 economies over the period 1984–2009, to gauge which of the four hypotheses are most important for understanding which countries maintain a high level of financial restrictions and which have few restrictions.

In the second step of the analysis, the paper then tries to explain the factors that cause policymakers to actively change the level of capital controls. Which of the four hypotheses best explains why some policymakers impose or raise capital controls and why others reduce them?

The third element of the analysis is based on an event study that investigates the evolution of macroeconomic and financial variables around changes in capital controls, including increases as well as reductions. How are countries that raise controls different from those that lower them or keep them unchanged? What is the experience of countries in the years after they change their capital controls relative to others?

Addressing these questions is challenging, partly because of the complexity of the various factors that may induce policy actions and partly due to methodological difficulties in identifying causes and effects. The paper takes a different approach from much of the literature that focuses on the effects or effectiveness of capital controls. The main goal of the present paper is not to analyze the effects of controls, but to identify which motives induce policymakers to adopt them in the first place; irrespective of whether they are then successful in achieving their objectives. This more modest objective also averts some of the difficult issues related to identification and, in particular, to endogeneity of the introduction of capital controls. The capital control measures employed are those developed by Chinn and Ito (2008, 2011) and Schindler (2009), which are proxies for the de jure financial openness of countries.

Overall, the empirical findings of the paper suggest that a foreign exchange policy objective has been an important, if not dominant, motive of capital controls globally. Countries with higher levels of capital controls tend to have undervalued (real effective) exchange rates. The undervaluation of the exchange rate is the single most important variable explaining a larger share of the difference in the level of capital controls across countries than any other variable in the analysis. Moreover, countries with undervalued exchange rates are more likely to raise existing capital controls further, especially since 1999. The event study analysis suggests that the degree of undervaluation increases in the years following large rises in capital controls. In addition, countries with high exchange rate volatility not only tend to have significantly higher levels of capital controls, but also are more likely to raise controls.

Another important dimension of the link between capital controls and foreign exchange policy relates to the country's exchange rate regime and monetary policy regime. Reducing the volatility and magnitude of capital flows through administrative controls makes it considerably easier for a central bank to maintain a fixed exchange rate regime. Conversely, countries with a flexible currency regime and an inflation-targeting monetary policy regime are less likely to need capital controls to achieve their policy objectives. The findings of the empirical analysis are consistent with this argument, as countries with flexible exchange rate regimes and those with an inflation-targeting regime tend to be more open financially. Moreover, since 1999 countries with inflation-targeting regimes have much more frequently reduced existing capital controls than nontargeting countries.

By contrast, there is no compelling evidence in the data that either the level of or changes in capital flows per se are an important motive for capital controls: countries with larger capital flows— measured relative to the overall size of countries' economies—are those that have more open capital accounts. Moreover, countries that have raised capital controls in the past have tended to have a comparatively lower level and volatility of capital flows. This evidence is corroborated by the event study, which shows that net portfolio flows decline in the years following significant increases in capital controls.

The evidence also uncovers only a mixed link between financial stability objectives and the level and changes in capital controls. Countries with deeper financial markets have a lower level of capital controls and are also less likely to raise capital controls. Moreover, countries with more financial stress (in bond, equity and money markets) in prior years tend to have lower levels of controls and are more likely to liberalize their capital account in subsequent years.

By contrast, countries with high growth rates in credit to the private sector are significantly more likely to raise capital controls. This variable on credit growth turns out to be one of three most important variables accounting for cross-country differences in capital controls. Moreover, countries with high inflation and volatile growth of gross domestic product (GDP) are also more likely to raise capital controls. Taken together, this suggests that concerns about an overheating economy, rather than purely about the financial market or asset prices, guide the decisions of policymakers to raise capital controls.

Many of these empirical links are either only present since 1999 or are particularly strong in that period, consistent with the argument that the 1997–98 Asian crisis may have induced a fundamental change in policymakers' objectives, in particular with regard to exchange rate policy.

In sum, the findings of the paper suggest that a foreign exchange policy objective and concerns about an overheating of the domestic economy have been the two main motives for capital flow management over the past two decades, especially in the 2000s. Both the level of capital controls the likelihood of raising existing controls further are strongly associated with fixed exchange rate regimes and significantly undervalued exchange rates. As to the financial stability side, the evidence suggests that capital controls are motivated not by worries about financial market volatility, but rather by concerns about capital inflows triggering or contributing to an overheating of the economy, in the form of high credit growth, rising inflation and output volatility. Finally, the paper also uncovers evidence that capital controls have externalities across countries, as governments are more likely to raise controls when other countries in the region have done so recently.

These findings have a number of policy implications. A first important point is that capital control measures seem to be used not in a purely defensive manner when it comes to foreign exchange policy: the presence and introduction of capital controls are not merely associated with avoiding an appreciation or overvaluation of the domestic currency, but rather are linked to a significant undervaluation of the exchange rate. This suggests that policymakers' concerns about competitive devaluations and currency wars, which have become so prominent in recent years, may not be unfounded. The competitive motive behind capital controls is strengthened by the finding that countries are more likely to raise controls when neighbouring countries have recently done so, as well.

Second, the evidence is consistent with the argument that capital flow management policies are used to compensate for the absence of autonomous macroeconomic and financial policies and effective adjustment mechanisms. The fact that countries with a high level of capital controls, as well as those actively implementing controls, tend to have fixed exchange rate regimes, a non-inflation-targeting monetary policy regime, and shallow financial markets indicates that policymakers need to use capital controls to protect their economies against capital flows. Although the size of the capital flows is rather modest relative to the overall size of the economy in countries with higher capital controls, their effect on the domestic economy (in terms of credit growth, inflation and output volatility) tends to be large when policy tools than other capital controls are absent and when financial markets are not deep enough to absorb those flows.

The fact that countries with high capital controls exhibit a worse performance with regard to credit growth, inflation and output volatility—and introducing (additional) controls does not seem to lower these overheating pressures systematically in subsequent years—makes it very hard to see capital control measures as a first-best policy option. Instead, financial market development and the creation of policy frameworks that allow for autonomous and credible macroeconomic and prudential policies may constitute a superior path to shield the domestic economy from fickle capital flows. While some consider capital flow management policies to be appropriate temporary measures to buy time for policymakers to enact more fundamental macroeconomic and prudential reforms, such policies carry the risk not only of creating domestic and international distortions, but reducing incentives for policymakers to pursue deeper reforms. The persistence or frequent re-introduction of capital control measures suggests that this risk may not be unfounded.

Several caveats have to be emphasized. Most importantly, one needs to be very cautious in interpreting the relationships identified here as establishing a causal link. Not only are countries with different levels of capital controls different in a multitude of ways, but the introduction of capital controls is never a random event and may be triggered by factors not covered by the analysis. This paper attempts to avoid these pitfalls by focusing not on assessing the effects or effectiveness of capital controls, but rather on analyzing and identifying differences in factors in the past, which are linked to policymakers' decisions to maintain or change capital controls today.

The paper proceeds by outlining the main arguments of both supporters and critics of capital controls in the current policy debate and reviewing some of the underlying academic literature, in section 1. Section 2 then describes the empirical methodology and the data used for the empirical analysis. Section 3 outlines the four main hypotheses to be tested and discusses the empirical findings. The final section summarizes the findings and draws policy implications.

## 1. The Pros and Cons of Capital Controls

Much of the recent policy debate has focused on the circumstances in which capital controls may constitute a useful policy tool.[1] This issue has become so important because of the experience of emerging market economies with capital flows during and after the 2007–08 financial crisis. The sudden collapse of capital inflows and the marked capital flight in the second half of 2008, and the subsequent influx in 2009 and 2010, put a lot of strain on domestic economies and financial markets in many emerging economies.[2]

A helpful framework for considering the issue is in terms of market distortions and market failures: if markets work efficiently, capital is allocated optimally, and any control on capital flows implies

1. The IMF has conducted substantial work in recent years on the issue of capital controls and their role in the policy mix, in particular in emerging markets. For a clear outline of the state of the debate and some underlying evidence, see Ostry and others (2010, 2011) and Chamon and others (2011).

2. A rapidly growing literature discusses various elements of this experience, including the drivers of capital flow cycles (that is, sudden stops, reversals, surges and retrenchments) and the 2007–08 crisis and its implications (see Forbes and Warnock, 2011; Aizenman and Sushko, 2011; Cowan and De Gregorio, 2007; Cowan and others, 2008; Calvo, Izquierdo and Mejía, 2011; Raddatz and Schmukler, 2011; and Fratzscher, 2011). There is also a growing literature linking capital flows to contagion and the cross-border transmission of shocks (see, for example, Broner, Gelos and Reinhart, 2006; Bekaert and others, 2011).

a distortion. Hence, much of the policy discussion about the potential role of capital controls has concentrated on the question of under which market failures are capital controls welfare improving.

A first type of distortion is related to international market failures. For instance, many ermerging market policymakers have argued that excessively loose monetary policy in the United States and other advanced economies since 2009 has been pushing more capital into emerging economies than warranted by underlying economic fundamentals. Other international distortions or market failures may relate to contagion and herd behavior of international investors, which can trigger excessive, temporary capital flows into some emerging economies. Capital controls may thus reduce the adverse effects of such distortions on the domestic economies receiving excessively large capital inflows. In short, capital controls may play a useful policy role if capital flows are excessive, temporary and primarily due to push factors, that is, factors that lie outside the control of domestic policy makers.

The second type of distortion or market failure that can be addressed through capital controls are domestic in nature. The most frequently emphasized domestic distortions frequently have a macroprudential and microprudential origin: capital flows may exacerbate existing financial fragilities in economies that are particularly vulnerable, that is, which have less financial development and depth and weaker institutions for dealing with financial stability issues. Other domestic fragilities may relate to the balance sheets of domestic firms and households, which may be adversely affected by large fluctuations in capital flows.

Based on the perspectives of both types of distortions, several policymakers have argued that capital controls may thus be seen as a macroprudential policy tool as much as a macroeconomic policy tool. Capital controls may become an even more important policy tool when other policies are constrained or not available at all. In particular, using an exchange rate appreciation as a buffer against a capital inflow surge is less feasible if the exchange rate is already overvalued and if the economy lacks competitiveness. Similarly, using foreign exchange interventions to absorb inflows is less desirable if foreign exchange reserves are already high and exceed what is needed for purely precautionary motives.[3]

3. For a discussion and evidence on the link between capital controls and exchange rate policy, see Jeanne (2011).

The desirability of using capital controls to deal with capital flow fluctuations may also depend on the space of monetary policy and fiscal policy. For instance, lowering interest rates to discourage capital inflows may not be a feasible policy option in an economy that has high inflation and is concerned about overheating. Tightening fiscal policy to reduce demand and counteract a surge in capital inflows may not be an option if fiscal policy is already tight and public debt high.

In a nutshell, this has been the general reasoning of many proponents of capital controls as a policy tool in the current debate. In contrast, critics tend to point out that in many cases capital controls are not a first-best solution, but rather an inferior alternative to needed policy reforms that address the financial stability risks from capital flow fluctuations, such as improving macro- and microprudential supervision and regulation; deepening financial markets; improving institutions; reforming macroeconomic policy frameworks (in particular with regard to monetary policy, fiscal policy and exchange rate regimes); and moving toward flexible exchange rate regimes to obtain fully autonomous monetary and fiscal policies.

In addition to being inferior policy responses, the imposition and maintenance of capital controls may in fact delay those needed reforms, with substantial longer-term costs to the domestic economy. Moreover, there is a huge literature investigating whether capital controls have been effective at all in dealing with capital flow fluctuations.[4] The findings in the literature do not yield compelling evidence in favor of the effectiveness of capital controls, although a consensus is emerging that while capital controls are easily circumvented and thus may not have a substantial effect on volume, they appear to change the composition of capital flows toward less risky and less volatile types of flows.

There is also compelling evidence that the capital controls imposed by individual economies can have adverse externalities and consequences for the global economy, which has triggered calls for closer cooperation of capital flow management policies at the global level, in particular through the G20 process. One such externality occurs through exchange rate management: if capital controls are used to maintain or induce undervalued exchange rates,

4. For an overview of this literature and its findings, see the excellent surveys of Magud, Reinhart and Rogoff (2011), Forbes (2007), Cardarelli, Elekdag and Kose (2009) and, for the 1980s and early 1990s, Calvo, Leiderman and Reinhart (1996). Henry (2007) provides a review of the broader experience with capital account liberalization.

it lowers the competitiveness of that country's trading partners. In fact, following the 2007–08 financial crisis, there has been a heated debated about some emerging economies engaging in competitive devaluations—or currency wars as Brazilian Finance Minister Guido Mantega called it—due to countries using foreign exchange interventions and capital controls to weaken their currencies. The massive increase in foreign exchange reserve holdings and the widespread introduction of capital controls by emerging economies are consistent with this argument.

Another externality is that the imposition of controls in one country may make it politically more attractive for other countries to adopt similar controls, thus leading to serious impediments to financial globalization.[5] Finally, the introduction of capital controls may divert capital flows to other countries. For instance, there is evidence that the introduction and raising of capital controls on portfolio inflows by Brazil in 2008–11 caused a significant diversion effect that increased capital inflows into other Latin American economies and other emerging economies outside Latin America.[6] Such externalities can be particularly strong for small emerging markets when the economy imposing controls is as large as Brazil. Overall, this case highlights the importance of pursuing and adopting a coordinated approach to capital controls.

## 2. Methodology and Data

This section starts by outlining the empirical approach for testing the four overarching potential motives for the use of capital controls, as stressed by the recent policy debate and outlined above: a foreign exchange policy objective; a capital flow management goal; a financial stability aim; and a macroeconomic policy objective. The main intention is to identify the factors that distinguish countries according to their choice of capital controls, in terms of both the overall level of de jure restrictions

5. See Prasad and others (2003) for a compelling overview of the arguments and underlying evidence on financial globalization. Many other benefits from financial globalization have been analyzed in the literature, in particular with regard to the diversification of risk and for investment; see Curcuru and others (2011), Hau and Rey (2005), Gelos and Wei (2005) and Rajan (2010).

6. Forbes and others (2012). Korinek (2010) provides a conceptual presentation of externalities and capital flows.

maintained by a country and the decision to either raise or lower existing controls. To identify the vector of factors $\mathbf{X}_{i,t}$ of country $i$ that relate to the level of capital controls ($CC$), the benchmark model to be estimated is formulated as

$$CC_{i,t} = \alpha_t + \mu\, \mathbf{X}_{i,t-1} + \varepsilon_{i,t} \tag{1}$$

while the benchmark model to relate factors to the choice of changes in capital controls is

$$D_{i,t}^{CC} = \alpha_t + \lambda\, \mathbf{X}_{i,t-1} + \varepsilon_{i,t} \tag{2}$$

$D_{i,t}$ is a dummy variable equal to one if a country raises capital controls in year $t$ and zero if it keeps existing controls unchanged. In a second model specification, the estimation is conducted for cases when capital controls are lowered, so that $D_{i,t}$ equals one if a country lowers capital controls in year $t$ and zero if existing controls are unchanged. Equation (1) is estimated via ordinary least squares (OLS); equation (2) uses a logit specification.[7]

Moreover, three types of models are estimated. In a first step, each individual factor $\mathbf{X}_{\mathrm{i,t}}$ is included separately (I call these the individual models); in a second step, all factors of a particular hypothesis are included together (the combined model); and in a third step, an encompassing procedure reduces the model specification in a stepwise fashion so as to arrive at the model that includes only those factors that are statistically significant at least at the 20 percent level (the encompassing model).

Both equations (1) and (2) include time effects $\alpha_t$ to take into account the general, common time trend in capital controls, whereby capital controls generally decrease over time. The inclusion of time dummies in equation (2) is less obvious, yet it turns out that the (re-) introduction of capital controls is clustered in a few particular years

7. In alternative specifications, equation (1) is estimated allowing for censoring at the lower bound, as a number of observations of the dependent variable lie at the lower/zero value of the dependent variable. Results are very similar to those using a linear OLS specification. The OLS estimation is presented below because the parameter estimates are more easily interpreted. Equation (2) is alternatively estimated using a multinomial logit specification, which allows estimating both models (the one for increasing capital controls and the one for lowering controls) in a single model, yielding identical parameter estimates.

of the sample.[8] Robust standard errors are reported throughout.

An important issue is the potential endogeneity of capital controls. As discussed above, much of the literature focuses on the effect of capital controls on various macroeconomic and financial variables, which raises the concern that such effects cannot be cleanly identified since capital controls are likely to be a direct or indirect endogenous result of the very same variables. This problem does not arise here because the analysis focuses on characterizing and identifying the factors that are associated with differences in the level and changes of capital controls. However, these factors may themselves be influenced by capital controls. I partly address this concern by analyzing past values of these factors, that is, including the lagged values of the factors $\mathbf{X}_{i,t\text{-}1}$. This does not entirely solve the problem, as both dependent and independent variables may be persistent over time; thus one needs to be careful when interpreting the parameter estimates in a causal way.[9]

The third part of the empirical analysis is an event study of the behavior of the factors $\mathbf{X}_i$ in the years before and after changes in capital controls. The motivation for this analysis is to understand whether fundamentals in countries raising capital controls in a particular year differ from fundamentals in countries that kept controls constant or lowered existing controls. The identification of countries raising, lowering and keeping constant their controls is the same as for equation (2) above. Again, the potential endogeneity of capital control policies means that the relationships identified in this event study should not be interpreted to imply causality.

The analysis is conducted for a broad set of 79 countries, using annual data for the period 1984–2009. Table 1 lists the countries included in the sample, where emerging market economies constitute about half of the countries. The sample and time period are mainly determined by data availability of the capital controls variables.

8. As one would expect, empirically the inclusion of time effects matters little in the estimation of equation (2), but is crucial for equation (1).

9. Various approaches have been employed in the literature to deal with the endogeneity issue of capital controls, such as using instrumental-variable approaches. However, these approaches are not free of pitfalls, as it is inherently difficult to identify appropriate instruments. Another challenge relates to the nonstationarity of the dependent variable in equation (1). Various test statistics are used to check, and confirm, the stationarity of the residuals.

**Table 1. Country Sample**

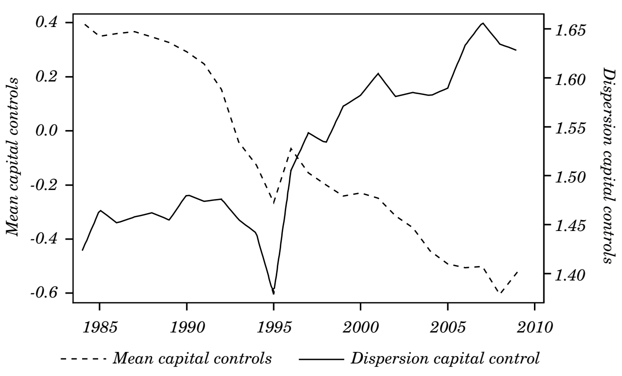
| | | |
|---|---|---|
| *Advanced* | | |
| Australia | Greece | Portugal |
| Belgium | Iceland | Spain |
| Canada | Ireland | Sweden |
| Denmark | Italy | Switzerland |
| Finland | Japan | United Kingdom |
| France | New Zealand | United States |
| Germany | Norway | |
| *Emerging* | | |
| Algeria | Indonesia | Romania |
| Argentina | Israel | Russian Federation |
| Bolivia | Korea | Singapore |
| Brazil | Latvia | Slovak Republic |
| Chile | Malaysia | Slovenia |
| China | Malta | South Africa |
| Colombia | Mexico | Thailand |
| Croatia | Morocco | Tunisia |
| Cyprus | Pakistan | Turkey |
| Czech Republic | Paraguay | Ukraine |
| Ecuador | Peru | Uruguay |
| Hungary | Philippines | Venezuela, RB |
| India | Poland | |
| *Developing* | | |
| Armenia | Ghana | Papua New Guinea |
| Burundi | Guyana | Samoa |
| Congo, DR | Iran | Sierra Leone |
| Costa Rica | Malawi | Solomon Islands |
| Dominican Republic | Moldova | Trinidad and Tobago |
| Fiji | Nicaragua | Uganda |
| Gambia | Nigeria | Zambia |

Source: Author's elaboration.

Mesuring capital controls is inherently difficult. The capital control measures by Chinn and Ito (2011) and Schindler (2009) are used here to proxy the de jure financial openness of countries. The use of *de jure* measures provides indications about the intentions of policymakers' intentions, rather than the actual outcome or de *facto* openness and integration of countries. The former proxy has a broader coverage and a longer time series, so it is the preferred measure in the analysis, although various robustness checks show that the empirical findings are very similar when using other proxies for *de jure* openness.[10] Both proxies are scaled so that a higher value indicates a higher degree of capital flow restrictions.[11]

Figure 1 plots the evolution over time of the average degree of capital controls, as well as the standard deviation of controls across countries at any point in time. The figure shows compellingly the overall trend toward fewer controls and more liberalization, although the dispersion across countries remains significant throughout the period and even rises toward the end of the 2000s. This is a powerful illustration that cross-country differences in capital controls globally have never been as dispersed as they are today.

**Figure 1. The Evolution of Capital Controls since the 1980s[a]**




Source: Author's elaboration.

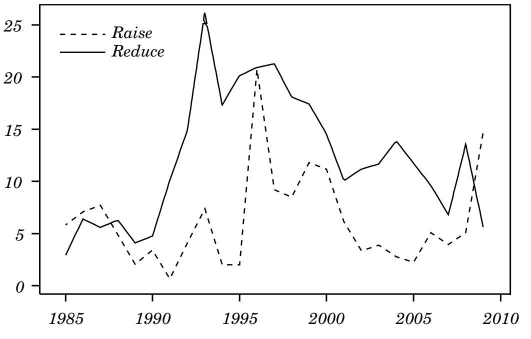
a. The figure shows the evolution of (normalized) capital controls, using the measure of Chinn and Ito (2011), for the average across all 79 countries in the sample, as well as providing the dispersion (the standard deviation across countries for each year) since 1984.

10. There are various strengths and advantages to the measure proposed by Schindler (2009), in particular its greater detail and breakdown of individual types and categories of capital controls. The main interest for the present paper is the dimension that refers to capital account restrictions, which is used for the analysis, although this measure is highly correlated with the Chinn-Ito measure. Moreover, a feature exploited for some of the analysis here is the distinction of the Schindler proxy between restrictions on capital inflows and controls on outflows.

11. For simplicity, the paper uses the term capital controls throughout, though strictly speaking the proxies include restrictions such as on foreign exchange or current account transactions.

Figure 2 shows the share of countries that raised capital controls, the share that lowered controls and the share that kept controls unchanged during a particular year. The figure reveals an interesting pattern, with sharp increases in capital controls occurring in many countries during the second half of the 1990s (during and following the Asian crisis) and in 2009 (after the global financial crisis of 2007–08). What is striking is that 2009 was the first year since the mid-1980s during which more countries raised capital controls than countries lowering them.

**Figure 2. The Evolution of Changes in Capital Controls since the 1980s[a]**




Source: Author's elaboration.
a. The figure shows the evolution of changes in (normalized) capital controls, using the measure of Chinn and Ito (2011). Specifically, the figure graphs the share of countries raising capital controls, lowering them or keeping them constant, as a share of all 79 countries in the sample for each year since 1984.

Finally, a broad set of potential proxies is used to test the four hypotheses discussed above. Table 2 provides an overview of the definition of the variables, while table 3 gives some summary statistics. For the empirical analysis below, all factors are normalized to have a zero mean and a standard deviation of unity in order to make the parameter estimates more easily comparable across variables.

**Table 2. Data Description and Sources**

| *Variable* | *Description* | *Source* |
| --- | --- | --- |
| *Foreign exchange policy* | | |
| FX overvaluation | FX overvaluation based on behavioral (BEER) and fundamental (FEER) equilibrium exchange rate models for REER | Bussiere and others (2010) |
| Trend appreciation | Appreciation of the REER over past year | BIS, IMF |
| Interest rate differential | Three-month money market interest rate differential vis-à-vis anchor currency country (US or euro area) | BIS, IMF |
| FX volatility | Standard deviation of monthly REER changes | BIS, IMF |
| FX reserves—level | Ratio of foreign exchange reserves to GDP | IMF |
| FX regime—float | Dummy: value of one if a currency is classified as freely floating; zero otherwise | IMF classification |
| Inflation-targeting regime | Dummy: value of one if the country is using an inflation-targeting strategy (including "IT light"); zero otherwise | IMF, Carare and Stone (2006), ECB |
| *Capital flows* | | |
| Capital outflows | Gross outflows of portfolio investment and other investment as a share of GDP | IMF |
| Capital inflows | Gross inflows of portfolio investment and other investment as a share of GDP | IMF |
| Net portfolio flows | Net portfolio investment flows as a share of GDP | IMF |
| Change capital outflows | Change in gross outflows relative to last year | IMF |
| Change capital inflows | Change in gross inflows relative to last year | IMF |
| Change net portfolio flows | Change in net portfolio flows relative to last year | IMF |
| Capital flow volatility | Standard deviation of monthly net portfolio flows to GDP | IMF |

**Table 2. (continued)**

| *Variable* | *Description* | *Source* |
|---|---|---|
| *Financial stability* | | |
| Financial depth | Institutional index of financial development (inverted): higher value = less financial depth | Dorrucci, Meyer-Cirkel and Santabárbara (2009) |
| Financial Stress Index | Composite of returns and volatility in equity, bond and money markets | IMF |
| Stock market capitalization | Stock market capitalization to GDP ratio | Datastream |
| Equity market returns | Change in equity return index | Datastream |
| Equity return volatility | Standard deviation of monthly equity returns | Datastream |
| Credit growth | Change in credit flows to the private sector, relative to GDP | IMF |
| Equity valuation | Deviation of annual equity returns from trend | Datastream |
| *Real economy and external stability* | | |
| GDP growth | Annual GDP growth rate | IMF |
| GDP growth volatility | Standard deviation of monthly net portfolio flows to GDP during the previous year | IMF |
| Inflation rate | CPI inflation rate | IMF |
| Current account/GDP | Ratio of current account to GDP | IMF |
| Trade openness | Ratio of exports plus imports to GDP | IMF |
| Public debt/GDP | Ratio of public debt to GDDP | GDI |
| External debt/GDP | Ratio of external debt to GDP | GDI |

Source: Author's elaboration.

## Table 3. Summary Statistics

| Variable | Mean | Std. Deviation | Minimum | Maximum |
|---|---|---|---|---|
| *Foreign exchange policy* | | | | |
| FX overvaluation | 7.175 | 17.663 | –21.649 | 45.700 |
| Trend appreciation | –0.005 | 0.127 | –19.922 | 26.606 |
| Interest rate differential | 7.530 | 18.671 | –7.810 | 69.150 |
| FX volatility | 0.034 | 0.064 | 0.000 | 1.735 |
| FX reserves—level | 0.136 | 0.154 | 0.036 | 1.583 |
| FX regime—float | 0.143 | 0.350 | 0.000 | 1.000 |
| Inflation-targeting regime | 0.133 | 0.340 | 0.000 | 1.000 |
| *Capital flows* | | | | |
| Capital outflows | –0.001 | 0.275 | –0.402 | 0.853 |
| Capital inflows | 0.001 | 0.189 | –0.544 | 0.505 |
| Net portfolio flows | 0.004 | 0.067 | –0.737 | 0.750 |
| Change capital outflows | –0.007 | 0.339 | –0.284 | 0.190 |
| Change capital inflows | 0.003 | 0.218 | –0.298 | 0.233 |
| Change net portfolio flows | –0.001 | 0.068 | –0.402 | 0.382 |
| Capital flow volatility | 0.036 | 0.087 | 0.000 | 0.853 |
| *Financial stability* | | | | |
| Financial depth | 0.428 | 0.627 | 0.000 | 8.125 |
| Financial Stress Index | –0.069 | 2.707 | –5.619 | 15.150 |
| Stock market capitalization | 0.473 | 0.602 | 0.000 | 2.425 |
| Equity market returns | 0.007 | 0.043 | –0.169 | 0.773 |
| Equity return volatility | 0.033 | 0.034 | 0.000 | 1.094 |
| Credit growth | 1.971 | 23.057 | 0.003 | 52.104 |
| Equity valuation | 7.175 | 17.663 | –21.649 | 45.700 |
| *Real economy and external stability* | | | | |
| GDP growth | 0.040 | 0.027 | –0.151 | 0.177 |
| GDP growth volatility | 0.013 | 0.012 | 0.001 | 0.113 |
| Inflation rate | 8.331 | 5.394 | –2.176 | 267.067 |
| Current account/GDP | –0.004 | 0.051 | –0.224 | 0.238 |
| Trade openness | 0.816 | 0.473 | 0.003 | 4.729 |
| Public debt/GDP | 0.584 | 0.392 | 0.050 | 2.898 |
| External debt/GDP | 0.177 | 0.282 | 0.003 | 0.734 |

Source: Author's elaboration.

As to the hypothesis that capital controls are related to foreign exchange policy, seven foreign exchange variables are analyzed. A first key variable is the degree of exchange rate misalignment, so as to test whether having an undervalued or overvalued exchange rate is associated with a different level of capital controls and whether it triggers active decisions by policymakers to raise or lower existing restrictions. The main measure of foreign exchange overvaluation used stems from behavioral (BEER) and fundamental (FEER) equilibrium exchange rate models for real effective exchange rates. As this variable is an important focus of the present paper, several alternative proxies for foreign exchange misalignment are used and based on deviations from a linear trend or from period averages of real effective exchange rates (REER), nominal effective exchange rates (NEER) and bilateral exchange rates vis-à-vis the main anchor currencies. While the estimates shown below are based on the foreign exchange overvaluation measures from the structural BEER and FEER models, those estimates are robust to using such proxies of misalignments from trend.[12]

Policymakers may also react to other foreign exchange policy variables in their decision about capital controls, including the past trend appreciation of the REER, the three-month money market interest rate differential vis-à-vis the anchor currency country and the exchange rate volatility (measured as the standard deviation of monthly REER movements during the previous year). All these variables are included in the model estimation of equations (1) and (2) and are based on lagged values (the previous year) so as to take into account the fact that changes in capital controls are likely to affect foreign exchange variables themselves contemporaneously.

In addition, the test of the foreign exchange policy hypothesis includes the level of foreign exchange reserves as a share of GDP, a dummy for the exchange rate regime (taking the value of one if a currency is classified by the IMF as being freely floating) and a dummy for whether countries have an inflation-targeting monetary policy strategy (taking a value of one if the country is targeting inflation). The priors are that countries with a floating exchange rate regime and an inflation-targeting regime are more likely to have fewer restrictions on

12. Data for REER and NEER are from the Bank for International Settlements (BIS) and the IMF. Bilateral exchange rates are mostly taken vis-à-vis the US dollar, with the exception of European currencies, for which the euro that is taken as the anchor currency.

capital flows. The prior for foreign exchange reserves is more difficult to gauge. On one hand, foreign exchange reserve accumulation and a fixed exchange rate regime may be complements, as both may be used to stabilize the country's currency. This would imply that more reserves are linked to more capital account restrictions. On the other hand, foreign exchange reserves and capital account openness may be negatively correlated, in that a country with a closed capital account may not need to intervene heavily in foreign exchange markets to stabilize the domestic currency.

As to the second hypothesis, the capital flow hypothesis, the level, change and volatility of capital flows are used as proxies to gauge whether capital controls are related to fluctuations in capital flows. Overall capital inflows and outflows (portfolio flows plus other investment flows, which mostly includes bank loans) and, more narrowly, net portfolio flows are analyzed in the empirical test. Changes in flows are percentage changes relative to the previous year; the volatility of flows is the standard deviation of monthly flows.

All capital flow proxies are measured as a share of GDP. This is an important point to keep in mind because when for example, people talk about "excessive" capital flows, they may have different benchmarks in mind. For instance, a given volume of capital inflows may not be large when measured against the overall size of the economy, but these flows may be very large relative to the size of the domestic financial sector. The reason for normalizing flows by GDP is to be able to distinguish the size of capital flows per se from the importance of other factors and characteristics, which are analyzed separately under the financial stability hypothesis below.

Third, a number of alternative proxies are used to test for the role of a financial stability objective of capital controls. Institutional indicators of financial sector development and stock market capitalization relative to GDP are employed as two alternative proxies for a country's financial market depth and development. The prior is that policymakers are more likely to maintain a higher level of capital controls or raise capital controls when the domestic financial sector is more shallow, causing external and domestic shocks to have an adverse effect on the domestic financial system and the domestic economy.

As a second dimension, the analysis tests for the role of financial stress; the prior is that higher financial stress should be positively correlated with capital control measures. The IMF's financial stress index (which is a composite of returns and volatility in equity, bond and money markets) and specifically equity market volatility (standard deviation of monthly returns) are used as proxies. Third, to capture the role of overheating and asset price bubbles, the analysis includes credit growth (the change in credit flows to the private sector, relative to GDP), the change in domestic equity returns and the deviation of equity returns from period averages (equity valuation) as proxies. The prior here is clear, with more financial stress or asset price rises in the previous year expected to be positively related to capital controls.

As to the fourth and final hypothesis, the role of the real economy and external stability for the choice of capital flow management measures, the GDP growth rate, GDP growth volatility (standard deviation of quarterly growth rates over the past two years), the consumer price index (CPI) inflation rate, the ratio of the current account to GDP, trade openness (exports plus imports over GDP), the ratio of public debt to GDP and the ratio of external debt to GDP are included. Most priors as to the relationship with capital controls are clear with regard to these proxies, possibly with the exception of trade openness. On one hand, more trade openness may imply that a country is more exposed to external shocks, potentially providing an incentive for domestic policymakers to try to shield the domestic economy from such shocks by restricting the mobility of capital into and out of the country. On the other hand, the literature contains solid evidence that capital flows piggy back trade, that is, that there is a positive relationship between the two for financing and risk-sharing motives.

## 3. Testing the Four Hypotheses: The Empirical Results

This section presents and discusses the results, systematically discussing each of the four hypotheses in turn.

### 3.1 Foreign Exchange Policy

The analysis first turns to the role of foreign exchange policy as a motivation for capital controls. Table 4 presents the estimates of equation (1) for the level of controls, while table 5 shows the estimates for equation (2) for the changes in controls. The last columns of each table indicate the conceptual prior about the expected signs of the coefficients, based on the discussion in the previous section. For

**Table 4. Foreign Exchange Policy (Hypothesis 1): Level of Capital Controls[a]**

| | *Combined model* | | *Encompassing model* | | |
|---|---|---|---|---|---|
| *Variable* | *Benchmark level* | *Post-1999 level* | *Benchmark level* | *Post-1999 level* | *Hypothesis* |
| FX overvaluation | –0.137<br>(0.271) | –0.600<br>(0.459) | | –0.828**<br>(0.372) | – |
| Trend appreciation | –0.213***<br>(0.0758) | –0.143<br>(0.147) | –0.225***<br>(0.0704) | | – |
| Interest rate differential | 0.645***<br>(0.139) | 0.406**<br>(0.183) | 0.657***<br>(0.135) | 0.161***<br>(0.0314) | + |
| FX volatility | 0.424**<br>(0.181) | 0.941***<br>(0.243) | 0.430**<br>(0.180) | 1.026***<br>(0.219) | + |
| FX reserves—level | –0.0172<br>(0.0564) | 0.148<br>(0.0974) | | 0.143<br>(0.0950) | + |
| FX regime—float | –1.061***<br>(0.139) | –0.790***<br>(0.192) | –1.027***<br>(0.116) | –0.778***<br>(0.156) | – |
| Inflation-targeting regime | 0.0677<br>(0.155) | –0.0219<br>(0.193) | | | – |
| *Summary statistic* | | | | | |
| No. observations | 778 | 397 | 778 | 397 | |
| No. countries | 79 | 79 | 79 | 79 | |
| $R^2$ | 0.194 | 0.149 | 0.397 | 0.343 | |

Source: Author's elaboration.
* Statistically significant at the 10 percent level. ** Statistically significant at the 5 percent level. *** Statistically significant at the 1 percent level.
a. The table shows the parameter estimates of equation (1), using OLS. The columns under "Hypothesis" provide the priors for the signs of the respective coefficients.

## Table 5. Foreign Exchange Policy (Hypothesis 1): Changes in Capital Controls[a]

| | *Combined model* | | | | *Encompassing model* | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | *Benchmark* | | *Post-1999* | | *Benchmark* | | *Post-1999* | | *Hypothesis* | |
| *Variable* | *Reduce* | *Raise* | *Reduce* | *Raise* | *Reduce* | *Raise* | *Reduce* | *Raise* | *Reduce* | *Raise* |
| FX overvaluation | 0.780 | −0.312 | 1.315 | −0.673 | | | | −0.613* | + | − |
| | (0.767) | (0.442) | (1.594) | (0.437) | | | | (0.369) | | |
| Trend appreciation | −0.0835 | 0.494** | 0.852* | 0.127 | | 0.444** | 0.841* | | + | − |
| | (0.151) | (0.227) | (0.510) | (0.374) | | (0.213) | (0.478) | | | |
| Interest rate differential | 0.253 | 0.000671 | −0.146 | 0.0218 | 0.633*** | | | | − | + |
| | (0.182) | (0.204) | (0.292) | (0.270) | (0.0367) | | | | | |
| FX volatility | 0.552* | 0.584 | 1.688*** | 1.424*** | | 0.610 | 1.471*** | 1.375*** | − | + |
| | (0.283) | (0.402) | (0.474) | (0.538) | | (0.373) | (0.442) | (0.437) | | |
| FX reserves—level | 0.112 | 0.115 | 0.398* | 0.112 | | | 0.450** | | − | + |
| | (0.121) | (0.112) | (0.206) | (0.155) | | | (0.196) | | | |
| FX regime—float | −0.650 | 0.0739 | −1.149* | −0.0706 | | | −0.982* | | + | − |
| | (0.407) | (0.385) | (0.603) | (0.611) | | | (0.553) | | | |
| Inflation-targeting regime | 0.755** | −0.391 | 1.622*** | −0.0108 | | | 1.623*** | | + | − |
| | (0.345) | (0.436) | (0.543) | (0.662) | | | (0.543) | | | |
| *Summary statistic* | | | | | | | | | | |
| No. observations | 778 | 772 | 397 | 397 | 778 | 772 | 397 | 397 | | |
| No. countries | 79 | 79 | 79 | 79 | 79 | 79 | 79 | 79 | | |
| $R^2$ | 0.194 | 0.066 | 0.149 | 0.051 | 0.397 | 0.079 | 0.343 | 0.048 | | |

Source: Author's elaboration.
* Statistically significant at the 10 percent level. ** Statistically significant at the 5 percent level. *** Statistically significant at the 1 percent level.
a. The table shows the parameter estimates of equation (2), using a logit model. The columns under "Hypothesis" provide the priors for the signs of the respective coefficients.

each hypothesis, three types of models are estimated and presented: individual models including each factor separately; a combined model capturing all factors of a particular hypothesis together; and an encompassing model that includes only those factors that are statistically significant at the 20 percent level.

Overall, there is significant evidence that the level and changes in capital controls are related to foreign exchange policy. In particular, there is a close link between the undervaluation of exchange rates and capital control policies. Since 1999, an undervalued exchange rate is associated with a higher level of capital controls. Moreover, countries with undervalued exchange rates are more likely to have raised capital controls since 1999.

Capital controls are also significantly related to other elements of concern for foreign exchange policy: higher REER volatility is associated with a higher level of capital controls (especially since 1999) and is more likely to trigger an increase in capital controls. Similarly, a trend depreciation of the REER is also linked to both a higher level and a lower probability of policymakers reducing capital controls since 1999.

Another key dimension connecting capital controls and foreign exchange policy is the country's exchange rate regime and underlying monetary policy regime. Containing the volatility and volume of capital flows through capital controls may make it easier for policymakers to maintain a fixed exchange rate regime. Countries with a flexible currency regime and an inflation-targeting monetary policy regime are less likely to need capital controls to achieve their policy objectives. The findings of the empirical analysis are consistent with this argument, as countries with a flexible exchange rate regime or an inflation-targeting regime tend to be more open financially. Moreover, since 1999 countries with inflation-targeting regimes have much more frequently reduced existing capital controls than nontargeting countries.

Table 6 tries to gauge the relevance of the various factors by looking at the interdecile range of the marginal effects. Concretely, the table displays how much the capital control measure is explained, on average, by differences in each of the factors analyzed when comparing countries with a value of a factor at the tenth percentile of the entire distribution (of countries and over time) with countries with a value of the same factor at the ninetieth percentile of the distribution. For instance, a country with a high degree of overvaluation at a particular point in time (that is, at the ninetieth percentile of the foreign exchange overvaluation variable) has a level of capital controls that is 2.55

## Table 6. Economic Relevance of Alternative Hypotheses

| *Variable* | *Hypothesis* | *Interdecile*[a] |
|---|---|---|
| *FX policy* | | |
| FX overvaluation | – | –2.55 |
| Trend appreciation | – | –0.27 |
| Interest rate differential | + | 0.14 |
| FX volatility | + | 1.73 |
| FX reserves—level | + | 0.21 |
| FX regime—float | – | –0.77 |
| Inflation-targeting regime | – | |
| *Capital flows* | | |
| Capital outflows | + | –0.33 |
| Capital inflows | + | –0.21 |
| Net portfolio flows | + | 0.19 |
| Change capital outflows | + | –0.09 |
| Change capital inflows | + | |
| Change net portfolio flows | + | –0.24 |
| Capital flow volatility | + | 0.13 |
| *Financial stability* | | |
| Financial depth | – | –0.59 |
| Financial Stress Index | + / ? | –0.34 |
| Stock market capitalization | – | –1.10 |
| Equity market returns | – | |
| Equity return volatility | + | 0.21 |
| Credit growth | + / ? | 1.66 |
| Equity valuation | – | –0.55 |
| *Real economy* | | |
| GDP growth | – | 0.32 |
| GDP growth volatility | + | 0.34 |
| Inflation rate | + | 0.84 |
| Current account/GDP | – | –0.20 |
| Trade openness | – / ? | –0.29 |
| Public debt/GDP | + | |
| External debt/GDP | + | –0.14 |

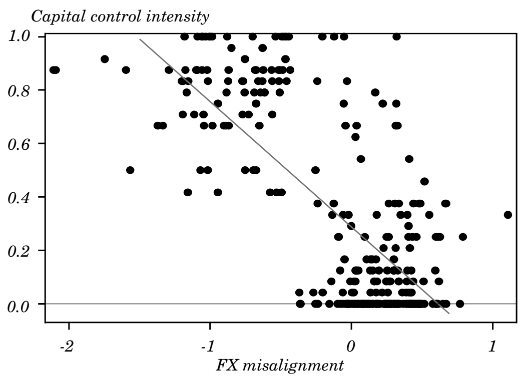
Source: Author's elaboration.
a. The column labeled "Interdecile" shows the difference in the level of capital controls for a country with the respective factor at its 90th percentile compared to a country with the same factor at the 10th percentile.

lower, on average, than a country with a low degree of overvaluation (that is, a high degree of undervaluation, at the tenth percentile of the foreign exchange overvaluation variable). The value of 2.55 is about one full standard deviation of the capital control level variable, which is a quite sizeable magnitude.

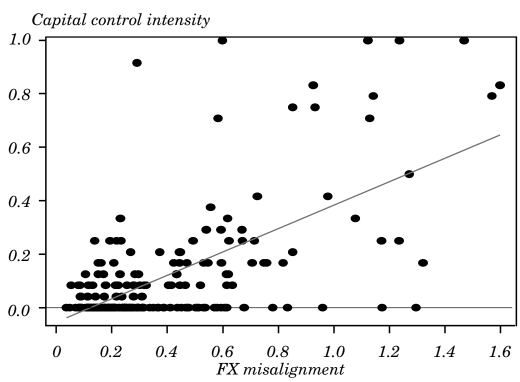
Figure 3 provides a visualization of the relationship between the level of capital controls and first, foreign exchange overvaluation and, second, the foreign exchange volatility variable. The fit is particularly

**Figure 3. Capital Controls and Exchange Rate Policy[a]**

*A. Foreign exchange overvaluation*




*B. Foreign exchange volatility*




Source: Author's elaboration.

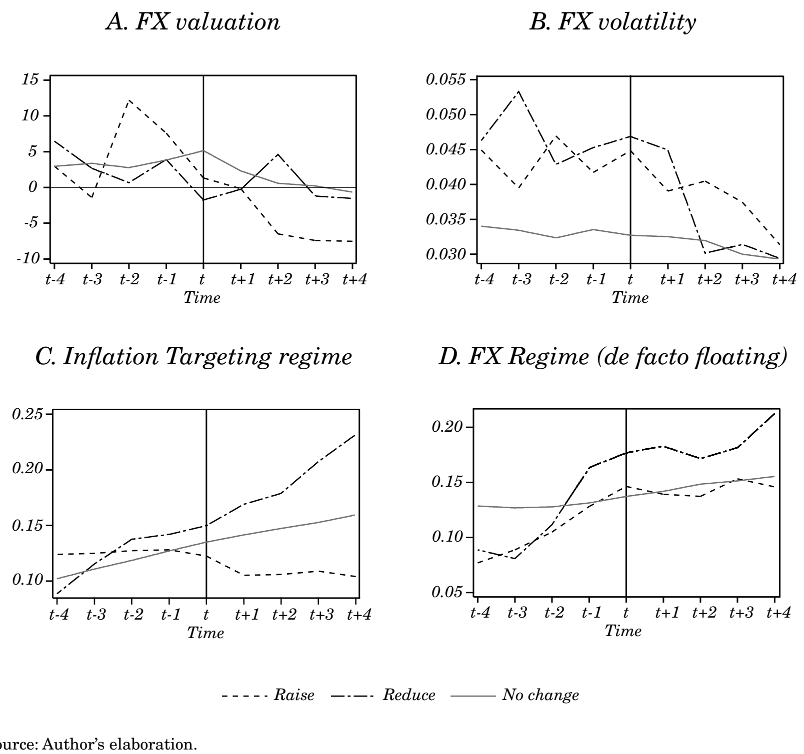
a. The figure shows the values of the capital control measure against the values for foreign exhcange overvaluation (panel A) and volatility (panel B) for all countries and each year in the precrisis period (2003–07).

good in the relationship between overvaluation and capital controls across countries and over time.

For the event study, figure 4 shows the evolution of four of the foreign exchange policy variables around changes in capital controls (either increases or reductions). In particular, the event study indicates that the degree of undervaluation increases in the years following large rises in capital controls. Moreover, countries with high exchange rate volatility not only tend to have significantly higher levels of capital controls, but are also more likely to raise capital controls.

The evidence for inflation targeting is also striking. Countries with inflation-targeting regimes are much more likely to reduce capital controls than keep them constant. By contrast, countries that

**Figure 4. Foreign Exchange Policy: Evolution around Changes in Capital Controls[a]**




Source: Author's elaboration.

a. The figures show the evolution of variables around changes in capital controls (either increases or reductions), compared with countries with no changes. The horizontal axis indicates the four years before and after these changes.

raise capital controls are less likely to have an inflation-targeting regime in the years after raising capital controls.

Finally, I conducted a battery of robustness tests to check for the sensitivity of the estimates. Table 7 presents the benchmark estimates when using the alternative capital control measure by Schindler (2009). The table indicates that the estimates are qualitatively very similar to those using the Chinn-Ito measure. Next, table 8 provides estimates when splitting controls on inflows from controls on outflows. The findings overall are qualitatively very similar for controls on inflows and outflows. Similarly, distinguishing across country groups does not yield systematically different findings, though some coefficients lose or gain significance in alternative models (table 9). Several other robustness tests were conducted that are not shown here for brevity reasons.[13]

In summary, the evidence shown points quite strongly toward foreign exchange policy motives being an important objective behind capital control policies, both for maintaining a high level of capital controls and for raising capital controls at times. This is particularly the case with regard to maintaining undervalued exchange rates.

## 3.2 Capital Flows

The section turns to analyzing the potential role of the second hypothesis, namely, whether and to what extent capital flow management policies are influenced by a capital flow objective. Overall, tables 10 and 11 indicate that there is no compelling evidence that either the level of or changes in capital flows per se are an important motive for capital controls. In fact, higher levels of gross capital inflows, gross capital outflows and changes in net portfolio flows are associated with a lower level of capital controls (table 10). Moreover, having experienced higher capital inflows, portfolio inflows or net portfolio flow volatility in the previous year reduces the probability of a country raising capital controls (table 11).

13. For instance, one of the strengths of the Schindler measure is that it allows distinguishing between controls across different types of investment. Again, the estimates did not show a pattern that would point toward systematic differences across categories. Moreover, equation (2) for changes was also estimated using these alternative capital control proxies, with similar empirical findings as for the presented benchmark results. The same holds for the estimates for the other three hypotheses.

**Table 7. Robustness Tests of Foreign Exchange Policy (Hypothesis 1): Alternative Proxy of Capital Controls (Schindler), Levels[a]**

| | *Combined model* | | *Encompassing model* | | |
|---|---|---|---|---|---|
| *Variable* | *Benchmark level* | *Post-1999 level* | *Benchmark level* | *Post-1999 level* | *Hypothesis* |
| FX overvaluation | –0.0800<br>(0.112) | –0.461***<br>(0.174) | | –0.388**<br>(0.156) | – |
| Trend appreciation | –0.0377<br>(0.0293) | 0.0269<br>(0.0468) | –0.0444*<br>(0.0258) | | – |
| Interest rate differential | 0.0829***<br>(0.0302) | 0.0359<br>(0.0362) | 0.0895***<br>(0.0267) | 0.0418<br>(0.0308) | + |
| FX volatility | 0.111*<br>(0.0571) | 0.127*<br>(0.0731) | 0.112**<br>(0.0567) | 0.122*<br>(0.0727) | + |
| FX reserves—level | 0.0371*<br>(0.0208) | 0.0595**<br>(0.0299) | 0.0366*<br>(0.0208) | 0.0603**<br>(0.0299) | + |
| FX regime—float | –0.142***<br>(0.0508) | –0.0752<br>(0.0675) | –0.138***<br>(0.0386) | –0.106**<br>(0.0506) | – |
| Inflation-targeting regime | 0.00766<br>(0.0498) | –0.0532<br>(0.0644) | | | – |
| *Summary statistic* | | | | | |
| No. observations | 352 | 220 | 352 | 220 | |
| No. countries | 79 | 79 | 79 | 79 | |
| $R^2$ | 0.120 | 0.122 | 0.481 | 0.486 | |

Source: Author's elaboration.
* Statistically significant at the 10 percent level. ** Statistically significant at the 5 percent level. *** Statistically significant at the 1 percent level.
a. The table shows the parameter estimates of equation (1), using OLS and the alternative capital control measure from Schindler (2009). The columns under "Hypothesis" provide the priors for the signs of the respective coefficients.

**Table 8. Robustness Tests of Foreign Exchange Policy (Hypothesis 1): Controls on Inflows versus Outflows, with Schindler Proxy[a]**

| | Combined model | | Encompassing model | | |
|---|---|---|---|---|---|
| *Variable* | *Benchmark level* | *Post-1999 level* | *Benchmark level* | *Post-1999 level* | *Hypothesis* |
| *A. Level of capital controls on inflows* | | | | | |
| FX overvaluation | −0.0664<br>(0.0871) | −0.318**<br>(0.149) | | −0.320**<br>(0.129) | − |
| Trend appreciation | −0.0234<br>(0.0243) | 0.0179<br>(0.0407) | −0.0285<br>(0.0220) | | − |
| Interest rate differential | 0.0574**<br>(0.0251) | 0.0169<br>(0.0286) | 0.0618***<br>(0.0217) | | + |
| FX volatility | 0.0748<br>(0.0489) | 0.0978<br>(0.0668) | 0.0746<br>(0.0487) | 0.104*<br>(0.0577) | + |
| FX reserves—level | 0.0142<br>(0.0181) | 0.0283<br>(0.0269) | | | + |
| FX regime—float | −0.138***<br>(0.0427) | −0.104*<br>(0.0596) | −0.116***<br>(0.0329) | −0.109***<br>(0.0408) | − |
| Inflation-targeting regime | 0.0464<br>(0.0421) | 0.0153<br>(0.0578) | | | − |
| *Summary statistic* | | | | | |
| No. observations | 352 | 220 | 352 | 220 | |
| No. countries | 79 | 79 | 79 | 79 | |
| $R^2$ | 0.090 | 0.081 | 0.447 | 0.448 | |

**Table 8. (continued)**

| | *Combined model* | | *Encompassing model* | | |
|---|---|---|---|---|---|
| *Variable* | *Benchmark level* | *Post-1999 level* | *Benchmark level* | *Post-1999 level* | *Hypothesis* |
| *B. Level of capital controls on outflows* | | | | | |
| FX overvaluation | –0.0935 | –0.603*** | | –0.562*** | – |
| | (0.147) | (0.213) | | (0.187) | |
| Trend appreciation | –0.0519 | 0.0359 | –0.0602* | | – |
| | (0.0359) | (0.0578) | (0.0312) | | |
| Interest rate differential | 0.108*** | 0.0550 | 0.115*** | 0.0722* | + |
| | (0.0371) | (0.0470) | (0.0330) | (0.0392) | |
| FX volatility | 0.146** | 0.157* | 0.150** | 0.125 | + |
| | (0.0706) | (0.0901) | (0.0697) | (0.0872) | |
| FX reserves—level | 0.0599** | 0.0906*** | 0.0607** | 0.0926*** | + |
| | (0.0242) | (0.0333) | (0.0245) | (0.0332) | |
| FX reserves—change | | | | | – |
| FX regime—float | –0.147** | –0.0465 | –0.164*** | | – |
| | (0.0624) | (0.0798) | (0.0468) | | |
| Inflation-targeting regime | –0.0310 | –0.122 | | –0.142** | – |
| | (0.0613) | (0.0751) | | (0.0568) | |
| *Summary statistic* | | | | | |
| No. observations | 352 | 220 | 352 | 220 | |
| No. countries | 79 | 79 | 79 | 79 | |
| $R^2$ | 0.138 | 0.155 | 0.477 | 0.491 | |

Source: Author's elaboration.
* Statistically significant at the 10 percent level. ** Statistically significant at the 5 percent level. *** Statistically significant at the 1 percent level.
a. The table shows the parameter estimates of equation (1), using OLS. The capital control measures used here are the total inflow controls (panel A) and the total outflow controls (panel B) from Schindler (2009). The columns under "Hypothesis" provide the priors for the signs of the respective coefficients.

**Table 9. Robustness Tests of Foreign Exchange Policy (Hypothesis 1): Alternative Country Samples[a]**

| | *Combined model* | | *Encompassing model* | | |
|---|---|---|---|---|---|
| *Variable* | *Benchmark level* | *Post-1999 level* | *Benchmark level* | *Post-1999 level* | *Hypothesis* |
| *A. Level of capital controls: Emerging market economies only* | | | | | |
| FX overvaluation | –0.279 | –0.926 | | –0.799* | – |
| | (0.310) | (0.648) | | (0.447) | |
| Trend appreciation | –0.168 | –0.300 | –0.163 | –0.302** | – |
| | (0.142) | (0.187) | (0.103) | (0.140) | |
| Interest rate differential | –0.0392 | –0.0884 | –0.0656*** | | + |
| | (0.121) | (0.181) | (0.0220) | | |
| FX volatility | 0.197 | 0.0624 | 0.260 | | + |
| | (0.206) | (0.299) | (0.164) | | |
| FX reserves—level | –0.491*** | –0.323*** | –0.493*** | –0.304*** | + |
| | (0.0533) | (0.0897) | (0.0481) | (0.0774) | |
| FX regime—float | –0.581** | –0.497** | –0.570*** | –0.433** | – |
| | (0.242) | (0.250) | (0.192) | (0.183) | |
| Inflation-targeting regime | –0.0707 | –0.130 | | | – |
| | (0.194) | (0.223) | | | |
| *Summary statistic* | | | | | |
| No. observations | 347 | 212 | 347 | 212 | |
| No. countries | 38 | 38 | 38 | 38 | |
| $R^2$ | 0.265 | 0.162 | 0.255 | 0.160 | |

**Table 9. (continued)**

| | Combined model | | Encompassing model | | |
|---|---|---|---|---|---|
| *Variable* | *Benchmark level* | *Post-1999 level* | *Benchmark level* | *Post-1999 level* | *Hypothesis* |
| B. Level of capital controls: Excluding less developed countries | | | | | |
| FX overvaluation | 0.161<br>(0.276) | –0.163<br>(0.459) | | | – |
| Trend appreciation | –0.204*<br>(0.105) | –0.265*<br>(0.160) | –0.188*<br>(0.0968) | –0.261*<br>(0.144) | – |
| Interest rate differential | 0.703***<br>(0.162) | 0.365**<br>(0.171) | 0.703***<br>(0.159) | 0.174***<br>(0.0350) | + |
| FX volatility | 0.695***<br>(0.179) | 1.225***<br>(0.282) | 0.687***<br>(0.179) | 1.243***<br>(0.264) | + |
| FX reserves—level | –0.0358<br>(0.0499) | 0.113<br>(0.0843) | | | + |
| FX regime—float | –1.306***<br>(0.133) | –1.107***<br>(0.192) | –1.289***<br>(0.129) | –1.177***<br>(0.183) | – |
| Inflation-targeting regime | 0.490***<br>(0.153) | 0.463**<br>(0.205) | 0.487***<br>(0.152) | 0.542***<br>(0.182) | – |
| *Summary statistic* | | | | | |
| No. observations | 706 | 348 | 706 | 348 | |
| No. countries | 58 | 58 | 58 | 58 | |
| $R^2$ | 0.246 | 0.189 | 0.470 | 0.417 | |

Source: Author's elaboration.
* Statistically significant at the 10 percent level. ** Statistically significant at the 5 percent level. *** Statistically significant at the 1 percent level.
a. The table shows the parameter estimates of equation (1), using OLS. Panel A provides the estimates when restricting the sample to emerging market economies, while panel B gives the estimates when excluding developing countries.

**Table 10. Capital Flows (Hypothesis 2): Level of Capital Controls[a]**

| | *Combined model* | | *Encompassing model* | | |
|---|---|---|---|---|---|
| *Variable* | *Benchmark level* | *Post-1999 level* | *Benchmark level* | *Post-1999 level* | *Hypothesis* |
| Capital outflows | 0.795*** | 0.756*** | –0.735*** | –0.562*** | + |
| | (0.160) | (0.163) | (0.145) | (0.120) | |
| Capital inflows | –0.261* | –0.273* | –0.192 | –0.252** | + |
| | (0.146) | (0.146) | (0.123) | (0.113) | |
| Net portfolio flows | 0.211*** | 0.198*** | 0.221*** | 0.159*** | + |
| | (0.0615) | (0.0617) | (0.0605) | (0.0482) | |
| Change capital outflows | –0.426 | –0.325 | –0.262 | | + |
| | (0.272) | (0.284) | (0.200) | | |
| Change capital inflows | 0.161 | 0.0986 | | | + |
| | (0.184) | (0.192) | | | |
| Change net portfolio flows | –0.185** | –0.205** | –0.208** | –0.200*** | + |
| | (0.0871) | (0.0824) | (0.0814) | (0.0714) | |
| Capital flow volatility | 0.142 | 0.119 | 0.144 | | + |
| | (0.0941) | (0.0988) | (0.0932) | | |
| *Summary statistic* | | | | | |
| No. observations | 743 | 463 | 743 | 463 | |
| No. countries | 79 | 79 | 79 | 79 | |
| $R^2$ | 0.0302 | 0.0415 | 0.401 | 0.381 | |

Source: Author's elaboration.
* Statistically significant at the 10 percent level. ** Statistically significant at the 5 percent level. *** Statistically significant at the 1 percent level.
a. The table shows the parameter estimates of equation (1), using OLS. The columns under "Hypothesis" provide the priors for the signs of the respective coefficients.

## Table 11. Capital Flows (Hypothesis 2): Changes in Capital Controls[a]

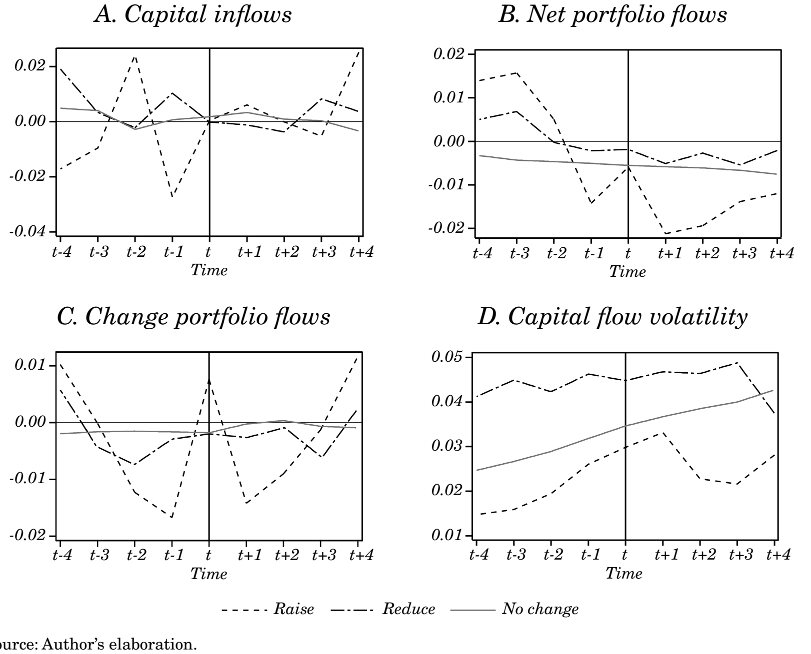
| | *Combined model* | | | | *Encompassing model* | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | *Benchmark* | | *Post-1999* | | *Benchmark* | | *Post-1999* | | *Hypothesis* | |
| *Variable* | *Reduce* | *Raise* | *Reduce* | *Raise* | *Reduce* | *Raise* | *Reduce* | *Raise* | *Reduce* | *Raise* |
| Capital outflows | 0.535 | −0.524 | 0.527 | −0.447 | | | | | − | + |
| | (0.458) | (0.539) | (0.527) | (0.605) | | | | | | |
| Capital inflows | −0.452 | −0.798* | −0.456 | −0.849 | | −0.623** | | −1.145*** | − | + |
| | (0.382) | (0.448) | (0.424) | (0.517) | | (0.274) | | (0.441) | | |
| Net portfolio flows | −0.182 | −0.368 | −0.307 | −0.839 | | | −0.219 | −1.202*** | − | + |
| | (0.211) | (0.282) | (0.254) | (0.516) | | | (0.159) | (0.408) | | |
| Change capital outflows | −0.0676 | 1.694 | 0.0974 | 0.734 | | | | | − | + |
| | (0.775) | (1.104) | (0.872) | (1.301) | | | | | | |
| Change capital inflows | 0.447 | −0.387 | 0.283 | −0.0635 | | | | | − | + |
| | (0.428) | (0.751) | (0.462) | (0.766) | | | | | | |
| Change net portfolio flows | 0.0933 | −0.368* | 0.117 | −0.299 | | −0.479*** | | | − | + |
| | (0.122) | (0.219) | (0.125) | (0.242) | | (0.158) | | | | |
| Capital flow volatility | 0.162 | −2.194*** | 0.0742 | −2.675*** | 0.201 | −1.700*** | | −2.447*** | − | + |
| | (0.157) | (0.697) | (0.162) | (1.012) | (0.125) | (0.626) | | (0.819) | | |
| *Summary statistic* | | | | | | | | | | |
| No. observations | 743 | 739 | 463 | 463 | 743 | 739 | 463 | 463 | | |
| No. countries | 79 | 79 | 79 | 79 | 79 | 79 | 79 | 79 | | |

Source: Author's elaboration.
* Statistically significant at the 10 percent level. ** Statistically significant at the 5 percent level. *** Statistically significant at the 1 percent level.
a. The table shows the parameter estimates of equation (2), using a logit model. The columns under "Hypothesis" provide the priors for the signs of the respective coefficients.

These findings underline the importance of being cautious in not necessarily interpreting these findings in a causal way. Countries with high capital flows are likely to be different in many other ways from countries with a relatively lower volume or volatility of capital flows. Specifically, capital flows here are measured relative to the size of the domestic economy, rather than the size of the domestic financial sector. As discussed above, this was a deliberate choice to distinguish the size and volatility of capital flows per se from other potential factors influencing the choice of capital controls, such as factors related to financial stability objectives.

Nevertheless, an important finding emerging from the analysis here is that there is no systematic evidence that links a larger magnitude and a higher volatility of capital flows per se with more capital flow restrictions. This evidence is corroborated by the event study of illustrated in figure 5, which shows that net portfolio flows decline in the years following significant increases in capital controls.

**Figure 5. Capital Flows: Evolution around Changes in Capital Controls[a]**




Source: Author's elaboration.

a. The figures show the evolution of variables around changes in capital controls (either increases or reductions), compared with countries with no changes. The horizontal axis indicates the four years before and after these changes.

## 3.3 Financial Stability

The third hypothesis relates to the role of financial stability objectives for policymakers to choose a capital control regime. The evidence shown in tables 12 and 13 uncovers an ambiguous relationship between financial stability objectives and the level and changes in capital controls. Countries with deeper financial markets have a lower level of capital controls and are also less likely to raise capital controls. This holds for both proxies of financial market depth, the institutional indicator ("financial depth") and the market-based measure ("stock market capitalization").

Second, countries with more financial stress (in bond, equity and money markets) in prior years tend to have lower levels of capital controls and are also more likely to liberalize their capital account.

Third, the evidence is much stronger for the role of credit growth. Here the findings suggest that countries with high rates of credit growth to the private sector in the previous year not only have a higher level of capital controls, but are also more likely to raise existing controls further. Table 6 indicates that this effect is indeed economically meaningful, as the credit growth variable is one of the three most important variables in terms of the magnitude explained of the differences in the level of capital controls across countries and over time.

The event study shown in figure 6 indicates that credit growth not only is higher in prior years for countries deciding to raise capital controls than for those lowering controls or keeping them constant, but also declines markedly during and after the (re-)introduction or raising of capital controls.

Overall, the evidence on financial stability suggests that it is not financial market stress that motivates decisions about raising and maintaining high levels of capital controls, but rather the credit growth rate that is linked to capital control measures. This points to policymakers' concerns about an overheating of the real economy rather than about financial markets per se.

## 3.4 Real Economy and External Stability

As to the fourth and final hypothesis, namely, the role of real economy and external stability objectives for capital control measures, the evidence reported in tables 14 and 15 indicates that countries with high inflation and high volatility in GDP growth both

**Table 12. Financial Stability (Hypothesis 3): Level of Capital Controls[a]**

| | Combined model | | Encompassing model | | |
|---|---|---|---|---|---|
| *Variable* | *Benchmark level* | *Post-1999 level* | *Benchmark level* | *Post-1999 level* | *Hypothesis* |
| Financial depth | –0.308** | –0.361*** | –0.261** | –0.367*** | – |
| | (0.130) | (0.133) | (0.125) | (0.132) | |
| Financial Stress Index | –0.0844 | –0.159* | | –0.156* | + / ? |
| | (0.0678) | (0.0844) | | (0.0838) | |
| Stock market capitalization | –0.502*** | –0.578*** | –0.443*** | –0.579*** | – |
| | (0.146) | (0.152) | (0.138) | (0.152) | |
| Equity market returns | 0.00644 | 0.0589 | | | – |
| | (0.0807) | (0.112) | | | |
| Equity return volatility | 1.828*** | 1.743*** | 1.794*** | 1.809*** | + |
| | (0.174) | (0.254) | (0.138) | (0.204) | |
| Credit growth | 28.69*** | 30.96*** | 22.16*** | 31.01*** | + / ? |
| | (4.199) | (5.041) | (1.906) | (5.048) | |
| Equity valuation | –0.182* | –0.261** | –0.171* | –0.256** | – |
| | (0.0978) | (0.114) | (0.0945) | (0.116) | |
| *Summary statistic* | | | | | |
| No. observations | 511 | 344 | 511 | 344 | |
| No. countries | 79 | 79 | 79 | 79 | |
| $R^2$ | 0.323 | 0.295 | 0.689 | 0.612 | |

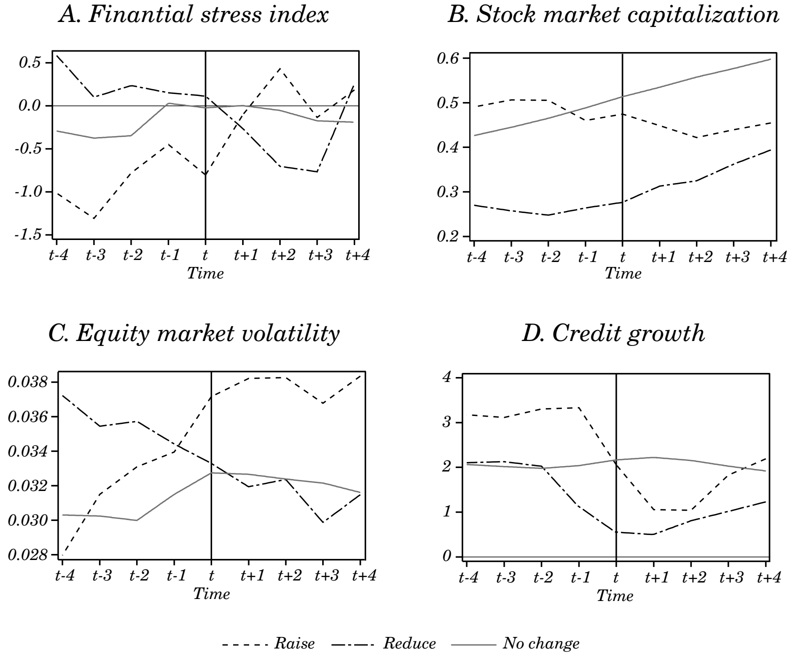
Source: Author's elaboration.
* Statistically significant at the 10 percent level. ** Statistically significant at the 5 percent level. *** Statistically significant at the 1 percent level.
a. The table shows the parameter estimates of equation (1), using OLS. The columns under "Hypothesis" provide the priors for the signs of the respective coefficients.

## Table 13. Financial Stability (Hypothesis 3): Changes in Capital Controls[a]

| | *Combined model* | | | | *Encompassing model* | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | *Benchmark* | | *Post-1999* | | *Benchmark* | | *Post-1999* | | *Hypothesis* | |
| *Variable* | *Reduce* | *Raise* | *Reduce* | *Raise* | *Reduce* | *Raise* | *Reduce* | *Raise* | *Reduce* | *Raise* |
| Financial depth | 0.921 | 0.137 | 0.585 | −0.0396 | 1.348*** | | 0.854 | | − | + |
| | (0.816) | (0.424) | (0.984) | (0.759) | (0.494) | | (0.535) | | | |
| Financial Stress Index | 0.00156 | −0.633* | 0.112 | −1.483** | | −0.424* | | −1.211*** | − / ? | + / ? |
| | (0.249) | (0.324) | (0.392) | (0.597) | | (0.250) | | (0.432) | | |
| Stock market capitalization | −0.231 | 0.253 | −0.349 | −0.985** | | | | −0.502** | + | − |
| | (0.557) | (0.379) | (0.590) | (0.440) | | | | (0.243) | | |
| Equity market returns | −0.0747 | −0.354 | −0.489 | −0.833* | | | | −0.684* | + | − |
| | (0.259) | (0.334) | (0.368) | (0.501) | | | | (0.401) | | |
| Equity return volatility | 1.140* | −0.225 | 2.458** | 1.216 | 1.031* | | 1.776** | 1.091 | − | + |
| | (0.657) | (0.624) | (1.064) | (0.834) | (0.537) | | (0.849) | (0.779) | | |
| Credit growth | 31.95 | 57.11*** | 54.89** | 85.11*** | | 37.58*** | | 50.58*** | − / ? | + / ? |
| | (20.45) | (11.80) | (26.02) | (23.18) | | (3.410) | | (9.574) | | |
| Equity valuation | 0.155 | 0.585 | −0.0510 | 0.164 | | 0.613** | | | + | − |
| | (0.352) | (0.447) | (0.397) | (0.525) | | (0.258) | | | | |
| *Summary statistic* | | | | | | | | | | |
| No. observations | 511 | 511 | 344 | 344 | 511 | 511 | 344 | 344 | | |
| No. countries | 79 | 79 | 79 | 79 | 79 | 79 | 79 | 79 | | |

Source: Author's elaboration.
* Statistically significant at the 10 percent level. ** Statistically significant at the 5 percent level. *** Statistically significant at the 1 percent level.
a. The table shows the parameter estimates of equation (2), using a logit model. The columns under "Hypothesis" provide the priors for the signs of the respective coefficients.

**Figure 6. Financial Stability: Evolution around Changes in Capital Controls[a]**




Source: Author's elaboration.
a. The figures show the evolution of variables around changes in capital controls (either increases or reductions), compared with countries with no changes. The horizontal axis indicates the four years before and after these changes.

have a higher a level of capital controls and are more likely to raise existing capital controls. By contrast, countries that are more open to trade tend to have lower levels of capital controls and are more likely to reduce existing controls. This confirms the prior that there is a positive relationship between trade and financial openness, as discussed earlier.

Moreover, there is little evidence that levels and changes in capital controls are systematically linked to the level of public debt or external debt. After 1999, however, there is some indication that countries with a higher external debt have been less likely to lower capital controls and more likely to keep existing restrictions.

As to the event study of figure 7, there is no indication that either inflation rates or GDP volatility decline in the years after the

### Table 14. Real Economy and External Stability (Hypothesis 4): Level of Capital Controls[a]

| | *Combined model* | | *Encompassing model* | | |
|---|---|---|---|---|---|
| *Variable* | *Benchmark level* | *Post-1999 level* | *Benchmar level* | *Post-1999 level* | *Hypothesis* |
| GDP growth | 0.724*** | 1.002*** | 0.735*** | 1.020*** | – |
| | (0.183) | (0.206) | (0.167) | (0.198) | |
| GDP growth volatility | 0.256** | 0.166 | 0.210* | | + |
| | (0.120) | (0.151) | (0.111) | | |
| Inflation rate | 13.01** | 36.84*** | 22.85*** | 41.99*** | + |
| | (5.262) | (9.156) | (1.682) | (8.109) | |
| Current account/GDP | –0.299*** | –0.163 | –0.304*** | –0.165 | – |
| | (0.111) | (0.109) | (0.110) | (0.109) | |
| Trade openness | –0.294*** | –0.329*** | –0.285*** | –0.314*** | – / ? |
| | (0.0904) | (0.0936) | (0.0873) | (0.0931) | |
| Public debt/GDP | –0.0368 | 0.0218 | | | + |
| | (0.103) | (0.111) | | | |
| External debt/GDP | –0.0974 | –0.0515 | –0.0913 | | + |
| | (0.0703) | (0.0716) | (0.0640) | | |
| *Summary statistic* | | | | | |
| No. observations | 352 | 273 | 352 | 273 | |
| No. countries | 79 | 79 | 79 | 79 | |
| $R^2$ | 0.102 | 0.162 | 0.554 | 0.579 | |

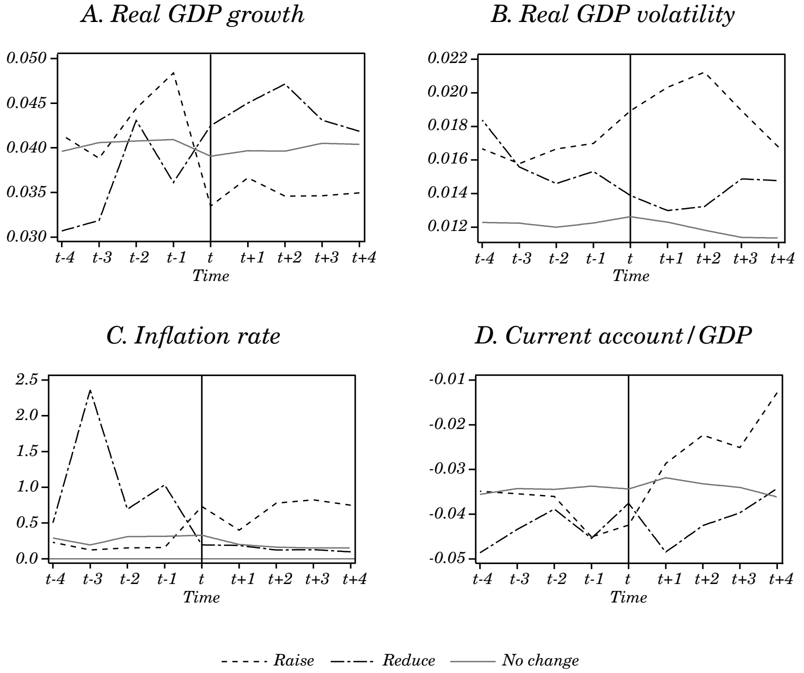
Source: Author's elaboration.
* Statistically significant at the 10 percent level. ** Statistically significant at the 5 percent level. *** Statistically significant at the 1 percent level.
a. The table shows the parameter estimates of equation (1), using OLS. The columns under "Hypothesis" provide the priors for the signs of the respective coefficients.

## Table 15. Real Economy and External Stability (Hypothesis 4): Changes in Capital Controls[a]

| | *Combined model* | | | | *Encompassing model* | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | *Benchmark* | | *Post-1999* | | *Benchmark* | | *Post-1999* | | *Hypothesis* | |
| *Variable* | *Reduce* | *Raise* | *Reduce* | *Raise* | *Reduce* | *Raise* | *Reduce* | *Raise* | *Reduce* | *Raise* |
| GDP growth | –2.172*** | 1.515*** | –2.039*** | 0.895 | –2.114*** | 1.256** | –1.987*** | | + | – |
| | (0.664) | (0.563) | (0.690) | (0.601) | (0.642) | (0.576) | (0.592) | | | |
| GDP growth volatility | –0.559 | 0.426 | –0.312 | 0.523 | –0.512 | 0.511* | | 0.661** | – | + |
| | (0.386) | (0.309) | (0.340) | (0.426) | (0.365) | (0.285) | | (0.322) | | |
| Inflation rate | 22.84 | 43.75*** | 65.40* | 57.72 | 18.93 | 57.06*** | 60.79*** | 50.58*** | – | + |
| | (14.08) | (12.90) | (35.77) | (47.08) | (12.69) | (7.723) | (9.091) | (7.762) | | |
| Current account/GDP | –0.130 | –0.130 | 0.289 | 0.123 | | | | | + | – |
| | (0.765) | (0.609) | (0.791) | (0.663) | | | | | | |
| Trade openness | 1.238*** | –0.0497 | 1.156** | 0.427 | 1.201*** | | 1.024** | | + / ? | – / ? |
| | (0.458) | (0.571) | (0.555) | (0.717) | (0.392) | | (0.409) | | | |
| Public debt/GDP | 0.614** | –0.655 | 0.399 | –0.258 | 0.572** | | | | – | + |
| | (0.270) | (0.484) | (0.433) | (0.564) | (0.270) | | | | | |
| External debt/GDP | –1.578** | 0.110 | –2.467*** | 0.121 | –1.706** | | –2.217*** | | – | + |
| | (0.774) | (0.215) | (0.875) | (0.199) | (0.727) | | (0.841) | | | |
| *Summary statistic* | | | | | | | | | | |
| No. observations | 352 | 352 | 273 | 273 | 352 | 739 | 273 | 273 | | |
| No. countries | 79 | 79 | 79 | 79 | 79 | 79 | 79 | 79 | | |

Source: Author's elaboration.
* Statistically significant at the 10 percent level. ** Statistically significant at the 5 percent level. *** Statistically significant at the 1 percent level.
a. The table shows the parameter estimates of equation (2), using a logit model. The columns under "Hypothesis" provide the priors for the signs of the respective coefficients.

**Figure 7. Real Economy and External Objectives: Evolution around Changes in Capital Controls**[a]




Source: Author's elaboration.

a. The figures show the evolution of variables around changes in capital controls (either increases or reductions), compared with countries with no changes. The horizontal axis indicates the four years before and after these changes.

introduction of capital controls. Again, this needs to be interpreted cautiously, since there is no proper counterfactual of what would have happened to these variables if capital controls had not been changed for these countries. Nevertheless, the results are suggestive that a reduction in inflation and output volatility did not materialize rapidly after capital controls were increased.

## 3.5 Joint Test of Four Hypotheses

As the final step of the analysis, the various hypotheses are tested jointly together in a single estimation. A key challenge of estimating all four hypotheses individually is, of course, that variables for different hypotheses may be correlated with one another, so tests of individual hypotheses may suffer from an omitted variable bias. On the other hand, given the large number of variables, it is impossible to combine all four hypotheses in a meaningful way by including all variables simultaneously in the estimations.

As a middle way between these two, I choose to focus on those variables that have been identified as important determinants in the individual hypothesis tests above. In particular, the overvaluation and foreign exchange regime variables are included for the foreign exchange hypothesis, credit growth and inflation as proxies for overheating, and financial depth is used to capture the degree of financial market development.

Another possible determinant of capital controls, which was discussed in detail in the introduction, is a potential externality of capital controls, in that high controls or the raising of capital controls in some countries may make it more likely for other countries to follow suit. Such an externality may be captured by including an additional variable ("Capital controls region") that measures the average level or average change of capital controls in the region in the previous year.

Table 16 shows the parameter estimates for this combined test of equation (1) for the level estimations, using OLS, and equation (2) for the estimation for changes in capital controls, using a logit model. All of the findings for the single-hypothesis tests above are confirmed when the different variables are combined in a single model. The only variable that loses significance somewhat is the financial depth variable. Moreover, the variable of capital controls in the region to capture externalities from capital controls is highly significant and large in magnitude. For the estimation for changes, this implies that countries are more likely to raise or lower controls when other countries in the region have done so recently. In addition, the magnitude of the coefficients becomes much larger after 1999, suggesting that such externalities have become more important in the 2000s.

Overall, the evidence on the real economy and on financial stability suggest that in making the decision to raise or maintain capital controls, policymakers are more concerned about an overheating of the economy—in the form of high credit growth, rising inflation and output volatility—than about narrow financial market issues.

## Table 16. Combining All Four Hypotheses, plus Capital Control Spillovers[a]

| | Level | | | Change | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | Benchmark | | Post-1999 | | Hypothesis | |
| *Variable* | *Benchmark* | *Post-1999* | *Hypothesis* | *Reduce* | *Raise* | *Reduce* | *Raise* | *Reduce* | *Raise* |
| FX overvaluation | −0.1786** | −0.3949* | − | 0.6790* | −0.6615** | 0.5123 | −1.8916** | + | − |
| | (0.087) | (0.229) | | (0.411) | (0.362) | (0.915) | (0.942) | | |
| FX regime—float | −0.4470*** | −0.3456** | − | 0.6876* | −0.5668 | 1.2647*** | 0.8147 | + | − |
| | (0.112) | (0.150) | | (0.357) | (0.436) | (0.439) | (0.817) | | |
| Credit growth | 4.1435** | 10.7229*** | + | 0.2111 | 16.1114** | 12.5636 | 24.1313* | − | + |
| | (1.879) | (2.114) | | (9.455) | (7.419) | (9.264) | (13.758) | | |
| Inflation rate | 11.6542*** | 14.2840*** | + | 4.8129 | 12.0152*** | 9.2813 | 37.1220** | − | + |
| | (2.652) | (4.509) | | (2.879) | (4.044) | (11.423) | (14.850) | | |
| Financial depth | −0.1200** | 0.0026 | − | −0.6074** | 0.2094 | −0.3429 | 0.0898 | + | − |
| | (0.053) | (0.068) | | (0.265) | (0.165) | (0.275) | (0.340) | | |
| Capital controls region | 0.7775*** | 0.6917*** | + | −2.5927** | 4.1658** | −39.2038*** | 4.4248** | − | + |
| | (0.051) | (0.070) | | (1.039) | (1.816) | (13.698) | (1.867) | | |
| *Summary statistic* | | | | | | | | | |
| No. observations | 778 | 397 | | 778 | 778 | 397 | 397 | | |
| No. countries | 79 | 79 | | 79 | 79 | 79 | 79 | | |
| $R^2$ | 0.45 | 0.33 | | 0.35 | 0.37 | 0.38 | 0.39 | | |

Source: Author's elaboration.

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

a. The table shows the parameter estimates of equation (1) for the level estimations, using OLS, and of equation (2) for changes in capital controls, using a logit model. The columns under "Hypothesis" provide the priors for the signs of the respective coefficients. "Capital controls region" provides the average level or average change of capital controls in the region for the level and change estimations, respectively.

## 4. Conclusions

The intention of the paper has been to gauge policymakers' motives in using capital controls as an active policy tool. Hence, the intended contribution of the present paper is not to analyze whether capital controls are effective in achieving their objectives—as a sizeable literature has been trying to establish—but rather to understand what drives policymakers in their decisions to use capital flow restrictions.

The findings of the paper suggest that foreign exchange policy management has been a central motive for policymakers who use capital controls. Countries with a high level of capital controls and countries that are actively raising existing controls tend to have undervalued exchange rates and a high degree of exchange rate volatility.

Moreover, the choice of capital flow restrictions is closely linked to countries' choices about their exchange rate and monetary policy regimes. The findings of the paper suggest that countries with a high level of capital flow restrictions tend to have fixed exchange rates and monetary policy regimes other than inflation targeting. Moreover, countries with fixed exchange rates and nontargeting regimes have been much more likely to raise capital controls over the past decade.

The analysis of the paper finds no systematic evidence for a link between capital controls and a high volume or volatility of capital flows per se. There is also no compelling evidence that policy decisions about capital controls are related to a high degree of financial market stress or volatility. It seems that choices about capital flow restrictions, in particular over the past decade, have been largely motivated by concerns about an overheating of the domestic economy—in the form of high credit growth, inflation and output volatility.

Taken together, the evidence suggests that both a foreign exchange policy objective and concerns about domestic overheating are the key motives for capital flow management policies over the past decade. Hence, capital controls have not merely been associated with preventing an overvaluation or appreciation of the domestic currency, but rather with a significant undervaluation of the exchange rate. This provides support to those who warn against the use of policies that trigger competitive devaluations and currency wars.

The evidence further indicates that capital controls may frequently be used to compensate for the absence of autonomous and independent monetary policy. Countries that have fixed exchange rate regimes and shallow financial markets have little ability to use monetary policy to deal with domestic overheating pressures. Even relatively modest capital inflows and volatility in flows pose a serious challenge to domestic policymakers and may induce them to use capital flow restrictions.

Putting these pieces of evidence together makes it hard to see how capital flow management policies can be a first-best solution to domestic policy challenges. The imposition of capital controls may help to buy time for domestic policymakers to address underlying economic, institutional and policy weaknesses at home, yet the risk is that these policy choices become entrenched and reduce the urgency and incentives of policymakers to address the true root causes of domestic vulnerabilities to fluctuations in capital flows. The persistence and frequent re-introduction of capital control measures in recent years suggest that this risk may become a reality.

## References


Aizenman, J. and V. Sushko. 2011. "Capital Flows: Catalyst or Hindrance to Economic Takeoffs?" Working Paper 17258. Cambridge, Mass.: National Bureau of Economic Research.

Bekaert, G., M. Ehrmann, M. Fratzscher, and A. Mehl. 2011. "Global Crises and Equity Market Contagion." Working Paper 17121. Cambridge, Mass.: National Bureau of Economic Research.

Broner, F., R.G. Gelos, and C. Reinhart. 2006. "When in Peril, Retrench: Testing the Portfolio Channel of Contagion." *Journal of International Economics* 69(1): 203–30.

Bussiere, M., M. Ca' Zorzi, A. Chudik, and A. Dieppe 2010. "Methodological Advances in the Assessment of Equilibrium Exchange Rates." Working Paper 1151. Frankfurt: European Central Bank.

Calvo, G., A. Izquierdo, and L.F. Mejía. 2011. "Systemic Sudden Stops: The Relevance of Balance-Sheet Effects and Financial Integration." Working Paper 14026. Cambridge, Mass.: National Bureau of Economic Research.

Calvo, G., L. Leiderman, and C. Reinhart. 1996. "Inflows of Capital to Developing Countries in the 1990s." *Journal of Economic Perspectives* 10(2): 123–39.

Carare, A. and M. Stone. 2006. "Inflation Targeting Regimes." European Economic Review 50(5): 1297–1315.

Cardarelli, R., S. Elekdag, and M.A. Kose. 2009. "Capital Inflows: Macroeconomic Implications and Policy Responses." Working Paper 40. Washington: International Monetary Fund.

Chamon, M., A. Ghosh, J. Ostry, and M. Qureshi. 2011. "Managing Capital Inflows: The Role of Controls and Prudential Policies." Working Paper 17363. Cambridge, Mass.: National Bureau of Economic Research.

Chinn, M. and H. Ito. 2008. "A New Measure of Financial Openness." *Journal of Comparative Policy Analysis* 10(3): 309–22.

————. 2011. "The Chinn-Ito Index: A de Jure Measure of Financial Openness." University of Wisconsin at Madison. Available online at http://web.pdx.edu/~ito/Chinn-Ito_website.htm.

Cowan, K. and J. De Gregorio. 2007. "International Borrowing, Capital Controls and the Exchange Rate: Lessons from Chile." In *Capital Controls and Capital Flows in Emerging Economies: Policies, Practices and Consequences*, edited by S. Edwards, pp. 241–96. University of Chicago Press.

Cowan, K., J. De Gregorio, A. Micco, and C. Neilson. 2008. "Financial Diversification, Sudden Stops and Sudden Starts." In *Current Account and External Finance*, edited by K. Cowan, S. Edwards and R. Valdés. Santiago: Central Bank of Chile.

Curcuru, S., C. Thomas, F. Warnock, and J. Wongswan. 2011. "US International Equity Investment and Past and Prospective Returns." *American Economic Review* 101(7): 3440–55.

Dorrucci, E., A. Meyer-Cirkel, and D. Santabárbara. 2009. "Domestic Financial Development in Emerging Economies: Evidence and Implications." Occasional Paper 102. Frankfurt: European Central Bank.

Forbes, K. 2007. "The Microeconomic Evidence on Capital Controls: No Free Lunch." In *Capital Controls and Capital Flows in Emerging Economies: Policies, Practices and Consequences*, edited by S. Edwards, pp. 171–202. University of Chicago Press.

Forbes, K., M. Fratzscher, T. Kostka, and R. Straub. 2012. "Bubble Thy Neighbor: Portfolio Effects and Externalities from Capital Controls." Working Paper 18052. Cambridge, Mass.: National Bureau of Economic Research.

Forbes, K. and F. Warnock. 2011. "Capital Flow Waves: Surges, Stops, Flight and Retrenchment." Working Paper 17351. Cambridge, Mass.: National Bureau of Economic Research.

Fratzscher, M. 2011. "Capital Flows, Global Shocks and the 2007–08 Financial Crisis." Working Paper 17357. Cambridge, Mass.: National Bureau of Economic Research.

Gelos, R.G. and S.J. Wei. 2005. "Transparency and International Portfolio Holdings." *Journal of Finance* 60(6): 2987–3020

Hau, H. and H. Rey. 2005. "Exchange Rates, Equity Prices and Capital Flows." *Review of Financial Studies* 19(1): 273–317.

Henry, P.B. 2007. "Capital Account Liberalization: Theory, Evidence and Speculation." *Journal of Economic Literature* 45(4): 887–935.

Jeanne, O. 2011. "Who Needs to Open the Capital Account?" Washington: Peterson Institute of International Economics.

Korinek, A. 2010. "Regulating Capital Flows to Emerging Markets: An Externality View." University of Maryland.

Magud, N., C. Reinhart, and K. Rogoff. 2011. "Capital Controls: Myth and Reality—A Portfolio Balance Approach." Working Paper 11–7. Washington: Peterson Institute of International Economics.

Ostry, J. , A.Ghosh, K. Habermeier, M. Chamon, M.Qureshi, and D. Reinhardt. 2010. "Capital Inflows: The Role of Controls." Staff Position Note 10/04. Washington: International Monetary Fund.

Ostry, J. , A.Ghosh, K. Habermeier, L. Laeven, M. Chamon, M.Qureshi, and A. Kokenyne. 2011. "Managing Capital Inflows: What Tools to Use?" Staff Discussion Note 11/06. Washington: International Monetary Fund.

Prasad, E., K. Rogoff, S.J. Wei, and M.A. Kose. 2003. "Effects of Financial Globalization on Developing Countries: Some Empirical Evidence." Occasional Paper 220. Washington: International Monetary Fund.

Raddatz, C. and S. Schmukler. 2011. "On the International Transmission of Shocks: Micro-Evidence from Mutual Fund Portfolios." Working Paper 17358. Cambridge, Mass.: National Bureau of Economic Research.

Rajan, R. 2010. "Beggaring the World Economy." New York: Project Syndicate. Available online at www.project-syndicate.org/commentary/beggaring-the-world-economy.

Schindler, M. 2009. "Measuring Financial Integration: A New Dataset," *IMF Staff Papers* 56(1): 222–38.

# Capital Inflows and Booms in Asset Prices: Evidence from a Panel of Countries

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*"There are huge capital inflows going into emerging countries creating (the) risk of asset price bubbles"*
*—Managing Director of the International Monetary Fund*[1]

Policymakers and academics often believe that large capital inflows are associated with booms in asset prices, and, therefore, with a higher risk of financial crisis. The belief is supported by the theoretical works of Krugman (1998), Caballero and Krishnamurthy (2006), Aoki, Benigno, and Kiyotaki (2009), Korinek (2010, 2011) and Adam, Kuang, and Marcet (2011). Though different, these models provide a simple parable. When capital inflows enter an economy, the demand for assets that are at a relatively fixed supply, increases, and asset prices move up. In general, because of financial market imperfections, such as adverse selection and moral hazard, the economy's borrowing capability is limited by the value of its assets. Thus, the initial increase in asset prices increases the economy's credit limit, promoting more capital inflows. New rounds of capital inflows evolve into a boom in asset prices through a sort of snowball effect, in which higher asset prices make financial conditions of the economy seem sounder than they actually are, promoting more capital inflows that in turn push asset prices even higher.

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1. Dominique Strauss-Kahn, April 22, 2010, Reuters Latin America.

*Capital Mobility and Monetary Policy*, edited by Miguel Fuentes D., Claudio E. Raddatz, and Carmen M. Reinhart, Santiago, Chile. 

Although this belief is widespread in theory, so far, it is solely based on anecdotal evidence. Reinhart and Reinhart (2008) state this clearly: to date “there has been discussion and some *anecdotal evidence* to suggest that asset prices boom during some famous capital inflow bonanzas” but robust cross-country empirical evidence is yet to be documented methodically.

This paper attempts to help close this gap in the literature by providing a systematic empirical analysis of the relationship between capital inflows and booms in asset prices. If theory is right, three empirical regularities should emerge. First, large capital inflows will be associated with booms in asset prices. Second, the association will be influenced by the economy’s quality of institutions, level of financial development, degree of financial openness, and exchange rate regime. And third, the association will be different for different categories of capital flows.

While the first regularity is implied by most theoretical works, the second is suggested by models where underdeveloped financial markets and low quality of institutions amplify problems of adverse selection and moral hazard (Krugman, 1998; Aoki, Benigno, and Kiyotaki, 2009) and by models where the degree of financial openness and the exchange rate regime affect the size of externalities (Korinek, 2011). In these models adverse selection, moral hazard or an externality are key ingredients of the circular process. Finally, the third regularity comes from Krugman (2000), Aoki, Benigno, and Kiyotaki (2009) and Korinek (2011). Aoki, Benigno, and Kiyotaki (2009) clearly specify that the mechanism in their model applies only to non-equity-related flows. Krugman (2000) argues that debt flows are more likely to exacerbate cycles in asset prices by encouraging excessive risky lending during booms, whereas FDI may help flatten cycles in asset prices through *fire sale FDI* during busts.

This paper looks for evidence of these empirical regularities by analyzing the experience of a sample of developed and developing countries in the quarters spanning 1990-2010. First, it constructs an indicator of booms in real asset prices that measures both the occurrence and the intensity of an event, using a *threshold method* similar to the one used in Mendoza and Terrones (2008) to identify credit booms. The method divides real asset prices in each country into its cyclical and trend components, and identifies a boom as an episode in which real asset prices exceed their long-run trend by more than a given threshold. According to this method booms in asset prices reflect *unusually large,* country-specific asset price expansions.

Then, I calculate the regression-based association between capital inflows and booms using a battery of panel regressions. Specifically, controlling for other macroeconomic factors, I estimate the association of *FDI*, *Portfolio* inflows (equity and bond) and *other* capital inflows with booms in real asset prices. Among the control variables, I include domestic and world GDP growth, inflation, the growth rate of government expenditure and a measure of global liquidity conditions. Also, I include measurements of quality of institutions, level of financial development, degree of financial openness and exchange rate regime, both independently and interacted with each measure of capital inflows, to consider the possibility that the links are influenced by these country characteristics. To control for potential endogeneity issues, I use instrumental variables.

The results provide some basis for policymakers' concerns and confirm previous theoretical findings. The estimates show that capital inflows are strongly associated with booms in asset prices, even when controlling for other factors. The mean effect, however, hides some interesting variation across countries and categories of capital inflows. In particular, while net debt inflows (portfolio and other) exhibit a strong and significant association with booms in real asset prices, the association with FDI inflows is not statistically significant. Furthermore, the association is only significant for emerging markets. Consistent with theory, the results reveal that a low level of financial development and poor quality of institutions increase the link between large capital inflows and booms in asset prices. In addition, more flexible exchange rates lessen the degree of association. Finally, contrary to the predictions of theory, I do not find evidence that capital controls help reduce the association.

I am not the first to study the link between capital inflows and booms in asset prices; there are other relevant papers and I defer a discussion of—and relation to—them to the next section. Simply put, this paper's contribution is to provide a collection of stylized facts characterizing the link between capital inflows and asset prices, providing the regularities that theory seeks to explain, and highlighting some ways in which the data is inconsistent with the theory.

In order to avoid misunderstanding, it could be helpful to state clearly the paper's goal and argument. The goal is not to estimate deep parameters of a structural model or conduct a formal test of a given hypothesis. To be precise, I am not trying to predict the response of asset prices to changes in capital inflows, or the other way around. The goal is more humble, though not less important. Rather than estimate structural parameters or reveal a causal relationship, I attempt to gauge the strength of the association between capital inflows and booms in asset prices, and highlight the factors that influence it. I do not see this as a weakness of the paper; quite the contrary. Like Summers (1991), I believe that "informal pragmatic empirical approaches to economic problems" have, potentially, a larger impact on the "growth of economic knowledge" than more formal econometric work.

## 1. The Links between Capital Inflows and Booms in Asset Prices

I divide this section in two parts. First, I discuss what the theoretical literature offers as an explanation of the potential link between capital inflows and booms in asset prices. Second, I review previous empirical works to help recognize this paper's contribution to the literature.

### 1.1 Links in theory: the conceptual framework

A variety of theoretical models have been put forth to explain a potential link between capital inflows and booms in asset prices. Although the mechanics of the models differ, their common denominator is the presence of some kind of financial market imperfection–such as adverse selection, moral hazard or externality–that restricts the economy's borrowing capability and amplifies the dynamics of asset prices in the presence of large capital inflows. In most works, the chain of causation runs from large capital inflows to booms in asset prices. But some models argue that causation goes the other way around.

In the first family of models, created to explain the Latin American and Asian crisis of the 1990s, the market failure stems from moral hazard and agency considerations (deposit security, implicit guarantees, imperfect monitoring, and so forth) that lead financial institutions to take on too much risk (for example, McKinnon and Pill, 1996, Krugman, 1998). For example, Krugman (1998) develops a simple model where financial intermediaries are central players in the propagation mechanism. In the model, since financial intermediaries are seen as having an implicit government guarantee and are not subject to strict regulation, there is a severe problem of moral hazard. Moral hazard encourages financial intermediaries to take excessive debts to get involved in too much risky lending. More risky lending pushes up asset prices and starts a kind of snowball effect in which financial conditions of intermediaries seem better than they actually are, promoting more borrowing and lending that in turn pushes asset prices even higher. In other words, it creates a boom in asset prices.

Similarly, according to Caballero and Krishnamurthy (2001, 2006), a key ingredient in the creation of booms in asset prices in emerging economies are their poor banking systems and severe corporate governance problems that are present. In an economy with a poor regulated financial market where it is difficult to enforce debtors to repay their debts unless they are secured by collateral, the borrower credit limit is affected by the price of its assets, and the price of assets is affected by the credit limit. Once again, the interaction between the credit limit and asset prices turns out to be a propagation mechanism that may engender booms in asset prices. Also, Aoki, Benigno, and Kiyotaki (2009) show that the degree of financial development determines the vulnerability of the domestic economy to shocks to private capital inflows in equity and debt (they do not address issues related to sovereign debt and FDI).

A second family of models puts the blame—instead of condemning financial intermediaries, as implicitly done by the previous works—on the side of atomistic private investors who do not internalize the consequences of their decisions. This externality represents a different kind of market failure. It may happen even when private agents form rational expectations about the evolution of macroeconomic variables. That is, when "agents correctly perceive the risks and benefits of their decisions, but fail to internalize the general equilibrium effects on prices" (Bianchi, 2010). In the case of firms, a similar friction arises when there are asymmetric financing opportunities for different sectors of the economy (see Caballero and Krishnamurthy, 2001, Tornell and Westermann, 2002).

Finally, there is a third and different family of models that also incorporates a borrowing constraint that limits households' leverage. The more recent models study the claim that a boom in asset prices generated by a global saving glut precipitated the global financial crisis of 2008-2009. Adam, Kuang, and Marcet (2011)'s model assumes that households form subjective beliefs about price behavior and update them using Bayes rule. The response of the economy to exogenous shocks depends on agents' beliefs at the time, which are a function of the country-specific history prior to the shock. Therefore, belief dynamics can temporarily delink asset prices from fundamentals, so that low interest rates can fuel a boom in asset prices. Furthermore, from a theoretical point of view, asset prices can have significant changes without any changes in quantities. This can happen, for example, if there is a change in fundamentals that increases the demand for assets and reduces the supply at the same time. In this case, prices will increase without any significant change in quantities.

In brief, the theoretical literature clearly implies that there is a potential strong association between capital inflows and booms in asset prices. But they also show that some country characteristics can magnify the association. In particular, most works imply that the levels of financial development and quality of institutions, which affect problems of moral hazard and adverse selection, play a key role in stimulating the link.

Other works call attention to other important factors, such as the exchange rate regime and the level of financial openness (capital controls). Yellen (2011) argues that heavily managed exchange rate regimes may provide incentives for the snowball effect to arise. Magud, Reinhart, and Vesperoni (2011) argue that the more flexible the exchange rate regime, the easier it is to absorb capital inflows and partially dampen the effects of the latter on domestic credit.

Consistently, Mendoza and Terrones (2008) find that credit booms in emerging economies are far more frequent in the presence of fixed or managed exchange rates than under floating or dirty floating regimes. It should be easy to understand why. Fixed or managed exchange rates make investors underestimate the volatility of the exchange rate, amplifying the externality and promoting excessive borrowing from abroad. In summary, theory suggests that a more flexible exchange rate regime could help stop the snowball effect: the exchange rate regime can potentially affect the degree of association between capital inflows and booms in asset prices.

Also, at least since Díaz-Alejandro (1985), a story that many economists tell is that when emerging economies open up to financial markets, they increase the probability of asset price bubbles and financial crisis. In a recent theoretical paper, Korinek (2011) argues that capital controls can help reduce externalities by making investors internalize the general equilibrium effect of their decisions. Hence, theory implies that the degree of financial openness can potentially influence the link between capital inflows and booms in asset prices.

Finally, theory also suggests that the link depends on the types of flow. Conceptually, it is easy to see why debt flows may have a stronger association with booms in asset prices than FDI flows. Unlike FDI, they do not solve agency problems and can lead to inefficient capital allocation if domestic banks are poorly supervised, and generate moral hazard when the government or international financial institutions implicitly guarantee debt. Korinek (2011) lends support to the idea that the composition matters by showing the different magnitude of externalities created by different types of capital inflows. In particular, Korinek suggests that FDI does not impose an externality since it often stays in the country when a financial crisis hits, and does not need to be taxed.

To sum up, the theory reviewed here insinuates the existence of three empirical regularities: (1) there is a strong link between capital inflows and booms in asset prices; (2) the link is influenced by country characteristics such as quality of institutions, financial development and openness, and exchange rate regime; and (3) the link is different for different types of capital flows. Section 2 of this paper looks for these empirical regularities in the data.

## 1.2 Links in the data: a review of previous empirical works

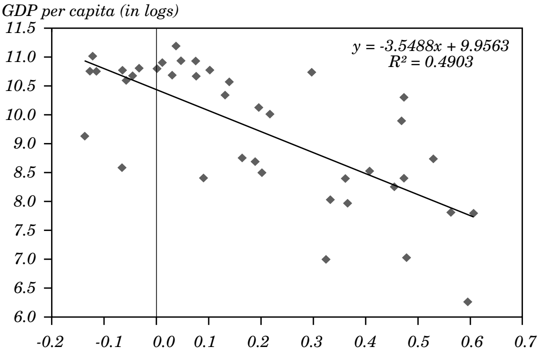
A number of empirical studies, analyzing episodes of large capital inflows, highlight the existence of a strong association between capital flows and booms in asset prices (for example, Calvo, Leiderman, and Reinhart, 1996, Sarno and Taylor, 1999, Kaminsky and Reinhart, 1999, Reinhart and Reinhart, 2008, and Cardarelli, Elekdag, and Kose, 2010). The evidence shows that periods of large capital inflows can be associated with currency appreciation, overheating, higher current account deficits, and booms in domestic credit and asset prices. But since these papers do not concentrate on the link between capital inflows and booms in asset prices, as acknowledged by Reinhart and Reinhart (2008), they only provide discussion and anecdotal evidence, not methodical cross-country empirical evidence. One of the first to focus exclusively on this link (as far as I know) was Jansen (2003)'s case study of the Thailand economy during 1980-1996. Using a VAR approach, Jansen finds capital inflows to be associated with higher asset prices (an increase of 1% in capital inflows, increases real stock prices 1% on impact, and ultimately, more than 3%). Also, Kim and Yang (2011) investigate the effect of capital inflows on asset prices by applying panel VAR to a group of emerging Asian economies. Their results suggest that although capital inflows contribute to booms in asset prices, they only explain a small part of asset price fluctuations. One of the many things that distinguish my paper from theirs is that they are case studies, whereas this paper is a cross-country investigation.

There are some recent cross-country studies focusing on the relationship between current account deficits, capital inflows and asset prices. For example, Aizenman and Yothin (2009) look at the association between the current account and real estate prices across countries. Controlling for lagged GDP per capita, inflation, institutions and interest rates, they find a robust and positive association. Similarly, Sá, Towbin, and Wieladek (2011) analyze the impact of monetary policy and capital inflows on house prices in OECD countries. They find that capital inflows have a significant and positive effect on both house prices and credit to the private sector. They also find that the legal system affects the impact of capital inflows on house prices. In a similar vein, Jinjarak and Sheffrin (2011) explore the issue of causality between real estate prices and the current account. They find that current account deficits directly drive real estate prices in Ireland, Spain and the US, but that the effect in England was only transitory.

Three things differentiate this paper from Sá, Towbin, and Wieladek (2011)'s and Jinjarak and coauthors'. First of all, while they concentrate mainly on advanced economies, this paper is particularly interested in emerging economies. The interest in emerging economies is justified, in part, by the simple evidence presented in figure 1. Figure 1 presents a scatter plot with the association between capital inflows and asset prices in the horizontal axis, and the level of development in the vertical axis measured by per capita GDP in 2010 US dollars. The plot suggests that the association is significantly stronger, and therefore more relevant, in emerging economies.

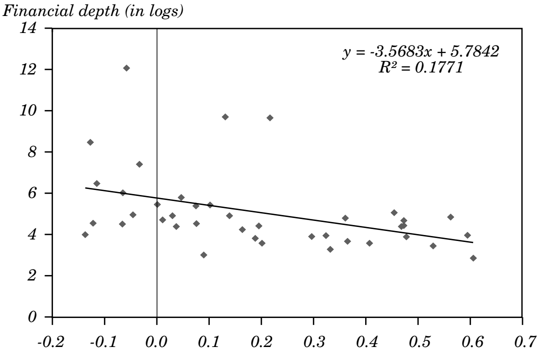
Second, Sá, Towbin, and Wieladek (2011) and coauthors do not explicitly consider if the link is influenced by country characteristics such as quality of institutions, level of financial development, exchange rate regime or degree of financial openness. This is relevant, not only because it is implied by theory and simple data (figures 2 to 5 show that the association is negatively related with the quality of institutions, financial development, financial openness and a less flexible exchange rate regime), but also because it has important

**Figure 1. Association Between Real Asset Prices and Capital Inflows vs the Level of Development**




Source: Author's elaboration.

**Figure 2. Association Between Real Asset Prices and Capital Inflows vs The Level of Financial Development**

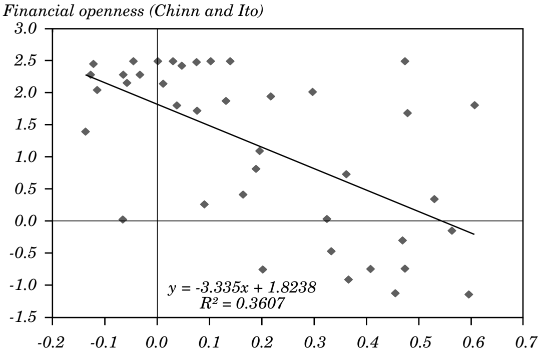



Source: Author's elaboration.

policy implications. For example, knowing whether the degree of financial openness can reduce the link can help policy makers decide if capital controls might be a useful policy tool; or if it's a better idea to adopt a given exchange rate regime, or invest resources to improve the quality of institutions and regulation.

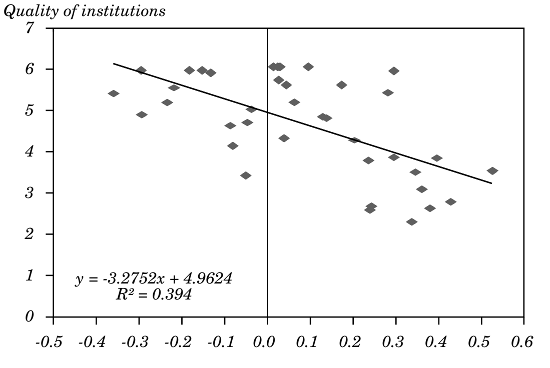
And third, previous papers do not discriminate by the capital inflow category. Once again, theory and simple evidence suggest that

**Figure 3. Association Between Real Asset Prices and Capital Inflows vs the Level of Financial Openness**




Source: Author's elaboration.

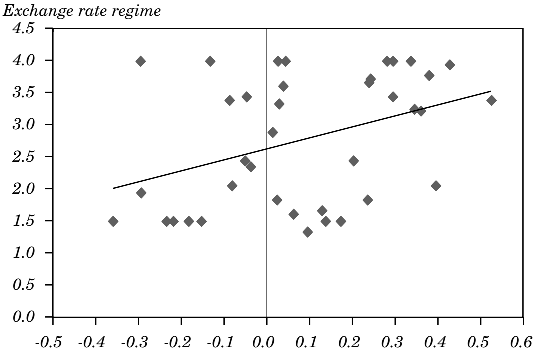
**Figure 4. Association Between Real Asset Prices and Capital Inflows vs the Quality of Institutions**




Source: Author's elaboration.

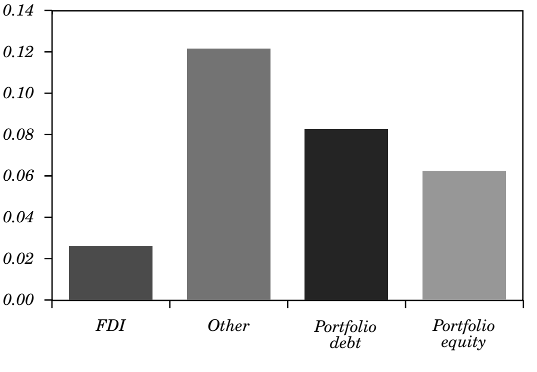
composition is relevant. Figure 6 shows that portfolio flows have a stronger association with asset prices than FDI inflows. Moreover, the composition also has policy implications. It helps policymakers distinguish types of capital inflows that are good, bad, and ugly, helping them choose which categories to target. This paper's main contribution to the literature is, indeed, to provide a systematic empirical analysis along these three lines.

## Figure 5. Association Between Real Asset Prices and Capital Inflows vs the Exchange Rate Regime




Source: Author's elaboration.

## Figure 6. Association Between Real Asset Prices and Different Categories of Capital Inflows




Source: Author's elaboration.

## 2. Sample, Data Issues, Methodology and Results

### 2.1 Data sources

I gathered from Bloomberg's end-of-the-period indices of stock markets–MSCI indices in Local Currency Units (LCUs)–at a quarterly frequency from 1990 (quarter 1) to 2010 (quarter 3). I deflate the MSCI indices in LCU with the respective CPI, and call the resultant series *real asset prices.* Then, I create a variable called "booms in asset prices" which measures both the occurrence and the intensity of an event. Following Mendoza and Terrones (2008) definition of a boom in credit, I define a *boom in asset prices* as an episode in which real asset prices grow more than during a typical cycle expansion. Figure 7 presents examples of how this variable is created for Australia and Mexico.

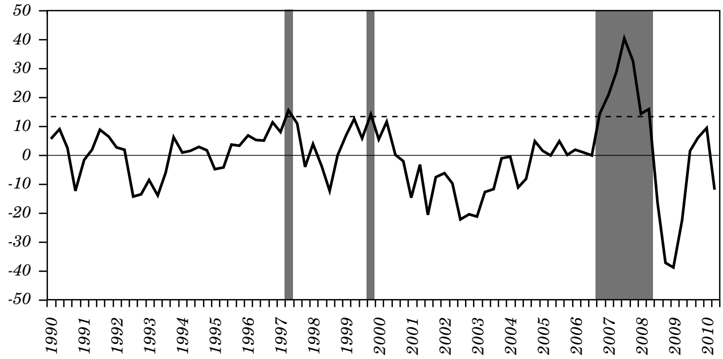
The figure presents the evolution of the deviation from the long-run trend of real asset prices, and the horizontal line represents the corresponding standard deviation. To be clear, let $l_{it}$ represent the deviation from the long-run trend of real asset prices in country $i$, on date $t$, and $\sigma(l_i)$, the corresponding standard deviation of the cyclical component. The long-run trend is calculated using the Hodrick-Prescott (HP) filter with the smoothing parameter set at 1600, typical for quarterly data. A *boom in asset prices* occurs in country $i$ when there are one or more contiguous dates for which $l_{it} \geq \phi\sigma(l_i)$; in other words, when the boom condition holds. Thus, during a boom the deviations from trends in real asset prices exceed the typical expansion of asset prices over the business cycle by a factor of $\phi$ (the boom threshold factor) or more.[2] This variable is equal to zero during normal times and equal to the deviation from trends during booms. The advantage of using this indicator is that it measures both the occurrence and the intensity of an event.

The data on the relevant macroeconomic variables are taken from International Financial Statistics (IFS) and World Development Indicators (WDI). Following the literature, I obtained quarterly data from IFS on the growth rate of real GDP (annualized rate), Consumer Price Index inflation (CPI Inflation) and the growth rate of real government expenditure. Annual data on domestic credit provided

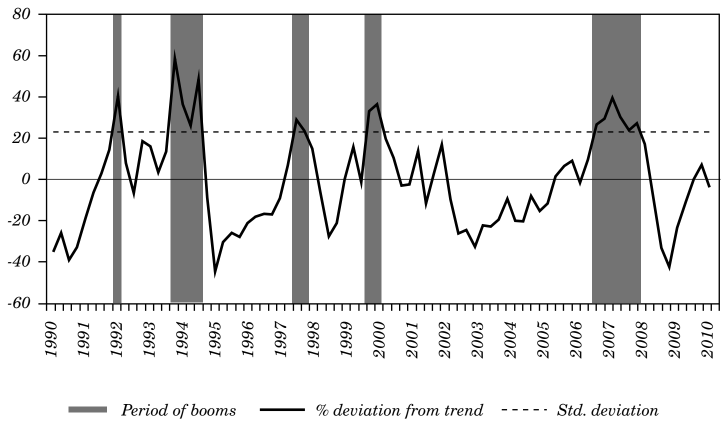
2. I used a baseline value of $\phi = 1.5$ in all the regressions reported in the paper. However, I conducted sensitivity analysis for $\phi = 1.2$ which confirmed that the main results are robust to the value of $\phi$.

**Figure 7. Examples of Booms in Real Stock Prices**

*A. Australia*




*B. Mexico*




Source: Author's elaboration.

by the banking sector as a percentage of GDP (Financial Depth) and nominal GDP in US dollars were obtained from WDI. I obtained the US interest rate from IFS and used International Country Risk Guide (ICRG) scores on law and order (the higher the better) as a proxy for quality of institutions.

Finally, for capital flows, I use quarterly data from the International Financial Statistics (IFS). Although there are other data sources, IFS provides the most comprehensive and comparable data on international capital flows. In practice, changes in both liabilities and assets are reported as a net of any disinvestment and consequently both can have either sign. In the database, an increase (decrease) in liabilities to foreigners is entered as positive (negative), while an increase (decrease) in foreign assets held by locals is entered as negative (positive). Thus, net flows of capital are calculated as the sum of the flows of foreign claims on domestic capital (change in liabilities) and the flows of domestic claims on foreign capital (change in assets) in a given quarter.

The main categories of capital flows used are foreign direct investment (FDI), portfolio equity investment, portfolio debt investment and *other flows*. *FDI flows* include equity capital, reinvested earnings, and other capital and financial derivatives associated with various intercompany transactions between affiliated enterprises. FDI includes greenfield investments and equity participation giving a controlling stake. When a foreign investor purchases a local firm's securities without exercising control over the firm, the investment is regarded as a portfolio equity investment. *Portfolio equity investment* includes shares, stock participations, and similar documents (such as American Depository Receipts) that usually denote ownership of equity. *Debt portfolio securities* include bonds, debentures, notes, and money market or negotiable debt instruments. Finally, *other flows* include all financial transactions not covered in direct investment, portfolio investment, financial derivatives, or other assets. Major categories are trade credits, loans, transactions in currency and deposits, and other assets. I divide each category of capital flows by current GDP in US dollars obtained from WEO 2011.

After combining the national domestic stock market data with the capital inflow data and macroeconomic variables, the sample covers the period from 1990 (quarter 1) to 2010 (quarter 3) for 40 countries, of which 20 are developed economies. Table 1 reports the sample of countries employed and table 2 provides a description and the primary sources of the variables. Tables 3 and 4 provide the number of observations, sample averages, and the Mackinnon approximate $p$-value of the Dickey-Fuller test under the null hypothesis of a unit root in the individual series for each country. Under the null hypothesis of a unit root, the rejection rates of the tests for real asset price appreciation and most of the capital inflow variables are conclusive: the series is stationary.

## Table 1: Sample of Countries

| *Emerging economies* | | *Developed economies* | | |
|---|---|---|---|---|
| Argentina | Mexico | Australia | Ireland | United States |
| Brazil | Peru | Austria | Italy | |
| Chile | Philippines | Belgium | Japan | |
| Colombia | Poland | Canada | Netherlands | |
| Hong Kong SAR | Russia | Czech Republic | New Zealand | |
| Hungary | South Africa | Denmark | Norway | |
| India | Thailand | Finland | Portugal | |
| Indonesia | Turkey | France | Spain | |
| Korea | Venezuela | Germany | Sweden | |
| Malaysia | | Greece | United Kingdom | |

Source: Author's elaboration.

## Table 2. Data Definition and Sources

| *Capital inflows* | *Description* | *Source* |
|---|---|---|
| FDI inflows | Foreign direct investment (liab.) | IFS |
| FDI outflows | Foreign direct investment abroad | IFS |
| Equity inflows | PI equity securities (liab.) | IFS |
| Equity outflows | PI equity securities (ass.) | IFS |
| Debt inflows | PI debt securities (liab.) | IFS |
| Debt outflows | PI debt securities (ass.) | IFS |
| Other inflows | Other investment liab. NIE | IFS |
| Other outflows | Other investment assets | IFS |
| Stock price index | MSCI in LCU | Bloomberg |
| Nominal GDP | Annual GDP in US$ dollars | WEO (2011) |
| Inflation | Growth rate of CPI (end of the period) | IFS |
| Real GDP | Quarterly real GDP | IFS |
| Echange rate regime | Reinhart and Rogoff (2008) classification | Reinhart's web-page |
| Financial openness | Chinn and Ito (2008) | |
| Quality of institutions | Scores of Law & Order | International Country Risk Guide (ICRG) |

Source: Author's elaboration.

**Table 3. Summary Statistics and Unit Root Tests Real Stock Prices**

| | MSCI index/CPI (Appreciation) | | | MSCI index/CPI (HP filtered) | | |
|---|---|---|---|---|---|---|
| *Country* | *Obs.* | *Avg.* | *p-value** | *Obs.* | *Avg.* | *p-value** |
| Argentina | 81 | 4.47 | 0.000 | 82 | -2.76 | 0.011 |
| Australia | 81 | 1.32 | 0.000 | 82 | -0.44 | 0.010 |
| Austria | 61 | 0.65 | 0.000 | 62 | -1.79 | 0.200 |
| Belgium | 61 | 0.62 | 0.000 | 62 | -1.35 | 0.276 |
| Brazil | 81 | 6.50 | 0.000 | 82 | -1.45 | 0.000 |
| Canada | 81 | 1.64 | 0.000 | 82 | -0.43 | 0.025 |
| Chile | 81 | 3.12 | 0.000 | 56 | -1.41 | 0.004 |
| Colombia | 70 | 4.18 | 0.000 | 71 | -3.35 | 0.040 |
| Czech Republic | 62 | 2.97 | 0.000 | 63 | -1.14 | 0.066 |
| Denmark | 81 | 1.67 | 0.000 | 82 | -0.68 | 0.064 |
| Finland | 61 | 3.57 | 0.000 | 62 | 3.06 | 0.000 |
| France | 61 | 1.21 | 0.000 | 62 | -0.89 | 0.138 |
| Germany | 61 | 1.50 | 0.000 | 62 | -1.23 | 0.110 |
| Greece | 46 | -1.38 | 0.000 | 47 | -2.42 | 0.434 |
| Hong Kong SAR | 81 | 2.17 | 0.000 | 82 | -0.60 | 0.001 |
| Hungary | 62 | 4.25 | 0.000 | 63 | -2.02 | 0.081 |
| India | 70 | 2.95 | 0.000 | 71 | -0.84 | 0.033 |
| Indonesia | 81 | 2.48 | 0.000 | 82 | -3.41 | 0.011 |
| Ireland | 61 | -0.64 | 0.000 | 62 | -2.10 | 0.230 |
| Italy | 61 | 0.53 | 0.000 | 62 | -0.97 | 0.132 |
| Japan | 81 | -0.34 | 0.000 | 82 | -0.44 | 0.031 |
| Korea | 81 | 2.59 | 0.000 | 82 | -1.04 | 0.012 |
| Malaysia | 81 | 1.80 | 0.000 | 82 | -1.17 | 0.020 |
| Mexico | 81 | 4.10 | 0.000 | 82 | -1.14 | 0.005 |
| Netherlands | 61 | 1.14 | 0.000 | 62 | -1.11 | 0.153 |
| New Zealand | 81 | 0.06 | 0.000 | 82 | -1.37 | 0.037 |
| Norway | 81 | 0.92 | 0.000 | 82 | -0.91 | 0.022 |
| Peru | 70 | 4.19 | 0.000 | 69 | -1.72 | 0.018 |
| Philippines | 81 | 1.52 | 0.000 | 82 | -2.47 | 0.000 |
| Poland | 70 | 5.25 | 0.000 | 71 | -1.54 | 0.002 |
| Portugal | 61 | 0.92 | 0.000 | 62 | -1.30 | 0.135 |
| Russia | 61 | 9.41 | 0.000 | 62 | -2.06 | 0.047 |
| Singapore | 81 | 1.44 | 0.000 | 82 | -0.72 | 0.015 |
| South Africa | 70 | 2.36 | 0.000 | 71 | -1.28 | 0.006 |
| Spain | 61 | 2.38 | 0.000 | 62 | -1.26 | 0.071 |
| Sweden | 81 | 2.63 | 0.000 | 82 | -0.74 | 0.020 |
| Thailand | 81 | 1.69 | 0.000 | 82 | -3.02 | 0.013 |
| Turkey | 81 | 4.44 | 0.000 | 82 | -1.78 | 0.001 |
| United Kingdom | 81 | 0.63 | 0.000 | 82 | -0.55 | 0.051 |
| United States | 81 | 1.10 | 0.000 | 82 | -0.45 | 0.058 |
| Venezuela | 70 | 2.01 | 0.000 | 71 | -0.65 | 0.005 |

Source: Author's elaboration.
* Mackinnon approximate *p*-value from the Augmented Dickey-Fuller Test under the null of unit-root.

**Table 4. Summary Statistics**

| | *Total net inflows* | | | | *Net FDI* | | | | *Net portfolio inflows* | | | | *Net other inflows* | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *Country* | *Obs.* | *Avg.* | *s.d.* | *p-value** | *Obs.* | *Avg.* | *s.d.* | *p-value** | *Obs.* | *Avg.* | *s.d.* | *p-value** | *Obs.* | *Avg.* | *s.d.* | *p-value** |
| Argentina | 83 | -0.04 | 1.91 | 0.005 | 83 | 0.49 | 0.65 | 0.000 | 83 | 0.15 | 1.51 | 0.000 | 83 | -0.69 | 1.29 | 0.000 |
| Australia | 78 | 1.08 | 0.63 | 0.000 | 78 | 0.22 | 0.74 | 0.000 | 78 | 0.75 | 1.23 | 0.000 | 78 | 0.12 | 0.79 | 0.000 |
| Austria | 83 | 0.08 | 1.05 | 0.000 | 83 | -0.09 | 0.63 | 0.000 | 83 | 0.35 | 1.49 | 0.000 | 83 | -0.19 | 1.69 | 0.000 |
| Belgium | 35 | -0.34 | 1.20 | 0.000 | 35 | 0.42 | 2.26 | 0.000 | 35 | -0.16 | 3.41 | 0.000 | 35 | -0.60 | 3.55 | 0.000 |
| Brazil | 83 | 0.52 | 0.86 | 0.000 | 83 | 0.43 | 0.46 | 0.000 | 83 | 0.37 | 0.86 | 0.000 | 83 | -0.29 | 0.84 | 0.000 |
| Canada | 83 | 0.01 | 0.75 | 0.000 | 83 | -0.08 | 0.67 | 0.000 | 83 | 0.17 | 1.04 | 0.000 | 83 | -0.09 | 0.87 | 0.000 |
| Chile | 79 | 0.58 | 1.60 | 0.000 | 79 | 0.94 | 0.88 | 0.000 | 79 | -0.55 | 1.22 | 0.000 | 79 | 0.19 | 1.40 | 0.000 |
| Colombia | 59 | 0.68 | 0.62 | 0.000 | 59 | 0.61 | 0.40 | 0.001 | 79 | 0.01 | 0.40 | 0.000 | 59 | 0.06 | 0.59 | 0.000 |
| Czech Republic | 62 | 1.49 | 1.48 | 0.000 | 62 | 1.29 | 1.23 | 0.000 | 62 | 0.03 | 0.88 | 0.000 | 62 | 0.17 | 1.38 | 0.000 |
| Denmark | 83 | -0.14 | 1.64 | 0.000 | 83 | -0.11 | 0.84 | 0.000 | 83 | -0.28 | 2.59 | 0.000 | 83 | 0.25 | 2.54 | 0.000 |
| Finland | 83 | -0.36 | 1.78 | 0.000 | 83 | -0.34 | 1.37 | 0.000 | 83 | -0.02 | 2.29 | 0.000 | 83 | 0.00 | 2.48 | 0.000 |
| France | 83 | -0.14 | 0.89 | 0.000 | 83 | -0.49 | 0.73 | 0.000 | 83 | 0.03 | 1.61 | 0.000 | 83 | 0.32 | 1.55 | 0.000 |
| Germany | 83 | -0.45 | 1.09 | 0.000 | 83 | -0.20 | 0.94 | 0.000 | 83 | 0.15 | 1.43 | 0.000 | 83 | -0.40 | 1.40 | 0.000 |
| Greece | 79 | 1.49 | 1.35 | 0.000 | 79 | 0.10 | 0.28 | 0.000 | 79 | 0.82 | 1.98 | 0.000 | 79 | 0.57 | 2.28 | 0.000 |
| Hong Kong SAR | 47 | -1.89 | 3.79 | 0.000 | 48 | 0.06 | 2.99 | 0.000 | 47 | -3.12 | 6.80 | 0.000 | 47 | 1.17 | 8.53 | 0.000 |
| Hungary | 83 | 1.77 | 1.96 | 0.000 | 83 | 1.00 | 1.24 | 0.000 | 83 | 0.52 | 1.48 | 0.000 | 83 | 0.25 | 1.71 | 0.000 |
| India | 53 | 0.77 | 0.63 | 0.002 | 73 | 0.17 | 0.14 | 0.001 | 53 | 0.21 | 0.32 | 0.002 | 81 | 0.35 | 0.43 | 0.000 |
| Indonesia | 78 | 0.01 | 1.19 | 0.000 | 81 | 0.11 | 0.37 | 0.003 | 78 | 0.13 | 0.66 | 0.000 | 80 | -0.22 | 0.71 | 0.000 |
| Ireland | 83 | 0.03 | 2.87 | 0.000 | 83 | 0.33 | 3.30 | 0.000 | 83 | -1.25 | 6.47 | 0.000 | 83 | 0.96 | 6.71 | 0.000 |
| Italy | 83 | 0.20 | 0.58 | 0.000 | 83 | -0.11 | 0.32 | 0.000 | 83 | 0.37 | 1.13 | 0.000 | 83 | -0.06 | 1.20 | 0.000 |
| Japan | 83 | -0.46 | 0.52 | 0.000 | 83 | -0.19 | 0.16 | 0.000 | 83 | -0.22 | 1.06 | 0.000 | 83 | -0.05 | 1.09 | 0.000 |
| Korea | 83 | 0.33 | 0.87 | 0.000 | 83 | -0.06 | 0.23 | 0.001 | 83 | 0.34 | 0.67 | 0.000 | 83 | 0.06 | 0.93 | 0.000 |

**Table 4. (continued)**

| | *Total net inflows* | | | | *Net FDI* | | | | *Net portfolio inflows* | | | | *Net other inflows* | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *Country* | *Obs.* | *Avg.* | *s.d.* | *p-value** | *Obs.* | *Avg.* | *s.d.* | *p-value** | *Obs.* | *Avg.* | *s.d.* | *p-value** | *Obs.* | *Avg.* | *s.d.* | *p-value** |
| Malaysia | 45 | -1.58 | 2.78 | 0.000 | 45 | 0.05 | 0.74 | 0.000 | 45 | -0.12 | 2.10 | 0.000 | 45 | -1.51 | 1.92 | 0.000 |
| Mexico | 75 | 0.92 | 0.74 | 0.000 | 75 | 0.52 | 0.31 | 0.000 | 83 | 0.30 | 0.83 | 0.000 | 83 | -0.01 | 0.59 | 0.000 |
| Netherlands | 83 | -0.80 | 1.43 | 0.000 | 83 | -0.72 | 2.68 | 0.000 | 83 | -0.22 | 3.27 | 0.000 | 83 | 0.14 | 2.39 | 0.000 |
| New Zealand | 82 | 1.08 | 1.44 | 0.000 | 82 | 0.64 | 1.01 | 0.000 | 82 | 0.21 | 1.41 | 0.000 | 82 | 0.22 | 1.43 | 0.000 |
| Norway | 75 | -1.86 | 2.01 | 0.000 | 75 | -0.42 | 0.99 | 0.000 | 75 | -1.67 | 3.21 | 0.000 | 75 | 0.23 | 3.35 | 0.000 |
| Peru | 78 | 0.95 | 1.18 | 0.000 | 78 | 0.82 | 0.73 | 0.000 | 78 | 0.09 | 0.59 | 0.000 | 78 | 0.03 | 0.93 | 0.000 |
| Philippines | 83 | 0.89 | 1.60 | 0.000 | 83 | 0.32 | 0.43 | 0.000 | 83 | 0.25 | 0.87 | 0.000 | 83 | 0.32 | 1.34 | 0.000 |
| Poland | 65 | 0.73 | 1.90 | 0.000 | 65 | 0.52 | 0.54 | 0.000 | 65 | 0.29 | 0.74 | 0.000 | 65 | -0.07 | 1.70 | 0.000 |
| Portugal | 83 | 1.37 | 1.36 | 0.000 | 83 | 0.15 | 0.75 | 0.000 | 83 | 0.28 | 2.17 | 0.000 | 83 | 0.94 | 2.40 | 0.000 |
| Russia | 67 | -0.72 | 1.95 | 0.000 | 67 | 0.06 | 0.30 | 0.000 | 67 | -0.01 | 0.81 | 0.000 | 67 | -0.76 | 1.74 | 0.000 |
| Singapore | 60 | -2.90 | 2.28 | 0.000 | 60 | 1.43 | 2.33 | 0.000 | 60 | -2.61 | 1.72 | 0.019 | 60 | -1.72 | 3.67 | 0.000 |
| South Africa | 83 | 0.54 | 0.92 | 0.000 | 83 | 0.17 | 1.20 | 0.000 | 83 | 0.39 | 1.28 | 0.000 | 83 | -0.02 | 0.93 | 0.000 |
| Spain | 83 | 0.86 | 1.01 | 0.008 | 83 | -0.21 | 0.77 | 0.000 | 83 | 0.61 | 1.99 | 0.000 | 83 | 0.45 | 1.75 | 0.000 |
| Sweden | 83 | -0.28 | 1.78 | 0.000 | 83 | -0.16 | 2.03 | 0.000 | 83 | -0.46 | 2.43 | 0.000 | 83 | 0.33 | 2.31 | 0.000 |
| Thailand | 78 | 0.44 | 2.20 | 0.004 | 82 | 0.65 | 0.45 | 0.001 | 78 | 0.17 | 0.76 | 0.000 | 82 | -0.30 | 2.30 | 0.046 |
| Turkey | 83 | 0.62 | 1.23 | 0.000 | 83 | 0.22 | 0.30 | 0.000 | 83 | 0.12 | 0.58 | 0.000 | 83 | 0.29 | 0.87 | 0.000 |
| United Kingdom | 83 | 0.44 | 1.04 | 0.000 | 83 | -0.37 | 1.87 | 0.000 | 83 | 0.54 | 2.87 | 0.000 | 83 | 0.27 | 2.16 | 0.000 |
| United States | 83 | 0.73 | 0.56 | 0.000 | 83 | -0.05 | 0.30 | 0.000 | 83 | 0.64 | 0.62 | 0.000 | 83 | 0.14 | 0.42 | 0.000 |
| Venezuela | 67 | -1.29 | 1.89 | 0.000 | 67 | 0.33 | 0.72 | 1.120 | 67 | -0.06 | 0.85 | 0.000 | 67 | -1.56 | 1.44 | 0.000 |

Source: Author's elaboration.
* Mackinnon approximate $p$-value from the Augmented Dickey-Fuller Test under the null of unit-root.

## 2.2 Data issues

Although the IFS data is the most comprehensive, there are several issues associated with the compilation of the BOP statistics, as discussed in greater detail by Lane and Milesi-Ferretti (2002). Data is missing for many countries, in particular for the early 1990s; therefore, the time coverage of the data varies substantially from country to country. For example, for Belgium the data begins in 2002, for Colombia and Singapore in 1996, Malaysia in 1999, and Russia and Venezuela in 1994. In addition, some countries do not report data for all forms of capital flows. Unfortunately, it is difficult to verify whether the data is in fact missing as opposed to simply being zero. Additionally, Lane and Milesi-Ferretti suggest that there are a number of measurement problems with debt data related to different methodologies for recording non-payments, rescheduling, debt forgiveness, and reductions. I recognize these are important limitations of the database that may bias the estimates, but it is something we have to live with.

## 2.3 Empirical estimation and results

The empirical analysis consists of explaining booms in real asset prices as a function of international capital inflows, external shocks, and domestic conditions. The objective is to study the simple association between booms in asset prices and different types of capital inflows, as well as of various shocks, and to consider whether this association is influenced by the degree of financial openness, quality of institutions, financial development and the exchange rate regime. By conducting these exercises, the paper aims to provide a comprehensive empirical assessment of the link between capital inflows and booms in asset prices.

The exercise is guided by the theoretical and empirical papers reviewed in section 1. I estimate the regression-based association between different categories of capital inflows and booms in real asset prices across countries, applying a battery of panel regressions, while controlling for relevant macroeconomic variables. Aizenman and Yothin (2009) use a similar approach to study the association between current account deficits and appreciation in real estate prices.

The point of departure is a standard regression equation designed for estimation using (cross-country, time-series) panel data:

$$Boom_{i,t} = \beta_0 + \beta_1 CV_{i,t} + \beta_2 CF_{i,t} + \mu_t + \eta_t + \xi_{i,t}, \tag{1}$$

where the subscripts $i$ and $t$ represent country and time period, respectively; *Boom* is the measure of booms in asset prices, *CV* is a set of control variables, and *CF* represents capital flows; $\mu_t$ and $\eta_i$ denote unobserved time- and country-specific effects, respectively, and $\xi$ is the error term. To perform the estimations, I use a pooled cross-country and time-series data panel, which I remind the reader, covers 40 developing and developed countries over the period from 1990 (quarter 1) to 2010 (quarter 3). The panel is unbalanced, with some countries having more observations than others.

The control variables represent factors that can, potentially, be associated with booms in asset prices. To correctly estimate the association between capital inflows and booms in asset prices, these factors need to be controlled for. I control for factors that can be directly associated with asset prices. With regard to this group, the regressions include the growth rate of output and areas of monetary and fiscal policy to capture the role of structural and stabilization policies. To control for the state of the economy, the corresponding growth rate of output is used in each regression. This is crucial to test if the economy is booming, in which case it is more likely to see asset prices booming too. Aggregate output is perhaps the most important variable representing the domestic economic condition, which may affect asset prices, both through its association with capital inflows and through other channels. The CPI inflation rate shows the nominal and monetary condition of the economy, which can also be associated with asset prices. Fiscal policy affects domestic investors' decisions and thereby indirectly affects asset prices. To analyze the link between capital inflows and booms in asset prices, it is essential that I control for these factors: if an important factor is not included in the model, there could be an omitted variable bias and all the effects of these factors could be captured as an association between capital inflows and asset prices.

Table 5 reports the estimation for different groups of countries in columns 1 through 3. Column 1 presents the regression using the entire sample of countries. With respect to the controls, they have the expected signs but are not always significant. While the growth rate of real GDP seems to be positively associated with booms, inflation is negatively associated with them, though the association is not always significant. The growth rate of government expenditure is, in general, statistically insignificant. Also, column 1 indicates that all categories of net capital inflows are positively associated with booms in real asset prices. However, the coefficients in the regression hide interesting variations across countries. Therefore, to account for the variations, columns 2 and 3 divide the sample between advanced and emerging economies. Comparing columns 2 and 3, I observe that the strong association between capital inflows and booms in real asset prices holds only in emerging economies. In column 3, when I use the sample of advanced economies alone, the association is not statistically significant.

Certainly, the methodology used in table 5 is subject to criticism. In particular, there are problems of endogeneity because some variables affect asset prices, as well as capital inflows. I try to take care of this issue by using instrumental variables. The method of

**Table 5. Estimation of Booms in Real Asset Prices**
Methodology: OLS with country fixed effects
Dependent variable: Booms in real asset prices

| *Variables* | *(1)* *All countries* | *(2)* *Emerging countries only* | *(3)* *Advanced countries only* |
|---|---|---|---|
| FDI inflows (% GDP) | 0.006* | 0.005 | -0.004 |
| | [1.668] | [1.006] | [-0.669] |
| Other inflows (% GDP) | 0.008*** | 0.009*** | 0.001 |
| | [3.611] | [3.616] | [0.201] |
| Equity inflows (% GDP) | 0.009*** | 0.012*** | 0.000 |
| | [2.991] | [2.993] | [0.057] |
| Debt portfolio inflows (% GDP) | 0.008*** | 0.011*** | -0.002 |
| | [2.828] | [3.024] | [-0.464] |
| Growth rate of real GDP | 0.001* | 0.001 | -0.004* |
| | [1.746] | [1.369] | [-1.709] |
| Growth rate of gov. exp. | 0.000 | 0.000 | -0.000 |
| | [0.116] | [0.276] | [-0.226] |
| Inflation (CPI) | -0.000 | 0.002 | -0.011 |
| | [-0.065] | [1.471] | [-1.343] |
| Constant | -0.003 | -0.009 | 0.024 |
| | [-0.104] | [-0.214] | [0.514] |
| Observations | 1,866 | 1,015 | 851 |
| Number of *ncode* | 36 | 17 | 19 |

Source: Author's elaboration.
$z$-statistics in brackets.
*** $p<0.01$, ** $p<0.05$, * $p<0.10$.

instrumental variables provides a simple solution to the problem of the endogeneity of capital inflows. To use this approach we need observable variables, not present in the previous estimation, that satisfy two conditions. First, they should not be correlated with the error term, in other words, they need to be completely exogenous. And second, they need to be correlated with capital inflows. The instruments that I use satisfy both conditions.

The instruments are not only the domestic factors but also the external factors, which can be associated with asset prices but mainly through their relation with capital inflows. This fact should be clear: in an economy totally closed to international financial markets, where by definition, capital inflows are non-existent, external factors cannot affect domestic financial markets. But when the economy opens and allows movement of foreign international flows, international factors do affect domestic asset prices through their effect on capital flows.

Among the external factors, I consider international financial conditions proxied by the US interest rate, the VIX, and the growth rate of real world GDP. The inclusion of the VIX variable is important because, as shown by Forbes and Warnock (2011), a measure of global risk is the most consistent driver of capital flows. Since these variables only affect asset prices through capital inflows, I only consider them in the first stage of the two-stage least square when I instrument for capital inflows. I report the results using instrumental variables in columns 1 through 3 of table 6.

Comparing the findings in column 3 with previous results, when using the sample of all countries, indicates that not all types of capital inflows can be associated with booms in real asset prices. Here, I find that only net portfolio debt inflows are positively and significantly associated with booms in real asset prices. Once again, the results show that this association is significant only in emerging economies. Column 3 shows that for developed countries, all categories of capital inflows remain insignificant.

To summarize, tables 5 and 6 provide for the first two statements of the paper: not all types of capital inflows can be associated with booms in real asset prices, and the association is only relevant for emerging economies. This result contrasts with the findings of Aizenman and Yothin (2009) and Sá, Towbin, and Wieladek (2011) who find that, in OECD countries, the current account balance (a close measure of total net capital inflows) is significantly associated with booms in real estate prices. Theory provides the reasons why emerging economies are more likely to be associated with booms in

**Table 6. Instrumental Variables Estimation of Booms in Real Asset Prices**
Methodology: Instrumental variables
Dependent Variable: Booms in real asset prices

| *Variables* | *(1)* *All countries* | *(2)* *Emerging only* | *(3)* *Developed only* |
|---|---|---|---|
| FDI inflows (% GDP) | -0.004 | 0.006 | -0.006 |
| | [-0.325] | [0.339] | [-0.393] |
| Other inflows (% GDP) | -0.001 | 0.002 | 0.009 |
| | [-0.098] | [0.197] | [0.586] |
| Equity inflows (% GDP) | 0.017* | -0.004 | 0.004 |
| | [1.698] | [-0.264] | [0.268] |
| Debt portfolio inflows (% GDP) | 0.044*** | 0.063*** | 0.017 |
| | [4.969] | [5.373] | [1.142] |
| Growth rate of real GDP | 0.005*** | 0.005*** | 0.005* |
| | [4.780] | [4.515] | [1.877] |
| Growth rate of gov. exp. | -0.000 | -0.000 | -0.001 |
| | [-0.623] | [-0.806] | [-0.858] |
| Inflation (CPI) | 0.002 | 0.003* | -0.002 |
| | [1.264] | [1.793] | [-0.227] |
| Constant | 0.056*** | 0.052*** | 0.053*** |
| | [7.647] | [4.653] | [3.883] |
| Observations | 1,702 | 912 | 790 |
| Number of *ncode* | 36 | 17 | 19 |

Source: Author's elaboration.
*z*-statistics in brackets
*** $p<0.01$, ** $p<0.05$, * $p<0.10$.

asset prices. First, these economies tend to have underdeveloped financial markets and poor regulation, which amplify the problems of moral hazard and adverse selection that feed the cycle described in section 1. It is now appropriate to study whether these factors influence the association. Furthermore, motivated by theory, it is also pertinent to explore the role of the exchange rate regime and financial openness.

In the framework of the panel data methodology, I now assess these issues by allowing the association of each measure of capital inflows and booms in asset prices to vary with quality of institutions, the level of financial development and financial openness, and the exchange rate regime. I do this by interacting each capital inflow measure with linear measures of the variables in each country and each period. The regression equation I estimate in this case is the following:

$$Boom_{i,t} = \beta_0 + \beta_1 CV_{i,t} + \beta_2 (CF_{i,t} \times Interactions_{i,t}) + \mu_t + \eta_t + \xi_{i,t}, \qquad (2)$$

The variables I use as interactions are: quality of institutions, exchange rate regime, financial depth and financial openness. Table 7 reports, in columns 1 through 4, the estimations including the interactions, individually. Column 1 interacts capital inflows with a measure of financial depth, column 2 with the measure of financial openness of Chinn and Ito (2008), column 3 with the exchange rate regime, as defined by Reinhart and Rogoff (2004), and column 4 with a measure of institutional quality. Finally, column 5 includes all the interactions simultaneously. In all columns, I control for other macroeconomic factors.

In general, the results presented in table 7 are in harmony with our expectations. The first insight is that net inflows of portfolio debt are significantly associated with booms in real asset prices in all regressions. This reinforces the findings reported in tables 5 and 6.

Portfolio equity also results significant and positive in all the estimations except the one in column 3. Column 3 only includes the interaction between capital inflows and the exchange rate regime. A surprising result of column 3 is that booms in real asset prices seem to be more likely in countries with flexible exchange rates, reflected in the coefficient accompanying the measure of the *exchange rate regime*. Other inflows only appear significant in columns 1 and 2.

On the other hand, I find that inflows of FDI are not significantly associated with booms in asset prices. This result was expected. Krugman (2000) argues that FDI inflows help smooth cycles in domestic asset prices; indeed, they should not be linked to booms.

For the case of the control variables, I find that not all of these factors are significantly associated with booms in asset prices. Only the growth rate of real GDP is significant in all regressions, an expected result indicating that asset prices are more likely to boom when the economy as a whole is booming.

When I interact with the measure of financial depth alone–a proxy for financial development–I find that the coefficient is negative but statistically significant only in the case of portfolio inflows (column 1). The level of financial development seems to reduce the

**Table 7. Estimating the Determinants of Booms in Real Asset Prices**
Estimation methodology: Panel with fixed effects (*xtreg*)
Dependent variable: Booms in real MSCI index

| | *(1)* | | *(2)* | | *(3)* | | *(4)* | | *(5)* | |
|---|---|---|---|---|---|---|---|---|---|---|
| *Capital inflow variables* | *Fin. depth* | | *KAOPEN* | | *Ex. rate regime* | | *Inst. quality* | | *All interactions* | |
| NET FDI % GDP | 0.025 | [0.799] | 0.016** | [2.197] | 0.017 | [1.561] | 0.028 | [1.559] | 0.008 | [0.198] |
| NET other % GDP | 0.032** | [2.084] | 0.017*** | [4.147] | 0.012 | [1.548] | 0.017 | [1.532] | 0.013 | [0.623] |
| NET equity % GDP | 0.109*** | [2.971] | 0.023** | [2.487] | 0.011 | [1.123] | 0.039** | [1.984] | 0.089* | [1.801] |
| NET debt % GDP | 0.045*** | [2.584] | 0.031*** | [4.626] | 0.016* | [1.853] | 0.039*** | [2.959] | 0.050** | [2.000] |
| *Control variables* | | | | | | | | | | |
| Growth rate or real GDP | 0.005*** | [4.964] | 0.005*** | [4.878] | 0.005*** | [4.696] | 0.005*** | [5.384] | 0.005*** | [4.927] |
| Inflation (CPI) | 0.001 | [0.580] | 0.002 | [1.349] | 0.000 | [0.177] | 0.001 | [0.763] | 0.003 | [1.568] |
| Growth rate of gov. exp. | -0.000 | [-1.065] | -0.000 | [-0.888] | -0.000 | [-0.974] | -0.000 | [-1.084] | -0.000 | [-0.617] |
| Financial depth | 0.042** | [2.338] | | | | | | | 0.060*** | [2.995] |
| Finacial openness (Chinn-Ito) | | | 0.002 | [0.359] | | | | | 0.001 | [0.152] |
| Exchange rate regime (Reinhart-Rogoff) | | | | | 0.023*** | [3.076] | | | 0.022*** | [2.787] |
| Institutional quality | | | | | | | 0.007 | [1.027] | 0.002 | [0.307] |

**Table 7. (continued)**

| | (1) | | (2) | | (3) | | (4) | | (5) | |
|---|---|---|---|---|---|---|---|---|---|---|
| *Interactions* | *Fin. depth* | | *KAOPEN* | | *Ex. rate regime* | | *Inst. quality* | | *All interactions* | |
| Net FDI × Financial depth | -0.003 | [-0.482] | | | | | | | 0.002 | [0.225] |
| Net Other × Financial depth | -0.004 | [-1.284] | | | | | | | -0.000 | [-0.120] |
| Net portfolio equity × Financial depth | -0.020** | [-2.578] | | | | | | | -0.016* | [-1.942] |
| Net portfolio debt × Financial depth | -0.006* | [-1.718] | | | | | | | -0.002 | [-0.413] |
| Net FDI × KAOPEN | | | -0.006* | [-1.839] | | | | | -0.003 | [-0.705] |
| Net other × KAOPEN | | | -0.005** | [-2.520] | | | | | -0.006** | [-2.171] |
| Net portfolio equity × KAOPEN | | | -0.008* | [-1.893] | | | | | -0.002 | [-0.282] |
| Net portfolio debt × KAOPEN | | | -0.010*** | [-3.362] | | | | | -0.009** | [-2.041] |
| Net FDI × Exchange rate regime | | | | | -0.002 | [-0.530] | | | -0.002 | [-0.420] |
| Net Other × Exchange rate regime | | | | | 0.002 | [0.653] | | | 0.000 | [0.127] |
| Net portfolio equity × Exchange rate regime | | | | | 0.002 | [0.571] | | | 0.004 | [0.865] |
| Net portfolio debt × Exchange rate regime | | | | | 0.001 | [0.229] | | | -0.001 | [-0.429] |
| Net FDI × Institutional quality | | | | | | | -0.004 | [-1.188] | 0.001 | [0.143] |
| Net Other × Institutional quality | | | | | | | -0.002 | [-0.679] | 0.002 | [0.630] |
| Net portfolio equity × Institutional quality | | | | | | | -0.006 | [-1.484] | -0.001 | [-0.083] |
| Net portfolio debt × Institutional quality | | | | | | | -0.006** | [-2.111] | -0.001 | [-0.225] |
| Constant | -0.145* | [-1.728] | 0.045*** | [4.516] | -0.022 | [-0.864] | 0.015 | [0.479] | -0.314*** | [-3.039] |
| Observations | 1,703 | | 1,715 | | 1,611 | | 1,854 | | 1,565 | |
| $R^2$ | 0.039 | | 0.041 | | 0.037 | | 0.034 | | 0.055 | |
| Number of *ncode* | 36 | | 36 | | 36 | | 36 | | 36 | |

Source: Author's elaboration.
$t$-statistics in brackets
*** $p<0.01$, ** $p<0.05$, * $p<0.10$.

link between booms in asset prices and portfolio inflows, both equity and debt. But there is no significant effect for FDI or other inflows.

In the case of financial openness, the interaction is negative and significant for all types of capital inflows (column 2). This suggests that more capital controls increase the association between capital inflows and booms in asset prices, a surprising result I discuss below.

The coefficients for the interactions of capital inflows and the measure of the exchange rate regime (column 3) are never significant. If this estimation were correct, the exchange rate regime would not influence the link between booms in asset prices and capital inflows.

When it comes to the quality of institutions, the evidence provided by these estimations is also weak. The interaction of capital inflows and the quality of institutions is not statistically significant, except for portfolio debt. The association between debt portfolio inflows and booms in real stock prices is lower, the higher the quality of the economy's institutions.

Finally, when I include all the interactions in the same regression (column 5), the results indicate that the only two factors that influence the degree of association between capital inflows and booms are the level of financial development and the degree of financial openness. The only significant coefficients in column 5 correspond to the interaction between portfolio equity and financial depth, and the interaction of financial openness with other flows and portfolio debt.

The estimates presented in table 7 suffer potential endogeneity problems. To control for potential endogeneity, I now estimate equation (2) using instrumental variables. The instruments that I use are the control variables (domestic factors) and external factors, such as the growth rate of world output, the interest rate from the US, and time dummies. I present this exercise next, in table 8.

Once again, I find that booms in real stock prices are strongly associated with capital inflows, but composition matters. For example, the association with FDI inflows is not statistically significant. In contrast, the association with debt portfolio inflows is positive, significant and robust. The positive association with other inflows is also significant and robust. For equity portfolio inflows the results are mixed but not robust.

Regarding the interactions, table 8 shows that, when included individually, the coefficients are, in general, negative and significant, except for the exchange rate regime. Columns 1 and 2 display negative and significant coefficients for the interactions of financial depth and financial openness with all types of capital inflows except

**Table 8. Estimating the Determinants of Booms in Real Asset Prices Using Instrumental Variables**

Methodology: instrumental variables

Dependent variable: Booms in real MSCI prices

| | *(1)* | | *(2)* | | *(3)* | | *(4)* | | *(5)* | |
|---|---|---|---|---|---|---|---|---|---|---|
| *Capital flows variables* | *Fin. depth* | | *KAOPEN* | | *Ex. rate regime* | | *Inst. quality* | | *All interactions* | |
| NET FDI % GDP | 0.176 | [1.167] | 0.040 | [1.213] | 0.025 | [0.557] | 0.016 | [0.195] | 0.079 | [0.358] |
| NET other % GDP | 0.365*** | [5.118] | 0.037** | [2.559] | -0.016 | [-0.477] | 0.099** | [2.275] | 0.501*** | [3.978] |
| NET equity % GDP | 0.380** | [1.999] | -0.092* | [-1.925] | -0.012 | [-0.361] | 0.037 | [0.369] | 0.348 | [1.202] |
| NET debt % GDP | 0.260*** | [3.369] | 0.127*** | [3.903] | 0.027 | [0.834] | 0.318*** | [4.896] | 0.510*** | [4.232] |
| *Control variables* | | | | | | | | | | |
| Growth rate of GDP | 0.005*** | [4.268] | 0.004*** | [3.751] | 0.005*** | [4.922] | 0.004*** | [4.165] | 0.005*** | [4.086] |
| Inflation (CPI) | 0.007*** | [3.097] | 0.005** | [2.075] | 0.002 | [1.040] | 0.004* | [1.816] | 0.006*** | [2.665] |
| Growth rate of gov. exp. | -0.000 | [-0.037] | -0.000 | [-0.162] | -0.000 | [-1.236] | 0.000 | [0.228] | -0.000 | [-0.075] |
| Financial depth | 0.101*** | [3.896] | | | | | | | 0.138*** | [4.443] |
| Financial openness (Chinn-Ito) | | | 0.006 | [0.465] | | | | | -0.028** | [-2.498] |
| Exchange rate regime (Reinhart-Rogoff) | | | | | 0.023** | [2.531] | | | 0.036*** | [3.574] |
| Institutional quality | | | | | | | -0.013 | [-1.105] | -0.007 | [-0.687] |

**Table 8. (continued)**

| | *(1)* | | *(2)* | | *(3)* | | *(4)* | | *(5)* | |
|---|---|---|---|---|---|---|---|---|---|---|
| *Interactions* | *Fin. depth* | | *KAOPEN* | | *Ex. rate regime* | | *Inst. quality* | | *All interactions* | |
| Net FDI × Financial depth | -0.037 | [-1.143] | | | | | | | 0.001 | [0.028] |
| Net other × Financial depth | -0.074*** | [-4.929] | | | | | | | -0.062*** | [-4.100] |
| Net portfolio equity × Financial depth | -0.077** | [-1.969] | | | | | | | -0.042 | [-1.052] |
| Net portfolio debt× Financial depth | -0.053*** | [-3.296] | | | | | | | -0.067*** | [-4.216] |
| Net FDI × KAOPEN | | | -0.012 | [-1.046] | | | | | 0.000 | [0.015] |
| Net other × KAOPEN | | | -0.012** | [-2.193] | | | | | 0.001 | [0.261] |
| Net portfolio equity × KAOPEN | | | 0.039** | [2.100] | | | | | 0.008 | [0.660] |
| Net portfolio debt × KAOPEN | | | -0.048*** | [-3.550] | | | | | 0.012 | [1.639] |
| Net FDI × Exchange rate regime | | | | | -0.004 | [-0.285] | | | -0.018* | [-1.695] |
| Net other × Exchange rate regime | | | | | 0.010 | [1.007] | | | -0.028*** | [-3.359] |
| Net portfolio equity × Exchange rate regime | | | | | 0.009 | [0.774] | | | -0.018* | [-1.794] |
| Net portfolio debt × Exchange rate regime | | | | | -0.002 | [-0.235] | | | -0.025*** | [-3.562] |
| Net FDI × Institutional quality | | | | | | | -0.003 | [-0.212] | -0.005 | [-0.501] |
| Net other × Institutional quality | | | | | | | -0.019** | [-2.184] | -0.024** | [-2.516] |
| Net portfolio equity × Institutional quality | | | | | | | -0.007 | [-0.379] | -0.019 | [-0.878] |
| Net portfolio debt × Institutional quality | | | | | | | -0.059*** | [-4.791] | -0.027** | [-2.457] |
| Constant | -0.433*** | [-3.484] | 0.031 | [1.319] | -0.024 | [-0.782] | 0.108* | [1.771] | -0.644*** | [-4.031] |
| Observations | 1,664 | | 1,702 | | 1,594 | | 1,691 | | 1,553 | |
| Number of *ncode* | 36 | | 36 | | 36 | | 36 | | 36 | |

Source: Author's elaboration.
$z$-statistics in brackets.
*** $p<0.01$, ** $p<0.05$, * $p<0.10$.

FDI. In column 4, quality of institutions is negative and significant when interacted with debt inflows (both portfolio and other). When combined in the same regression, as is done in column 5, the patterns of the interactions change slightly. While financial openness never emerges significant when interacted with capital inflows, the other three country characteristics are always negative and significant when interacted with debt inflows.

## 2.4 Discussion of the results in light of previous works

Most of the findings are consistent with theory. Specifically, the results confirm previous theoretical findings that large capital inflows can potentially be linked to booms in real stock prices, particularly in countries with underdeveloped and poorly regulated financial markets–low quality of institutions.

The results are also consistent with the empirical literature. In particular the findings that debt flows are the more dangerous type of capital. Tong and Wei (2010) show that the volume of total capital flows has no significant effect on the severity of stock market declines, but that composition matters: large pre-crisis exposure to debt inflows tends to be associated with a more severe decline in stock prices during the crisis. This paper suggests an explanation for Tong and Wei (2010)'s result—that there is more severe decline in stock prices after debt flow—since it shows that debt flows are more likely to have been involved in the development of a boom in stock prices before the crisis. The findings in this paper also provide some evidence that what links debt flows with booms in asset prices is the ability of the financial sector to intermediate the debt flows. But it could also be the case that debt flows are not being intermediated through the financial system and directly buying government bonds. If this is the case, the impact on real stock prices would be through the interest rate. Although analyzing this transmission channel is out of the scope of this paper, I provide evidence that this can potentially be the case in table 9. Table 9 shows that debt-related inflows are negatively related to interest rates on government bonds, and since interest rates are negatively related to stock prices, it may be the case that the association with booms in stock prices is through the interest rate. However, to support this argument, more evidence is required and is an area for future research.

A perhaps surprising result is that higher capital controls (less financial openness) do not appear to reduce the probability

**Table 9. Estimating the Association of Different Types of Capital Flows and Interest Rate**
Methodology: Panel with fixed effects
Dependent variable: Interest rate T-bills

| | *(1)* | *(2)* | *(3)* |
|---|---|---|---|
| *Variables* | *All countries* | *Emerging only* | *Developed only* |
| NET FDI % GDP | -0.444 | -1.096 | 0.288** |
| | [-1.356] | [-1.371] | [2.042] |
| NET other % GDP | -0.805*** | -1.379*** | -0.026 |
| | [-3.634] | [-2.944] | [-0.255] |
| NET equity % GDP | -0,612 | -1,197 | 0.160 |
| | [-1.327] | [-1.285] | [1.076] |
| NET debt % GDP | -0.831*** | -1.277** | -0.141 |
| | [-3.211] | [-2.106] | [-1.261] |
| Constant | 10.439*** | 17.629*** | 5.573*** |
| | [4.521] | [3.190] | [9.961] |
| Observations | 1,680 | 616 | 1,064 |
| Number of *ncode* | 28 | 11 | 17 |

Source: Author's elaboration.
*z*-statistics in brackets
*** $p<0.01$, ** $p<0.05$, * $p<0.10$.

of large capital inflows being associated with booms in real asset prices. This result is robust, it holds in all estimations, but it goes against previous theoretical findings (Korinek, 2011). The story told, at least since Díaz-Alejandro in "Good-bye Financial Repression, Hello Financial Crash," is that when emerging economies open up to financial markets, they increase the probability of asset price bubbles and financial crisis. However, the result is consistent with other empirical works. For example, Edwards (2011) finds that capital controls are an ineffective tool for isolating countries from global financial shocks. The idea of why capital controls may not be useful to reduce the association between capital inflows and booms is found in Kamisnky and Schmukler (2008). Kamisnky and Schmukler show that financial deregulation creates forces that favor more efficient financial markets over the long run, such as improvements in institutions and accountability of investors. In the long run, financial liberalization promotes more stable financial markets and growth. It is true, however, that in the short run, financial liberation may still trigger booms (and subsequent busts) in economies with distortions in capital markets as protected domestic financial institutions obtain access to new funds. In light of the evidence presented in this paper, these developments are more likely related to the degree of financial development and quality of institutions than to lower regulation of capital flows.

## 3. Final Remarks

As a consequence of the global financial crisis, policy makers are reassessing regulatory policies to reduce systemic vulnerabilities and costly financial crises. A key lesson we learned from the crisis is that wrong macroeconomic policy, weak regulation and market failures pose a great risk to financial stability. In this context, this paper makes a significant contribution for policy analysis, it contributes to our understanding of the role institutions and policies can play in moderating the vulnerabilities associated with large capital inflows. The paper's findings can, potentially, help policy makers choose the appropriate policy options to handle large capital flows.

A major implication of this paper is that capital inflows, in particular debt related inflows, are associated with booms in asset prices, and, therefore, can potentially increase the risk of financial crisis. Nonetheless, there are some factors that can help reduce this association. Consider, as an example, the prescription given in a recent IMF paper by Ostry and others (2011). Ostry and others claim countries "may have incentives to establish administrative controls to capital inflows if they increase the risk of financial distress." Since financial distress is one of the (undesired) consequences of booms in asset prices (Kaminsky and Reinhart, 1999), one could reinterpret this claim as: *if capital inflows were found to be associated with booms in asset prices, policy makers may have incentives to establish capital controls*. This inquiry can, in part, be answered by the findings of this paper.

If this paper is any guide, capital controls—implying a lower degree of financial openness—do not contribute to reduce the association between capital inflows and booms in asset prices. Although they may be useful for other reasons, capital controls will not be able to prevent capital inflows from increasing the vulnerabilities in domestic financial markets created by booms in asset prices. In fact the introduction of capital controls may help amplify financial market imperfections and should, therefore, be used with care.

Moreover, the findings in this paper suggest countries should improve the quality of their institutions and regulations, and adopt more flexible exchange rates before making use of capital controls, evidence suggests they are a more efficient tool to handle large and volatile capital inflows.

## References

Adam, K., P. Kuang, and A. Marcet. 2011. "House Price Booms and the Current Account." Working Paper 17224. Cambridge, Mass.: National Bureau of Economic Research.

Aizenman, J. and J. Yothin. 2009. "Current Account Patterns and National Real Estate Markets." *Journal of Urban Economics* 66(2): 75–89.

Aoki, K., G. Benigno, and N. Kiyotaki. 2009. "Capital Flows and Asset Prices." Department of Economics, Princeton University.

Bianchi, J. 2010. "Credit Externalities: Macroeconomic Effects and Policy Implications." *American Economic Review* 100(2): 398–402.

Caballero, R.J. and A. Krishnamurthy. 2001. "International and Domestic Collateral Constraints in a Model of Emerging Market Crises." *Journal of Monetary Economics* 48(3): 513–48.

————. 2006. "Bubbles and Capital Flow Volatility: Causes and Risk Management." *Journal of Monetary Economics* 53(1): 35–53.

Calvo, G.A., L. Leiderman, and C.M. Reinhart. 1996. "Inflows of Capital to Developing Countries in the 1990s." *Journal of Economic Perspectives* 10(2): 123–39.

Cardarelli, R., S. Elekdag, and M.A. Kose. 2010. "Capital Inflows: Macroeconomic Implications and Policy Responses." *Economic Systems* 34(4): 333–56.

Chinn, M.D. and H. Ito. 2008. "A New Measure of Financial Openness." *Journal of Comparative Policy Analysis* 10(3): 309–22.

Díaz-Alejandro, C. 1985. "Goodbye Financial Repression, Hello Financial Crash." *Journal of Development Economics* 19(1–2): 1–24.

Edwards, S. 2011. "*The Federal Reserve and Interest Rate Pass-Through in Latin America.*"

Forbes, K. and F. Warnock, 2013. "Capital Flow Waves: Surges, Stops, Flight and Retrenchment." in this volume.

Jansen, W.J. 2003. "What Do Capital Inflows Do? Dissecting the Transmission Mechanism for Thailand, 1980-1996." *Journal of Macroeconomics* 25(4): 457–80.

Jinjarak, Y. and S.M. Sheffrin. 2011. "Causality, Real Estate Prices, and the Current Account." *Journal of Macroeconomics* 33(2): 233–46.

Kaminski, G. and C.M. Reinhart. 1999. "The Twin Crises: The Causes of Banking and Balance of Payments Problems." *American Economic Review* 89(4): 473–500.

Kaminsky, G. and S. Schmukler. 2008. "Short-Run Pain, Long-Run Gain: Financial Liberalization and Stock Market Cycles." *Review of Finance* 12(2): 253–292.

Kim, S. and D.Y. Yang. 2011. "The Impact of Capital Inflows on Asset Prices in Emerging Asian Economies: Is Too Much Money Chasing Too Little Good?" *Open Economies Review* 22(2): 293–315.

Korinek, A. 2010. "*Regulating Capital Flows to Emerging Markets: An Externality View.*"

————. 2011. "Hot Money and Serial Financial Crises." *IMF Economic Review* 59(2): 306–339.

Krugman, P. 1998. "*What Happened to Asia?*" Cambridge, Mass.: Massachusetts Institute of Technology.

————. 2000. "Fire-Sale FDI." In *Capital Flows and the Emerging Economies*, edited by S. Edwards. Chicago, Illinois: University of Chicago Press.

Lane, P.R. and G.M. Milesi-Ferretti. 2002. "External Wealth, the Trade Balance, and the Real Exchange Rate." *European Economic Review* 46(6): 1049–71.

Magud, N., C.M. Reinhart, and E. Vesperoni. 2011. "Capital Inflows, Exchange Rate Flexibility, and Domestic Credit." Working Paper 1241. Cambridge, Mass.: National Bureau of Economic Research.

McKinnon, R.I. and H. Pill. 1996. "Credible Liberalizations and International Capital Flows: The Over Borrowing Syndrome." *Financial Deregulation and Integration in East Asia*. Chicago, Illinois: University of Chicago Press.

Mendoza, E.G. and M.E. Terrones. 2008. "An Anatomy of Credit Booms: Evidence from Macro Aggregates and Micro Data." International Finance Discussion Papers 936. Board of Governors of the US Federal Reserve System.

Ostry, J.D., A.R. Ghosh, K. Habermeier, L. Laeven, M. Chamon, M.S. Qureshi, and A. Kokenyne. 2011. "Managing Capital Inflows: What Tools to Use?" IMF Staff Discussion Note 11/06.

Reinhart, C.M. and V.R. Reinhart. 2008. "Capital Flow Bonanzas: An Encompassing View of the Past and Present." Working Paper 14321. Cambridge, Mass.: National Bureau of Economic Research.

Reinhart, C.M. and K.S. Rogoff. 2004. "The Modern History of Exchange Rate Arrangements: A Reinterpretation." *Quarterly Journal of Economics* 119(1): 1–48.

Sá, F., P. Towbin, and T. Wieladek. 2011. Low Interest Rates and Housing Booms: The Role of Capital Inflows, Monetary Policy and Financial Innovation." Working Paper 411. London: Bank of England.

Sarno, L. and M.P. Taylor. 1999. "Moral Hazard, Asset Price Bubbles, Capital Flows, and the East Asian Crisis: The First Test." *Journal of International Money and Finance* 18: 63–657.

Summers, L. 1991. "The Scientific Illusion in Empirical Macroeconomics." *Scandinavian Journal of Economics* 24: 129–148.

Tong, H. and S.J. Wei. 2010. "The Composition Matters: Capital Inflows and Liquidity Crunch During a Global Economic Crisis." *Review of Financial Studies* 24(6): 2023–2052.

Tornell, A. and F. Westermann. 2002. "Boom-Bust Cycles in Middle Income Countries: Facts and Explanation." *IMF Staff Papers* 49(Special i): 111–155.

Yellen, J.L. 2011. "Reaping the Full Benefits of Financial Openness." Speech at the Bank of Finland 200th Anniversary Conference, Helsinki, 6 May 2011.

# Debt- and Equity-Led Capital Flow Episodes

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Our earlier work has helped to switch the focus of studies of extreme capital flow movements toward the use of data on gross inflows (mainly driven by foreigners) and outflows (mainly driven by domestics) rather than relying on net flows (the sum of the two) (Forbes and Warnock, 2012). The old focus on net flows is understandable: in the early and mid-1990s, net capital inflows roughly mirrored gross inflows, so the capital outflows of domestic investors could often be ignored, and changes in net inflows could be interpreted as being driven by changes in foreign flows. More recently, however, the size and volatility of gross flows have increased while net capital flows have been more stable, which heightens the importance of differentiating between gross inflows and gross outflows. Foreign and domestic investors can be motivated by different factors and respond differently to various policies and shocks. Policymakers might also react differently based on whether episodes of extreme capital flow movements are triggered by domestic or foreign sources. Analysis based solely on net flows, while appropriate a few decades ago, would miss the dramatic changes in gross flows that have occurred over the past decade and disregard important information contained in the these flows. As domestic investors' flows have become increasingly important, changes in net flows can no longer be interpreted as being driven solely by foreigners. This point is made forcefully in Forbes and Warnock (2012).

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One question immediately emerges from the Forbes and Warnock (2012) analysis: to what extent are the extreme episodes of surges, stops, retrenchment and flight driven by different types of capital flows? We tackle this question by dividing up episodes into those that are led by debt and those that are led by equity. For a given episode—for example, a surge of inflows—if the increase in flows was mainly through debt (specifically, bonds and banking flows), we identify that episode as debt led. If the surge resulted mainly from an increase in equity inflows (specifically, portfolio equity and foreign direct investment, or FDI), it is equity led. We use the same approach to define equity- and debt-led stops, retrenchment and flight.

Our underlying quarterly data on gross inflows and gross outflows is identical to that in Forbes and Warnock (2012). It covers the period from 1980 (at the earliest) through 2009 and includes over 50 emerging and developed economies.[1] Using this database, we document the incidence of each type of episode of extreme capital flow movements over time, by income level and region. We show an unprecedented incidence of stops and retrenchment during the recent global financial crisis, as investors around the world liquidated foreign investment positions and brought money home. Importantly, we show that the vast majority of extreme capital flow episodes across our sample—80 percent of inflow episodes (surges and stops) and 70 percent of outflow episodes (flight and retrenchments)—are fueled by debt flows rather than equity flows.

Next, the paper shifts to its second goal of understanding the factors that are associated with debt- and equity-led episodes of extreme capital flows. We follow the Forbes and Warnock (2012) analysis here by describing capital flow episodes as being driven by specific global factors, contagion or domestic factors. To a first approximation, equity-led episodes appear to be idiosyncratic, bearing little systematic relation to our explanatory variables. Notably, even the risk measures that were highlighted in Forbes and Warnock (2012) as being significantly related to extreme movements in aggregate capital flows have little or no significant relationship with equity-led episodes. In contrast, risk measures are important in explaining debt-led episodes; when risk aversion is high, debt-led surges are less likely and debt-led stops are more likely. Contagion is also important for debt-led episodes, especially at the regional

1. Some graphs include 2010 data, but the empirical analysis does not because recent years' balance-of-payments data are subject to substantial revisions.

level. Country-level variables are largely insignificant, except for domestic growth shocks: debt-led stops are more likely in countries experiencing a negative growth shock, and debt-led surges are more likely in countries with a positive growth shock. Capital controls have little or no significance in both equity-led and debt-led episodes, as also found in Forbes and Warnock (2012).

Our key results—namely, that the majority of episodes are debt led and that debt-led episodes are associated with factors that agree with theory and past work—suggest that understanding debt flows is critically important. For example, the literature on credit booms is an important contribution to understanding sharp movements in capital flows (Gourinchas, Valdés and Landerretche, 2001; Mendoza and Terrones, 2008).

The remainder of the paper is as follows. Section 1 focuses on measures of extreme capital flow episodes. It explains our methodology and presents some descriptive statistics. Section 2 discusses the global, contagion and domestic factors we use to explain the incidence of surges, stops, flight and retrenchment; explains the estimation strategy; and reports results on the factors associated with debt- and equity-led capital flow waves. Section 3 concludes.

## 1. Identifying Debt- and Equity-Led Extreme Capital Flow Episodes

This section discusses our measures of debt- and equity-led capital flow episodes and provides a descriptive analysis of the episodes.

### 1.1 Methodology

Several methodologies can be used to identify capital flow episodes; each has advantages and disadvantages. The traditional approach using proxies for net flows is exemplified in the literature on sudden stops (for example, Calvo, Izquierdo and Mejía, 2004) and capital flow bonanzas (Reinhart and Reinhart, 2009). A number of studies facilitated a switch from net flows to gross flows in the examination of extreme capital flow episodes (Faucette, Rothenberg and Warnock, 2005; Cowan and De Gregorio, 2007; Cowan and others, 2008; Rothenberg and Warnock, 2011).

In this paper, our methodology closely follows that in Forbes and Warnock (2012), which builds on the traditional measures of sudden stops and capital flow bonanzas but makes three fundamental changes relative to the traditional approach: we use data on actual flows instead of current-account-based proxies for flows; we use data on gross flows from the outset to identify episodes, rather than relying on proxies for net flows; and we analyze both large increases and large decreases of both inflows and outflows, instead of just focusing on either increases or decreases. Forbes and Warnock (2012) is the first paper to analyze all types of capital flow episodes, whether driven by foreigners or domestics and whether characterized by sharp increases or decreases.

Our main innovation relative to our earlier paper is that we delve into the types of flows—namely, debt (including banking) or equity (including FDI)—that are behind the extreme flow episodes. A cursory look at the underlying data for gross flows in Chile suggests that the country's aggregate gross capital flows are largely (but not entirely) driven by movements in debt flows (figure 1).

More specifically, we use quarterly gross flow data in a sample of 58 countries over the period from 1980 through 2009 to identify four types of episodes:[2]

—Surges: a sharp increase in gross capital inflows;

—Stops: a sharp decrease in gross capital inflows;

—Flight:[3] a sharp increase in gross capital outflows; and

—Retrenchment: a sharp decrease in gross capital outflows.

The first two types of episodes (that is, surges and stops) are driven by foreigners, while the last two (flight and retrenchment) are driven by domestic investors. For any type of episode, a debt-led episode is one in which the debt flows were larger in magnitude than the equity flows. All other episodes are equity led, in which portfolio equity and FDI flows account for the majority of flows during the episode.

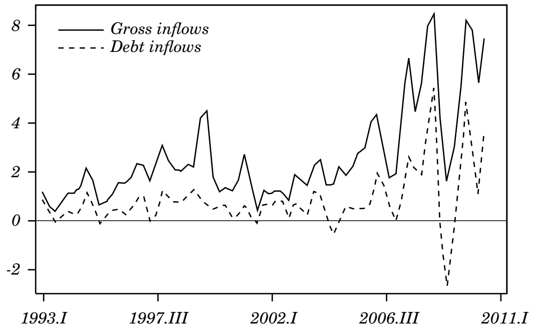
We calculate year-over-year changes in four-quarter gross capital inflows and outflows and define episodes using three criteria: (1) the current year-over-year change in four-quarter gross capital inflows or outflows is more than two standard deviations above or below the historical average during at least one quarter of the episode; (2) the episode lasts for all consecutive quarters for which the year-over-year change in annual gross capital flows is more than one standard

2. We start with as broad a sample as possible and only exclude countries that do not have detailed quarterly gross flow data.

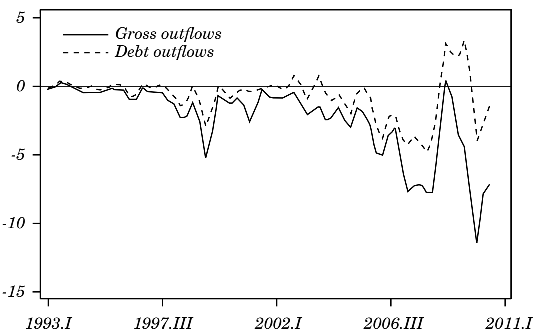
3. Flight is sometimes called starts (Cowan and others, 2008) or sudden diversification.

**Figure 1. Chile's Gross Flows[a]**

*A. Total and debt inflows*




*B. Total and debt outflows*




Source: Authors' elaboration.
a. The graphs show gross debt and equity inflows and outflows for Chile. Each flow is calculated as the two-quarter moving average. Gross outflows are reported using BPM5 definitions, so that a negative number indicates a gross outflow.

deviation above or below the historical average; and (3) the length of the episode is greater than one quarter.[4]

To provide a more concrete example of our methodology, consider the calculation of surge and stop episodes. Let $C_t$ be the four-quarter

4. Summing capital flows over four quarters is analogous to the literature's focus on one year of flows and eliminates seasonal fluctuations. The historical average and standard deviation are calculated over the last five years. We require that countries have at least four years worth of data to calculate a historical average.

moving sum of gross capital inflows (GINFLOW) and compute annual year-over-year changes in $C_t$:

$$C_t = \sum_{i=0}^{3} \mathrm{GINFLOW}_{t-i}, \text{ with } t = 1, 2, \ldots, N \tag{1}$$

and

$$\Delta C_t = C_t - C_{t-4}, \text{ with } t = 5, 6, \ldots, N. \tag{2}$$

Next, compute the rolling means and standard deviations of $\Delta C_t$ over the last five years. A surge episode is defined as starting the first month $t$ that $\Delta C_t$ increases more than one standard deviation above its rolling mean. The episode ends once $\Delta C_t$ falls below one standard deviation above its mean. In addition, for the entire period to qualify as a surge episode, there must be at least one quarter $t$ when $\Delta C_t$ increases at least two standard deviations above its mean.

A stop episode, defined using a symmetric approach, is a period when gross inflows fall one standard deviation below their mean, provided they reach two standard deviations below at some point. The episode ends when gross inflows are no longer at least one standard deviation below the mean.

Episodes of flight and retrenchment are defined similarly, but using gross private outflows rather than gross inflows and taking into account that in balance-of-payments (BOP) accounting terms, outflows by domestic residents are reported with a negative value.[5] In other words, when domestic investors acquire foreign securities, gross outflows are negative in BOP accounting terms. A sudden flight episode therefore occurs when gross outflows (in BOP accounting terms) fall one standard deviation below the mean, provided they reach two standard deviations at some point, and ends when gross outflows come back above one standard deviation below the mean. A sudden retrenchment episode occurs when gross outflows increase one standard deviation above their mean, provided they reach two standard deviations above at some point, and ends when gross outflows come back below one standard deviation above their mean.

5. As of August 2012, the IMF's balance-of-payments data are reported using the sixth edition of the Balance-of-Payments Manual. Our study predates the change to the sixth edition, so throughout this paper, balance-of-payments terminolgy and accounting rules refer to the fifth edition of the manual (BPM5).

For any type of episode, a debt-led episode is one in which the change in debt flows was larger in magnitude than the change in equity flows. That is, a debt-led episode is one in which the $\Delta C_t$ in equation (2) was driven primarily by a change in debt flows. All other episodes are equity led, in which portfolio equity and FDI flows represent the majority of flows behind the episode.

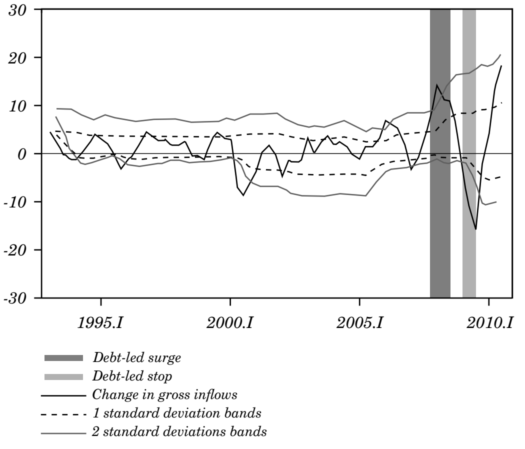
Our primary source of flow data is the International Monetary Fund's *International Financial Statistics* (IFS) on quarterly gross capital inflows and outflows.[6] A number of modifications are necessary, however, to transform the IFS flow data into a usable data set; some are straightforward, whereas others involve detailed inspection of country data and the filling in of gaps using source-country information. The creation of the underlying flow data set is described in more detail in Forbes and Warnock (2012, appendix A), which also lists the 58 countries in the resulting sample and the start date for which quarterly capital flow data is available for each country. In our baseline measure, we define gross capital inflows as the sum of inflows of direct investment, portfolio and other inflows; gross private capital outflows are defined analogously as the sum of direct investment, portfolio and other outflows. We also conduct sensitivity tests using alternative measures. In 2007, our sample includes US$10.8 trillion of gross capital inflows, capturing 97 percent of global capital inflows recorded by the International Monetary Fund (IMF).

Figure 2 (panel A) shows our identification of debt- and equity-led surges and stops for one country (Chile) from 1990 through 2009. The solid line is the change in annual gross capital inflows as defined in equation (2). The dashed lines are the bands for mean capital inflows plus or minus one standard deviation, and the dotted lines are the comparable two-standard-deviation bands. We classify an episode as a sudden stop if the change in annual capital inflows falls below the lowest line (the two-standard-deviation line) for at least one quarter, with the episode starting when it initially crosses the one-standard-deviation line and ending when it crosses back over the same line. Similarly, we classify an episode as a sudden surge if annual capital flows rise above the highest line (the two-standard-deviation line), with the episode starting when flows initially cross the one-standard-deviation line and ending when they cross back over the same line.

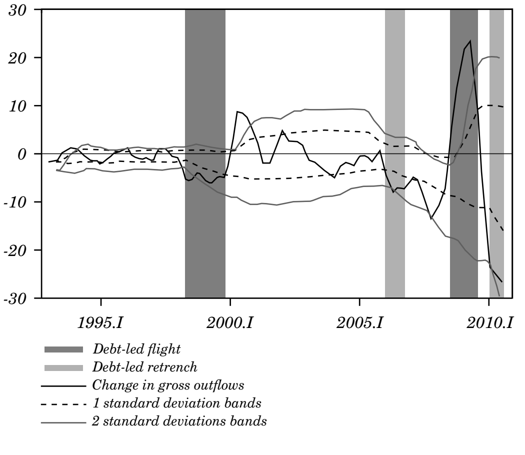
6. Accessed through Haver Analytics in January 2012.

## Figure 2. Chile: Construction of the Episodes[a]

*A. Surge and stop episodes*




*B. Retrenchment and flight episodes*




Source: Authors' elaboration.

a. Panel A shows the construction of our measures of debt- and equity-led surges and stops for Chile. A surge episode of any type begins when gross inflows (the solid line) exceed one standard deviation above the rolling mean, provided they eventually exceed two standard deviations above the mean. The surge episode ends when gross inflows again cross the one standard deviation line. A surge is identified as debt-led if debt inflows exceeded equity inflows during the episode. Stops are defined analogously; a stop episode begins when gross inflows fall one standard deviation below the rolling mean, provided they eventually fall two standard deviations below the mean, and ends when gross inflows again cross the one standard deviation line. Flights and retrenchments, shown in panel B, are defined analogously but using gross outflows data.

**Table 1. Summary Statistics for Episodes, 1980–2009**

| | *Percent of episodes that are debt led* | | | |
|---|---|---|---|---|
| *Sample* | *Surge* | *Stop* | *Flight* | *Retrenchment* |
| Full sample | 82 | 80 | 71 | 72 |
| By income group[a] | | | | |
| High income | 81 | 83 | 79 | 75 |
| Middle income | 81 | 83 | 63 | 76 |
| Lower income | 84 | 68 | 64 | 56 |
| By region | | | | |
| North America | 67 | 69 | 74 | 72 |
| Western Europe | 89 | 87 | 81 | 77 |
| Asia | 80 | 79 | 67 | 68 |
| Eastern Europe | 88 | 71 | 64 | 82 |
| Latin America | 81 | 85 | 74 | 67 |
| Other[b] | 33 | 54 | 42 | 29 |

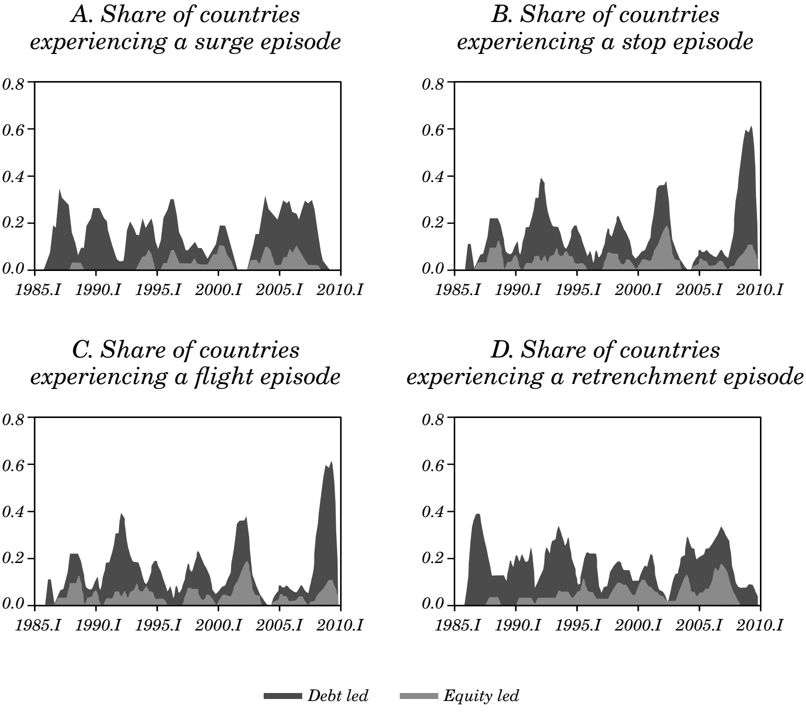
Source: Authors' elaboration.
a. Income classifications are based on per capita gross national income in 2000 as reported by the World Bank. We combine the World Bank's lower and lower-middle income countries into the group "lower income" because there are only four countries in our sample that qualify as lower income based on the World Bank classification. Our middle income group then includes countries classified as upper-middle income by the World Bank.
b. Other encompasses South Africa and Israel.

A given episode is debt led if the change in debt flows (that is, bonds and banking flows) is larger in magnitude than the change in equity flows (that is, portfolio equity and FDI); otherwise the episode is equity led. Debt-led episodes are identified with shaded bars in the figure; nonshaded episodes (that is, times when the solid line crosses the outermost bands) are equity led. For example, for Chilean inflows the most recent surge and stop were debt led, whereas previous inflow episodes were equity led.

## 1.2 The Episodes: Debt- and Equity-Led Surges, Stops, Flight and Retrenchment

Using the quarterly gross flow data and the criteria discussed above, from 1980 through 2009 we identify 167 surges, 221 stops, 196 flights and 214 retrenchments. The appendix lists episodes by country and suggests that the Chilean experience, with just as many equity-led as debt-led episodes, is not the norm. Table 1 aggregates the results and reports summary statistics on the incidence of

**Figure 3. Percent of Countries with Each Type of Episode**




Source: Authors' elaboration.

episodes for the full sample and the average length of each episode by income group and region.[7] The table shows that most extreme capital flow episodes around the world are debt led (80 percent of inflow episodes and 70 percent of outflow episodes). Equity-led episodes are, by contrast, relatively infrequent. Figure 3 shows the incidence of debt- and equity-led episodes through time.

7. We use income classifications based on per capita gross national income in 2000 as reported by the World Bank. We combine the World Bank's lower and lower-middle income countries into the group "lower income" because there are only four countries in our sample that qualify as lower income based on the World Bank classification. Our middle income group then includes countries classified as upper-middle income by the World Bank. We focus on six regions: North America, Western Europe, Asia, Eastern Europe, Latin America and other (which encompasses South Africa and Israel).

## 2. Global, Contagion and Domestic Factors

This section provides regression analysis of the relationship between debt- and equity-led episodes of extreme capital flows and global, contagion and domestic factors.

### 2.1 Estimation Strategy and Variables

Our estimation strategy follows Forbes and Warnock (2012). More specifically, to assess the role of these global, contagion and domestic variables on the conditional probability of having a surge, stop, flight or retrenchment episode each quarter, we estimate the following model:

$$\Pr\left(e_{i,t}=1\right)=F\left(\phi_{t-1}^{\text{Global}}\mathbf{B}_G+\phi_{i,t-1}^{\text{Contagion}}\mathbf{B}_C+\phi_{i,t-1}^{\text{Domestic}}\mathbf{B}_D\right), \tag{3}$$

where $e_{i,t}$ is an episode dummy variable that takes the value of one if country $i$ is experiencing an episode (surge, stop, flight or retrenchment) in quarter $t$; $\phi_{t-1}^{\text{Global}}$ is a vector of global factors; $\phi_{i,t-1}^{\text{Contagion}}$ is a vector of contagion variables; and $\phi_{i,t-1}^{\text{Domestic}}$ is a vector of domestic variables. The appropriate methodology to estimate equation (3) is determined by the distribution of the cumulative distribution function, $F(\cdot)$. Because episodes occur irregularly (83 percent of the sample is zero), $F(\cdot)$ is asymmetric. We therefore estimate equation (3) using the complementary logarithmic (or cloglog) framework, which assumes that $F(\cdot)$ is the cumulative distribution function (CDF) of the extreme value distribution. In other words, this estimation strategy assumes that

$$F\left(z\right)=1-\exp\left[-\exp\left(z\right)\right]. \tag{4}$$

While we estimate each type of episode separately, we use a seemingly unrelated estimation technique that allows for cross-episode correlation in the error terms. This captures the fact that the covariance matrix across episodes is not zero, without assuming a structural model specifying a relationship between episodes. We also cluster the standard errors by country.

In Forbes and Warnock (2012), we provide a detailed review of the literature on capital flows that motivates the parsimonious set of variables we now use—global factors such as global risk, liquidity, interest rates and growth; contagion through trade linkages, financial linkages and geographic location; and domestic factors such as a country's financial market development, integration with global financial markets, fiscal position and growth shocks. We focus on measures that are available over the full sample period from 1985 to 2009 for most countries in the sample.[8] The variables are discussed in detail below.

### 2.1.1 Global variables

For our initial analysis, we measure global risk as the original volatility index calculated by the Chicago Board Options Exchange (the VXO).[9] This measures implied volatility using prices for a range of options on the S&P 100 index and captures overall economic uncertainty or risk, including both the riskiness of financial assets and investor risk aversion. To measure global liquidity, we use the year-over-year growth in the global money supply, with the global money supply calculated as the sum of M2 in the US, the euro area and Japan and M4 in the United Kingdom, all converted into US dollars. Global interest rates are measured using the average rate on long-term government bonds in the US, the core euro area and Japan. Global growth is measured by quarterly global growth in real economic activity. The last three variables are based on data from the IMF's IFS database.

### 2.1.2 Contagion variables

We use three measures to capture contagion effects. The first is a measure of geographic proximity, with a dummy variable equal to one if a country in the same region has an episode. The regions are

8. Most of the variables are available quarterly. For market statistics that are available at a higher frequency, we use quarterly averages. Economic statistics that are only available on an annual basis are calculated by approximating quarterly values based on the annual frequencies. Also, as specified in equation (3), each variable is lagged by one quarter unless noted.

9. The VXO, as the original volatility index is now known, is similar to the current VIX. The VIX is calculated using a broader set of prices, but it is only available starting in 1990. The correlation between the two measures is 99 percent, so we focus on the VXO for our baseline analysis to maximize sample size. Section 2.3 discusses alternative measures of risk.

described above. We also measure contagion through trade linkages (TL) as an export-weighted average of rest-of-the-world episodes:

$$\mathrm{TL}_{xt} = \frac{\sum_{i=1}^{n}\left(\mathrm{Exports}_{x,i,t} \times \mathrm{Episode}_{i,t}\right)}{\sum_{i=1}^{n}\mathrm{Exports}_{x,i,t}} \times \frac{\mathrm{Exports}_{x,t}}{GDP_{x,t}}, \tag{5}$$

where $\mathrm{Exports}_{x,i,\,t}$ is exports from country $x$ to country $i$ in quarter $t$ from the IMF's Direction of Trade Statistics; $\mathrm{Exports}_{x,t}/\mathrm{GDP}_{x,\,t}$ is a measure of country $x$'s trade openness; and $\mathrm{Episode}_{i,\,t} = 1$ if country $i$ had an episode in the quarter. $\mathrm{TL}_{xt}$ is calculated for each country $x$ for each type of episode (surge, stop, flight and retrenchment) in each quarter $t$.

We also include a measure of financial linkages that is as similar as possible to the trade linkages measure, given the more limited data available on bilateral financial linkages. The measure is based on banking data provided by the Bank for International Settlements (BIS) and uses the algorithm underlying the analysis in McGuire and Tarashev (2006, 2007). While no measure of financial linkages is perfect, we focus on banking data because they are the only cross-country financial data that are of reasonable quality and widely available across countries and time periods. Let $\mathrm{BANK}_{x,i}$ be total bank claims between country $x$ and BIS reporting entity $i$, where some $i$ are individual countries (namely, the US, the United Kingdom, the Netherlands and Japan) but for confidentiality reasons other $i$ are groups of countries.[10] Our measure of financial linkages (FL) first computes the GDP-weighted averages of episodes within each group, termed group episodes, which vary between zero and one.[11] Then for a country $x$, $\mathrm{FL}_x$ is a $\mathrm{BANK}_{x,i}$-weighted average of the group episodes multiplied by a financial openness measure ($\mathrm{BANK}_x/\mathrm{GDP}_x$).

10. The groupings are as follows: AT CY GR IE PT; BE LU; FR DE IT ES; FI DK NO SE; HK MO SG BH, BS BM KY AN PA; GG IM JE; BR CL MX; TR ZA; TW IN MY KR; and CH AU CA.

11. The GDP-weighted average of episodes within a group is computed because we do not have the full matrix of bilateral banking claims, just claims vis-à-vis groups (and a few individual countries).

### 2.1.3 Country variables

To capture the domestic factors, we use five variables. Depth of the financial system is the sum of each country's stock market capitalization divided by GDP, from Beck and Demirgüç-Kunt (2009); in robustness tests we use other measures that are only available for smaller samples. Capital controls is a broad measure of the country's capital controls as calculated in Chinn and Ito (2008).[12] This statistic is one of the few measures of capital controls available back to 1985 for a broad sample of countries; we explore the impact of a range of other measures in section 2.3. Real GDP growth is from the IFS, with the growth shock as the deviation between actual growth and the country's trend growth. Country indebtedness is public debt to GDP from the new database described in Abbas and others (2010). We also include a control for GDP per capita.[13]

## 2.2 Main Results

To assess whether global, contagion and domestic factors are associated with debt- and equity-led surge, stop, flight and retrenchment episodes, we estimate equation (3) using a complimentary logarithmic framework that includes adjustments for covariances across episodes and robust standard errors clustered by country. The results are presented in tables 2 and 3.

The immediate impression from the results for equity-led episodes (table 2) is that very few variables are significant. To a first approximation, equity-led episodes appear to be idiosyncratic, bearing little systematic relation to the explanatory variables. Moreover, some of the estimates that are significant do not correspond to the underlying economic theory. For example, equity-led surges and stops are both more likely to occur when global interest rates are low. The one noteworthy significant coefficient estimate in table 2 indicates that equity-led stops and surges are more likely when a country's trading partners are also experiencing them. Finally, the

12. We focus on the KAOPEN measure of capital controls in Chinn and Ito (2008), updated in April 2011. To be consistent with other measures of capital controls in the additional tests in section 2.3, we reverse the sign so that a positive value indicates greater controls.

13. All country-level variables, except for the index of capital controls, GDP per capita, and the contagion variables, are winsorized at the 1 percent level to reduce the impact of extreme outliers.

**Table 2. Regression Results for Equity-Led Episodes of Extreme Capital Flows[a]**

| *Factor* | *Surge* | *Stop* | *Flight* | *Retrenchment* |
|---|---|---|---|---|
| *Global factors* | | | | |
| Risk | –0.023 | –0.007 | –0.063* | 0.012 |
| | (0.039) | (0.012) | (0.034) | (0.012) |
| Liquidity | –19.591 | –6.498 | 4.088 | –5.645 |
| | (14.658) | (11.209) | (11.426) | (12.009) |
| Interest rates | –0.355* | –0.285** | –0.216* | 0.078 |
| | (0.196) | (0.106) | (0.131) | (0.108) |
| Growth | 38.518 | –0.408 | 21.951* | –0.513 |
| | (25.861) | (6.708) | (13.182) | (6.545) |
| *Linkages* | | | | |
| Regional | –0.347 | –0.287 | –0.679** | –0.333 |
| | (0.485) | (0.407) | (0.279) | (0.336) |
| Trade | 2.838** | 2.223** | –0.073 | 1.865* |
| | (0.910) | (0.944) | (0.863) | (1.090) |
| Financial | –3.188* | –0.301 | –0.740 | –0.222 |
| | (1.770) | (0.919) | (1.358) | (1.048) |
| *Domestic Factors* | | | | |
| Financial system | 0.384 | 0.420 | 0.060 | 0.176 |
| | (0.380) | (0.299) | (0.296) | (0.256) |
| Capital controls | 0.021 | 0.013 | –0.008 | 0.090 |
| | (0.159) | (0.119) | (0.119) | (0.119) |
| Debt to GDP | –0.004 | –0.003 | –0.004 | –0.009 |
| | (0.007) | (0.008) | (0.006) | (0.008) |
| Growth shock | –1.034 | –0.745 | –0.198 | –0.283 |
| | (0.673) | (0.773) | (0.595) | (0.828) |
| GDP per capita | –0.011 | –0.010 | –0.026* | 0.012 |
| | (0.016) | (0.017) | (0.015) | (0.016) |
| No. observations | 3,446 | 3,446 | 3,446 | 3,446 |

Source: Authors' elaboration.

* Statistically significant at the 10 percent level.

** Statistically significant at the 5 percent level

a. The dependent variable is a dummy variable that takes the value of one if there is an equity-led episode (surge, stop, flight or retrenchment) and zero otherwise. Variables are defined in section 2.1. Estimates are obtained using the complementary logarithmic (or cloglog) framework, which assumes that $F(\cdot)$ is the cumulative distribution function (CDF) of the extreme value distribution. To capture the covariance across episodes, the set of four episodes is estimated using seemingly unrelated estimation with robust standard errors clustered by country.

## Table 3. Regression Results for Debt-Led Episodes of Extreme Capital Flows[a]

| *Factor* | *Surge* | *Stop* | *Flight* | *Retrenchment* |
|---|---|---|---|---|
| *Global factors* | | | | |
| Risk | –0.059** | 0.013** | –0.016 | 0.007 |
| | (0.021) | (0.005) | (0.023) | (0.006) |
| Liquidity | 7.441 | –0.714 | –9.859 | 4.056 |
| | (5.144) | (5.012) | (6.680) | (6.083) |
| Interest rates | 0.015 | 0.101** | –0.038 | 0.131** |
| | (0.058) | (0.049) | (0.084) | (0.042) |
| Growth | 22.805** | –0.182 | 1.353 | –1.836 |
| | (9.448) | (3.230) | (7.349) | (3.398) |
| *Linkages* | | | | |
| Regional | 0.490 | 0.383** | 0.849** | 0.335** |
| | (0.306) | (0.128) | (0.315) | (0.159) |
| Trade | 1.118** | 0.298 | 0.539 | 0.566 |
| | (0.434) | (0.679) | (0.514) | (0.454) |
| Financial | –1.821** | 1.953** | –0.425 | 1.354** |
| | (0.903) | (0.679) | (1.903) | (0.503) |
| *Domestic Factors* | | | | |
| Financial system | –0.403* | 0.223* | –0.315 | 0.106 |
| | (0.228) | (0.115) | (0.202) | (0.150) |
| Capital controls | 0.011 | –0.101 | 0.226** | –0.003 |
| | (0.087) | (0.076) | (0.088) | (0.074) |
| Debt to GDP | –0.004 | 0.003 | –0.007** | 0.001 |
| | (0.004) | (0.002) | (0.004) | (0.003) |
| Growth shock | 0.992** | –1.518** | –0.348 | 0.294 |
| | (0.331) | (0.767) | (0.571) | (0.569) |
| GDP per capita | 0.005 | 0.004 | 0.024** | 0.016** |
| | (0.008) | (0.007) | (0.009) | (0.007) |
| No. observations | 3,446 | 3,446 | 3,446 | 3,446 |

Source: Authors' elaboration.

* Statistically significant at the 10 percent level.

** Statistically significant at the 5 percent level.

a. The dependent variable is a dummy variable that takes the value of one if there is a debt-led episode (surge, stop, flight or retrenchment) and zero otherwise. Variables are defined in section 2.1. Estimates are obtained using the complementary logarithmic (or cloglog) framework, which assumes that $F(\cdot)$ is the cumulative distribution function (CDF) of the extreme value distribution. To capture the covariance across episodes, the set of four episodes is estimated using seemingly unrelated estimation with robust standard errors clustered by country.

risk measures that were highlighted in Forbes and Warnock (2012) as explaining extreme episodes in aggregate capital flows have little or no significant relationship with equity-led episodes.

Risk measures are significant, however, in explaining debt-led extreme capital flows episodes (table 3). When risk aversion is high, debt-led surges are less likely and debt-led stops are more likely. Contagion is also important for debt-led episodes, especially at the regional level. For the country-level variables, growth shocks are most important: debt-led stops are more likely in countries experiencing a negative growth shock, and debt-led surges are more likely in countries with a positive growth shock. Capital controls continue to have little or no significance in explaining debt-led episodes, as also documented for equity-led episodes and episodes of aggregate capital flows.

## 2.3 A Closer Look at Global Risk and Capital Controls

Two results from our baseline analysis of extreme capital flow episodes are the significance of global risk (at least for debt-led episodes) and the insignificance of capital controls. This Section looks more closely at these results.

The finding that global risk is the most consistently significant factor associated with capital inflow episodes (measured based on gross flows) has important implications for understanding capital flow movements. To further explore this role of risk, we use three different measures of risk (in addition to our baseline measure of the VXO): the VIX, the Credit Suisse First Boston (CSFB) Risk Appetite Index (RAI) and the variance risk premium (VRP).[14] The most common measures of risk—such as the VXO and the VIX—capture both economic uncertainty and risk aversion. The RAI is constructed with the aim of capturing only risk aversion (or risk appetite) while

14. See section 2.1.1 for details on the VXO and VIX, which are nearly identical but cover different time periods. The RAI is the beta coefficient of a cross-sectional regression of a series of risk-adjusted asset price returns in several countries on the past variance of these assets. This calculation is based on 64 global assets, including equities and bonds for all developed countries and major emerging markets. If the beta is positive, the price of riskier assets is rising relative to the price of safer assets, so risk appetite among investors is higher. For more information, see Wilmot, Mielczarski and Sweeney (2004). To simplify comparisons with the other risk measures, we reverse the sign of the RAI. The VRP is the difference between the risk-neutral and objective expectation of realized variance, where the risk-neutral expectation of variance is measured as the end-of-month observation of the VIX squared and de-annualized and the realized variance is the sum of squared five-minute log returns of the S&P 500 index over the month (see Zhou, 2010).

controlling for overall risk and uncertainty. Misina (2003) shows, however, that it may not control for changes in overall risk unless a strict set of theoretical conditions is met. In contrast, the VRP index is based on a less rigid set of assumptions and therefore is a more accurate measure of risk aversion independent of expectations of future volatility (that is, future risk). A minor disadvantage of the VRP (as well as the VIX) is that it is only available starting in 1990.

Table 4 reports the estimated coefficients on the risk variable when the base regression reported in tables 2 and 3 is repeated with these alternate measures of risk (with the top line replicating the baseline results from the earlier tables). For debt-led inflow episodes (panel A), the coefficient on risk is highly significant in all but one case. Broad measures of risk (including the VXO, the VIX and possibly the RAI) that capture both changes in economic uncertainty and changes in risk aversion are positively correlated with stop and retrenchment episodes and negatively correlated with surges. The measure that most accurately isolates changes in risk aversion (the VRP) is positively and significantly related to stops and negatively related to surges. This suggests that risk aversion (and not just increased economic uncertainty) is an important factor associated with debt-led stop and surge episodes. For equity-led episodes (panel B), risk matters only for flight, which is less likely when global risk aversion is high. Otherwise, no risk measure is associated with any type of equity-led episode. A key implication from table 4 is that some of the main results of Forbes and Warnock (2012) for aggregate capital flow episodes are caused by debt-led episodes and not equity-led ones.

A second key result from the baseline regressions in tables 2 and 3 is that a country's capital controls are not significantly related to any type of extreme capital flow episode (except that countries with greater controls are more likely to have flight episodes). This does not support the recent interest in capital controls as a means of reducing capital flow surges and overall capital flow volatility. To further explore this result, we use several measures of capital controls. First, instead of a direct *de jure* measure of capital controls, we use a broad *de facto* measure of financial integration—namely, the sum of foreign assets and liabilities divided by GDP.[15] Second, we consider a broad measure of capital account restrictions from

15. The financial integration data are from an updated and extended version of the data set constructed by Lane and Milesi-Ferretti (2007), available online at www.philiplane.org/EWN.html

## Table 4. Coefficient on Global Risk Variable with Alternate Measures of Risk

| *Type of episode and risk measure* | *Surge* | *Stop* | *Flight* | *Retrenchment* | *No. observations* |
|---|---|---|---|---|---|
| *A. Debt-led episode* | | | | | |
| VXO | –0.059** | 0.013** | –0.016 | 0.007 | 3,446 |
| | (0.021) | (0.005) | (0.023) | (0.006) | |
| VIX | –0.073** | 0.016** | –0.014 | 0.007 | 3,291 |
| | (0.029) | (0.006) | (0.031) | (0.007) | |
| CSFB RAI | –0.036 | 0.101** | –0.027 | 0.112** | 3,453 |
| | (0.029) | (0.025) | (0.042) | (0.025) | |
| Volatility risk premium | –0.025* | 0.005** | –0.004 | 0.001 | 3,291 |
| | (0.013) | (0.002) | (0.009) | (0.003) | |
| *B. Equity-led episodes* | | | | | |
| VXO | –0.023 | –0.007 | –0.063* | 0.012 | 3,446 |
| | (0.039) | (0.012) | (0.034) | (0.012) | |
| VIX | –0.041 | –0.007 | –0.078* | 0.006 | 3,291 |
| | (0.046) | (0.013) | (0.040) | (0.014) | |
| CSFB RAI | –0.124 | 0.010 | –0.042 | 0.029 | 3,453 |
| | (0.084) | (0.045) | (0.049) | (0.045) | |
| Volatility risk premium | –0.013 | 0.002 | –0.019 | –0.002 | 3,291 |
| | (0.019) | (0.005) | (0.015) | (0.004) | |

Source: Authors' elaboration.
* Statistically significant at the 10 percent level.
** Statistically significant at the 5 percent level.
a. The table reports the coefficients on global risk when the base regressions reported in tables 2 and 3 are estimated using one of the alternative measures listed in the table. See table 2 or 3 for information on the estimation technique and additional variables included in the regressions.

Schindler (2009) that is only available from 1995 to 2005. Third, we use measures of capital account restrictions from the same source and time period, but that focus specifically on controls on just inflows or outflows.[16] Finally, we also use two new indices of capital controls from Ostry and others (2011), which measure capital controls in the financial sector and regulations on foreign exchange.

Table 5 shows the coefficient estimates on each of these capital control measures when we repeat the base regression from tables 2 and 3 using the alternate measure of controls or financial integration (with the top line replicating the baseline results). Capital controls are almost never significant for either debt- or equity-led episodes, except occasionally for flight episodes. More capital account restrictions are associated with more debt-led flight episodes (for some measures of controls) and fewer equity-led flight episodes (again, for some controls measures). Other than for flight episodes (for which four of the ten coefficients are significant), only one coefficient out of 30 is (marginally) significant. Greater capital controls do <u>not</u> seem to be associated with a reduction in the probability of having a surge or stop episode driven by foreigners, counter to an argument made by policymakers to support the use of these controls.

## 3. Conclusions

We extend the analysis in Forbes and Warnock (2012) by separating episodes of extreme capital flows into those driven primarily by debt flows (that is, bonds and banking flows) and those driven by equity flows (portfolio equity and FDI). Most episodes around the world result primarily from changes in debt flows, including 80 percent of episodes of sharp changes in capital inflows (driven by foreigners) and 70 percent of episodes of sharp movements in capital outflows (driven by domestics).

Risk measures are highly correlated with sudden changes in debt inflows (driven by foreigners), as found for aggregate capital flows in Forbes and Warnock (2012). When risk aversion is high, debt-led surges are less likely and debt-led stops are more likely. Contagion, especially within regions, is also important for debt-led

16. For regressions predicting surges and stops, we use the index of controls on local purchases and sales, respectively, by nonresidents. For regressions predicting flight and retrenchments, we use the index of controls on purchases or sales abroad, respectively, by residents.

**Table 5. Coefficient on Capital Control Variable with Alternate Measures of Capital Controls**

| *Type of episode and capital control measure* | *Surge* | *Stop* | *Flight* | *Retrenchment* | *No. observations* |
|---|---|---|---|---|---|
| *A. Debt-led episodes* | | | | | |
| Capital controls (Chinn and Ito, 2008) | 0.011 | −0.101 | 0.226** | −0.003 | 3,446 |
| | (0.087) | (0.076) | (0.088) | (0.074) | |
| Financial integration (Lane and Milesi-Ferretti, 2007) | −0.010 | −0.000 | −0.149 | 0.020 | 3,446 |
| | (0.034) | (0.016) | (0.095) | (0.015) | |
| Overall capital account restrictions (Schindler, 2009) | 0.427 | −0.983* | 1.390* | −0.210 | 1,783 |
| | (0.731) | (0.591) | (0.749) | (0.595) | |
| Specific capital account restrictions (Schindler, 2009) | 0.222 | −0.083 | 0.660 | 0.416 | 1,783 |
| | (0.397) | (0.410) | (0.420) | (0.330) | |
| Financial controls (Ostry and others, 2011) | 0.239 | −0.401 | 0.553 | 0.417 | 1,210 |
| | (0.761) | (0.428) | (0.611) | (0.619) | |
| Forex regulations (Ostry and others, 2011) | −0.480 | 0.118 | 0.886 | 0.493 | 1,240 |
| | (0.499) | (0.571) | (0.614) | (0.632) | |
| *B. Equity-led epsidoes* | | | | | |
| Capital controls (Chinn and Ito, 2008) | 0.021 | 0.013 | −0.008 | 0.090 | 3,446 |
| | (0.159) | (0.119) | (0.119) | (0.119) | |
| Financial integration (Lane and Milesi-Ferretti, 2007) | 0.001 | −0.094 | 0.086** | −0.143 | 3,446 |
| | (0.098) | (0.064) | (0.043) | (0.074) | |
| Overall capital account restrictions (Schindler, 2009) | 0.060 | 1.201 | −0.700 | 1.834 | 1,783 |
| | (0.725) | (1.205) | (0.715) | (1.151) | |
| Specific capital account restrictions (Schindler, 2009) | 0.170 | 0.495 | −1.076** | 0.575 | 1,783 |
| | (0.647) | (0.640) | (0.486) | (0.672) | |
| Financial controls (Ostry and others, 2011) | 0.057 | 0.159 | −0.680 | 0.884 | 1,210 |
| | (1.086) | (1.110) | (1.042) | (0.921) | |
| Forex regulations (Ostry and others, 2011) | −1.280 | −0.518 | −0.046 | −0.363 | 1,240 |
| | (1.142) | (0.799) | (1.263) | (0.803) | |

Source: Authors' elaboration.

* Statistically significant at the 10 percent level.

** Statistically significant at the 5 percent level.

a. The table reports the coefficients on capital controls when the base regressions reported in tables 2 and 3 are estimated using one of the alternative measures listed in the table. All measures of capital controls have higher values if the country has greater capital controls, except the financial integration measure (Lane and Milesi-Ferretti, 2007), which takes on a higher value if the country is more financially integrated. See tables 2 or 3 for information on the estimation technique and additional variables included in the regressions.

episodes. Among the country-level variables, growth shocks are most important: debt-led stops are more likely in countries experiencing a negative growth shock, and debt-led surges are more likely in countries with a positive growth shock. Capital controls are not significantly related to debt-led episodes, as also found in Forbes and Warnock (2012) for episodes based on overall capital flows. In contrast to debt-led episodes, equity-led episodes appear to be idiosyncratic, bearing little systematic relation to our explanatory variables. Notably, even the risk measures that were highlighted in Forbes and Warnock (2012) have little or no significant relationship with equity-led episodes.

Our results indicate that the majority of episodes are debt led and that debt-led episodes are associated with factors that are in line with theory and past work. Much more work is needed, however, to understand the nature of extreme capital flow episodes, especially episodes caused by sharp changes in capital outflows (flight and retrenchments).

Appendix

## List of Equity- and Debt-Led Episodes by Country, 1985 to 2009

### Table A1. Equity-Led Episodes by Country, 1985 to 2009

| | *Type of episode* | | | |
|---|---|---|---|---|
| *Country* | *Surge* | *Stop* | *Flight* | *Retrenchment* |
| Argentina | — | — | — | 1992:4–1993:2 |
| Australia | 1993:4–1994:3; 2006:2–2007:1 | 2005:1–2005:4 | 2006:2–2007:1 | 2005:1–2005:4 |
| Austria | 2005:1–2005:4 | 2006:1–2006:4 | 2005:1–2005:4 | 2006:1–2006:4 |
| Bangladesh | 1998:1–1998:3 | — | 1995:3–1997:1 | — |
| BelLux | 1999:3–2000:3 | 1994:1–1995:1; 2001:4–2002:3 | 1999:3–2000:3; 2005:2–2006:1 | 1994:1–1995:1; 2001:4–2002:3 |
| Bolivia | 1996:1–1996:3 | — | 2001:1–2001:2; 2003:3–2004:1 | 2004:3–2005:1 |
| Brazil | 1988:1–1988:4 | 1995:1–1995:2 | 1987:4–1988:3 | 1997:4–1998:2 |
| Canada | 2000:1–2001:1; 2006:2–2007:1 | 1991:2–1991:3; 2008:4–2009:2 | 2000:1–2001:1; 2006:2–2007:1 | 2008:4–2009:3 |
| Chile | 2005:4–2006:3 | 2000:2–2001:1; 2007:1–2007:2 | 2007:2–2008:1 | 1997:2–1997:3; 2000:2–2000:4 |
| Colombia | 2005:4–2006:3 | — | 2006:2–2006:3 | — |
| Croatia | — | — | 2000:1–2000:4; 2006:4–2007:3 | — |
| Czech Republic | 2002:3–2003:1 | 2003:2–2004:1; 2006:2–2006:4 | — | 2002:1–2002:3 |
| Denmark | 1993:3–1994:2; 1995:3–1996:2 | 1998:3–1999:1; 2008:4–2009:4 | 1993:3–1994:2 | 2001:2–2002:2; 2008:3–2009:4 |
| Estonia | — | — | — | 2000:1–2000:2 |
| Finland | 1998:4–1999:1 | 2009:2–2009:3 | 1998:4–1999:1 | 2009:1–2009:3 |
| Germany | — | — | — | 1990:4–1992:2 |
| Guatemala | — | 1994:4–1995:3 | 1998:2–1998:3; 1999:1–1999:4; 2001:1–2001:3 | 1988:3–1988:4; 1989:2–1990:1; 2002:2–2002:3 |
| Hungary | 2007:2–2008:1 | 2009:3–2009:4 | 2001:2–2002:1; 2006:1–2008:1 | 2009:3–2009:4 |
| Indonesia | — | 1997:4–1998:3; 2006:4–2007:1; 2009:1–2009:3 | 2002:3–2003:2; 2004:1–2005:1; 2005:3–2006:2 | 1997:2–1998:3; 2006:3–2007:1 |
| Ireland | 2003:3–2004:2 | 2001:2–2001:3 | 1997:4–1998:4; 2006:3–2007:2 | — |

**Table A1. (continued)**

| | Type of episode | | | |
|---|---|---|---|---|
| *Country* | *Surge* | *Stop* | *Flight* | *Retrenchment* |
| Israel | 1999:2–2000:1; 2006:1–2006:4 | 1998:3–1998:4; 2001:2–2002:2; 2007:3–2007:4 | 1998:1–1998:4; 2006:1–2006:4 | 1995:2–1995:3; 2001:2–2002:2; 2007:3–2009:2 |
| Japan | — | 2006:3–2007:1 | — | 1987:4–1988:3 |
| Korea | — | — | — | 2005:1–2005:3 |
| Malaysia | — | — | 2006:2–2007:4 | — |
| Mexico | — | — | 2001:3–2002:2 | 1991:3–1991:4 |
| Netherlands | — | 2001:2–2001:3; 2002:1–2002:4 | 2005:2–2006:2 | 2001:2–2001:3; 2002:1–2002:4 |
| New Zealand | 2000:2—2001:1 | — | 2000:2–2001:1 | — |
| Nicaragua | — | — | — | 2002:4–2003:2 |
| Norway | — | — | 1994:3–1995:3 | 1987:4–1988:4; 1992:2–1994:1; 1999:2–1999:3; 2001:4–2002:3 |
| Peru | — | 1998:1–1998:2 | 2003:2–2004:1 | — |
| Philippines | 1994:2–1994:3; 1996:1–1997:1; 2005:2–2005:4 | 1997:3–1998:4 | 1991:4–1994:2; 1999:1–1999:2; 2007:1–2007:2 | 1997:3–1998:2 |
| Poland | — | 2001:4–2002:3 | 2004:2–2005:1 | 2002:3–2003:2 |
| Portugal | 2003:4–2004:2 | 1999:3–1999:4 | 1990:2–1991:2; 2003:3–2004:1 | 1989:4–1990:1 |
| Romania | — | 1999:4–2000:1 | 2003:4–2004:1; 2006:4–2007:2 | — |
| Russia | — | 2006:2–2006:3 | — | — |
| Slovenia | 2002:3–2003:3 | 2003:4–2004:2; 2008:3–2009:3 | 1998:3–1999:2 | — |
| South Africa | 1997:2–1998:1; 2003:4–2004:4; 2005:2–2006:2 | 2007:1–2007:2; 2008:3–2009:3 | 1995:3–1996:2; 1997:2–1998:2; 2003:4–2004:3; 2006:1–2006:4 | 1999:1–1999:2; 2000:3–2001:1 |
| Spain | — | 1994:2–1995:1 | — | — |
| Sri Lanka | 2000:1–2000:4 | 1994:2–1994:3; 1995:4–1996:1; 1998:3–1999:1; 2001:2–2002:1 | 1995:1–1995:3 | 1993:2–1994:3; 1998:4–1999:1; 2001:4–2002:3 |

**Table A1. (continued)**

| | *Type of episode* | | | |
|---|---|---|---|---|
| *Country* | *Surge* | *Stop* | *Flight* | *Retrenchment* |
| Sweden | — | — | — | 2001:1–2002:3 |
| Taiwan | 1999:2–2000:2; 2003:3–2004:2 | — | 2000:1–2000:4; 2003:3–2004:1 | 2008:2–2009:2 |
| Thailand | — | 2008:3–2009:3 | — | 1986:4–1988:4; 2008:1–2009:3 |
| Turkey | — | — | 2006:4–2007:3 | — |
| United States | — | 1988:3–1988:4; 2001:3–2002:2 | — | 2001:3–2002:2 |
| Venezuela | 2003:4–2004:1 | — | — | — |

Source: Authors' elaboration.

## Table A2. Debt-Led Episodes by Country, 1985 to 2009

| | *Type of episode* | | | |
|---|---|---|---|---|
| *Country* | *Surge* | *Stop* | *Flight* | *Retrenchment* |
| Argentina | 1990:4–1992:3; 2003:1–2003:4 | 1989:2–1990:3; 1994:4–1995:1; 1998:4–1999:3; 2000:4–2002:2; 2008:2–2009:3 | 1989:3–1990:1; 1991:2–1992:3; 2002:4–2003:1; 2006:3–2008:3 | 1988:3–1989:1; 1998:3–1999:2; 2009:2–2009:4 |
| Australia | 1995:3–1996:3; 2002:3–2002:4; 2003:4–2004:3 | 1989:3–1991:3; 1997:3–1998:1; 1998:3–1998:4 | 1995:4–1996:3; 2004:1–2004:3 | 1989:2–1991:1; 1994:4–1995:2; 2003:1–2003:3 |
| Austria | 1992:2–1993:1; 1999:2–2000:1 | 1996:4–1997:1; 1998:2–1998:3; 2001:1–2002:1; 2008:3–2009:3 | 1992:2–1993:1; 1997:2–1998:1; 1999:2–2000:1 | 1986:1–1986:2; 1993:3–1993:4; 1998:2–1998:3; 2001:2–2002:1; 2008:4–2009:4 |
| Bangladesh | 1989:1–1989:4; 2003:4–2004:1; 2005:1–2005:2 | 1991:3–1992:1; 2006:1–2006:2 | 1987:1–1987:3; 1988:2–1989:3; 2005:4–2006:3; 2008:2–2008:4 | 1992:2–1993:1; 2001:1–2001:4; 2009:3–2009:4 |
| BelLux | 1987:1–1987:4 | 1988:2–1989:1; 2008:2–2009:3 | 1987:1–1987:4 | 1988:2–1989:1; 2008:2–2009:3 |
| Bolivia | 2007:3–2008:4 | 1995:1–1995:2; 1999:2–2001:2; 2006:3–2007:2 | 1994:1–1994:4; 2008:4–2009:3 | 2006:2–2006:3 |
| Brazil | 1990:2–1991:1; 1994:1–1994:3; 1995:4–1996:2; 2006:3–2007:4 | 1993:1–1993:3; 1999:1–1999:2; 2008:2–2009:3 | 1994:2–1994:4; 1998:3–1999:2; 2006:4–2007:3 | 1992:1–1992:4; 1995:2–1996:1; 2008:2–2008:3 |
| Canada | 1996:4–1997:3; | 1995:2–1996:1; 1999:1–1999:4; | 1986:2–1986:4; 1994:2–1994:4; 1996:3–1997:2 | 1993:2-1993:3; 1995:2–1996:1; 1998:1–1998:3 |
| Chile | 2007:4–2008:3 | 2009:1–2009:3 | 1998:2–1999:4; 2006:1–2006:4 | 2008:3–2009:3 |
| Colombia | — | 2008:2–2009:1 | — | 2002:2–2003:1; 2007:2–2007:3 |
| Croatia | 2002:4–2003:4 | 2004:4–2005:3 | 2002:4–2003:1 | 2001:3–2002:1; 2004:4–2005:4 |
| Czech Republic | — | 2008:4–2009:3 | 2003:3–2005:1 | 2000:1–2000:4; 2008:4–2009:4 |
| Denmark | 2005:1–2005:4 | 1989:2–1989:4; 1991:4–1993:2; 1994:3–1995:1 | 2005:2–2005:4 | 1992:2–1993:2; 1994:3–1995:1 |
| Estonia | 2003:1–2005:1 | 1998:3–1999:3; 2008:2–2009:4 | 2001:1–2001:2; 2004:2–2005:3 | 1998:4–1999:1; 2008:2–2009:3 |

**Table A2. (continued)**

| | Type of episode | | | |
|---|---|---|---|---|
| *Country* | *Surge* | *Stop* | *Flight* | *Retrenchment* |
| Finland | 1987:1–1987:4; 1996:3–1997:3; 2004:3–2004:4; 2006:2–2007:1 | 1991:1–1992:2; 2001:1–2001:4 | 1986:3–1987:1; 1988:3–1989:1; 1993:1–1993:3; 2004:3–2005:1; 2006:2–2006:4 | 1987:3–1987:4; 1990:3–1990:4; 1992:1–1992:3; 2001:1–2001:4 |
| France | 1986:3–1987:4; 1997:4–1998:3; 2001:1–2001:2; | 1991:1–1992:1; 2001:4–2002:3; 2008:1–2009:3 | 1986:4–1987:4; 1992:3–1992:4; 1997:4–1998:3; 2001:1–2001:2 | 1991:2–1992:1; 2001:4–2002:3; 2008:1–2009:3 |
| Germany | 1986:1–1986:4; 1989:2–1990:1; 1992:3–1993:2; 2005:1–2005:4; 2007:2–2008:1 | 1987:4–1988:3; 1994:1–1994:4; 2001:1–2002:2; 2008:3–2009:3 | 1986:1–1986:4; 1993:1–1993:4; 2004:3–2005:4 | 1987:3–1988:2; 1994:2–1994:4; 2000:4–2002:2; 2008:2–2009:3 |
| Greece | 2005:1–2005:4 | 2006:1–2006:4; 2009:2–2009:4 | 2005:1–2005:3 | 2006:1–2006:4 |
| Guatemala | 1987:4–1988:1; 2006:1–2006:4 | 2008:4–2009:3 | 1990:3–1991:2; 2004:1–2004:4 | 1991:3–1992:1; 2008:4–2009:3 |
| Hong Kong | — | 2008:3–2009:3 | — | 2008:3–2009:3 |
| Hungary | 2003:1–2003:4; 2004:2–2005:3 | 1996:4–1997:1; 2002:2–2002:3; | — | — |
| Iceland | 1987:1–1987:4; 1995:4–1996:4; 2003:3–2006:1 | 1989:2–1990:1; 2001:2–2002:1; 2008:2–2009:3 | 1986:3–1987:2; 1993:2–1993:3; 1997:3–1998:2; 1999:1–1999:4; 2003:1–2006:1 | 1992:1–1992:3; 2001:3–2002:2; 2006:4–2007:1; 2008:1–2009:2 |
| India | 1993:4–1994:4; 1996:2–1997:1; 2003:3–2004:2; 2004:4–2005:3; 2006:4–2008:1 | 1989:4–1990:4; 1991:3–1992:1; 1998:2–1998:3; 2008:3–2009:3 | 1990:3–1991:2; 1995:4–1996:4; 2000:4–2001:3; 2004:1–2004:3; 2008:4–2009:2 | 1992:1–1992:4; 1999:2–2000:2; 2002:1–2002:4; 2007:4–2008:2 |
| Indonesia | 1990:3–1991:2; 1995:2–1996:3; 2005:4–2006:1 | 1993:2–1993:3 | 1993:3–1994:3 | 2003:3–2003:4 |
| Ireland | 1989:3–1990:2; 1992:4–1993:4; 1995:3–1996:3; 1997:4–1999:1; 2006:3–2007:3 | 1991:3–1992:2; 2008:2–2009:3; | 1987:2–1988:1; 1989:3–1990:1; 1992:3–1993:1; 1995:4–1996:3; 2003:3–2004:2 | 1991:4–1992:2; 2000:4–2001:3; 2008:2–2009:3 |
| Israel | 1986:3–1987:1; 1989:4–1990:3 | 1988:3–1989:2; 1996:3–1996:4; 2008:4–2009:2 | 1986:2–1987:1; 1992:1–1992:3 | 1991:1–1991:3; 1993:3–1993:4 |

**Table A2. (continued)**

| | *Type of episode* | | | |
|---|---|---|---|---|
| *Country* | *Surge* | *Stop* | *Flight* | *Retrenchment* |
| Italy | 1987:1–1987:3; 1996:1–1997:1; 2003:1–2003:4; 2005:2–2006:1 | 1991:4–1992:2; 1992:4–1993:3; 1999:1–1999:2; 2000:4–2002:3; 2007:3–2008:4 | 1987:1–1987:3; 2003:1–2003:4; 2005:1–2005:4 | 1986:1–1986:2; 1993:1–1993:3; 2000:3–2002:3; 2007:3–2008:4 |
| Japan | 1986:2–1987:3; 1993:4–1995:1; 2000:2–2001:1 | 1990:4–1991:4; 1992:2–1993:1; 1998:1–1999:1; 2005:2–2005:3; 2008:3–2009:3 | 1986:1–1987:2; 1993:4–1994:4; 2000:2–2001:1 | 1990:3–1991:3; 1996:3–1996:4; 1998:2–1999:4; 2008:3–2009:3 |
| Korea | 1994:3–1995:4 | 1997:2–1998:3; 2008:1–2009:2 | 1994:2–1995:4; 2002:4–2003:3; 2006:1–2007:4 | 1997:3–1999:1; 2008:3–2009:3 |
| Latvia | 2003:3–2005:1; 2006:2–2007:4 | 2005:3–2005:4; 2008:3–2009:3 | 2006:3–2007:4 | 2005:3–2006:1; 2008:3–2009:2 |
| Lithuania | 2004:2–2004:3; 2005:4–2006:2; 2006:4–2008:1 | 2000:4–2001:2; 2008:3–2009:4 | 2004:1–2004:4 | 2001:2–2001:3; 2008:3–2009:3 |
| Malaysia | — | 2005:4–2006:3; 2008:3–2009:2 | — | 2008:3–2009:2 |
| Mexico | 1989:2–1991:2; 2007:3–2008:2 | 1994:4–1995:4; 2008:4–2009:3 | 1987:3–1988:2; 1990:1–1990:4; 1993:2–1994:1 | 1992:2–1993:1; 1997:3–1997:4; 2008:4–2009:3 |
| Netherlands | 1995:3–1996:2; 1997:4–1998:4; 2005:2–2006:2 | 1990:4–1991:4; 2008:1–2009:3 | 1986:2–1987:1; 1997:4–1998:4 | 1990:4–1992:1; 2008:1–2009:3 |
| New Zealand | 1986:3–1987:2; 2006:3–2007:3 | 1987:4–1988:3; 2008:2–2009:3 | 1986:4–1987:2; 1989:2–1990:2; 2006:3–2007:3 | 1986:1–1986:2; 1988:1–1989:1; 2005:3–2006:1 |
| Nicaragua | — | 2000:3–2001:2 | 2001:1–2001:2; 2001:4–2002:1 | 1998:1–1998:4 |
| Norway | 1992:4–1993:2; 2000:3–2000:4; 2002:4–2003:2; 2005:4–2007:1 | 1988:3–1989:2; 1991:3–1992:2; 1997:4–1998:1; 2001:3–2002:1; 2007:4–2008:4; 2009:2–2009:4 | 1986:3–1987:3; 2000:2–2001:2; 2005:4–2007:1 | 2007:4–2008:3; 2009:2–2009:4 |
| Panama | — | 2008:4–2009:3 | — | 2008:4–2009:3 |
| Peru | 2006:4–2008:2 | 1998:4–1999:3; 2005:4–2006:1; 2008:4–2009:3 | 2001:1–2001:2; 2005:4–2006:3; 2009:2–2009:4 | 2007:1–2007:2; 2007:4–2008:3 |
| Philippines | 2007:1–2007:3 | 1992:1–1992:2; 2008:1–2009:1 | — | 2008:1–2008:4 |

**Table A2. (continued)**

| | *Type of episode* | | | |
|---|---|---|---|---|
| *Country* | *Surge* | *Stop* | *Flight* | *Retrenchment* |
| Poland | 2003:4–2004:4; 2007:1–2008:2 | 2008:4–2009:3 | — | 2008:3–2009:3 |
| Portugal | 1987:3–1988:2; 1988:4–1990:2; 1994:3–1995:3; 2000:1–2000:4; 2006:1–2006:2 | 1992:3–1993:2; 1996:2–1996:3; 2002:4–2003:1; 2004:4–2005:2; 2008:3–2009:2 | 1993:1–1993:4 | 1987:4–1988:1; 1992:1–1992:2; 1996:1–1996:3; 2002:4–2003:1; 2004:3–2005:2 |
| Romania | 2000:4–2001:2; 2004:1–2005:3; 2006:4–2007:4 | 2008:3–2009:4 | 2004:4–2005:3 | 2007:4–2008:2 |
| Russia | 2003:2–2004:1; 2007:1–2008:1 | 2008:4–2009:3 | 2003:2–2004:2; 2007:2–2009:1 | 2001:3–2002:2 2009:3–2009:4 |
| Slovak Republic | 2004:3–2005:2 | 2006:1–2006:4 | 2008:2–2008:3; 2009:1–2009:4 | 1999:1–1999:2; 2007:2–2007:3 |
| Slovenia | 2007:1–2007:4 | — | 2002:4–2003:3; 2007:1–2007:4 | 2008:1–2009:3 |
| South Africa | 1987:1–1987:4 | 1990:2–1990:4; 1998:3–1999:2; 2000:3–2001:1 | 1991:2–1993:1 | 1987:4–1988:2 |
| Spain | 1987:1–1988:2; 1990:4–1991:3 | 1992:1–1992:2; 2001:3–2002:2; 2008:1–2009:4 | 1988:2–1989:1; 1990:1–1991:2; 1992:3–1993:4 | 1987:1–1987:3; 1991:4–1992:1; 1994:2–1995:1; 2001:3–2002:2; 2007:3–2009:3 |
| Sri Lanka | 1989:4–1990:3 | 2008:1–2008:2 | 1990:3–1991:2; 2007:3–2008:1; 2009:1–2009:3 | 1990:1–1990:2 |
| Sweden | 1989:2–1990:4; 2004:4–2005:3 | 1991:2–1992:2; 1997:1–1997:3; 2001:4–2002:3; 2008:4–2009:3 | 1986:3–1988:1; 1988:4–1990:3; 1995:3–1996:3 | 1991:1–1992:1; 1997:1–1997:3; 2008:1–2009:3 |
| Switzerland | 2005:3–2006:2 | 2008:1–2009:1 | 2005:3–2006:1 | 2008:1–2009:1 |
| Taiwan | — | 1995:3–1995:4; 1997:4–1998:3; 2001:1–2001:2; 2005:1–2005:2; 2008:4–2009:2 | 1996:1–1996:3 | 1997:1–1997:4; 2002:2–2002:3 |
| Thailand | 1987:4–1990:3; 1995:2–1996:1; 2004:3–2006:1 | 1992:1–1992:4; 1996:3–1998:2; 2007:1–2007:4 | 1989:3–1990:2; 1993:2–1994:2; 2005:1–2006:1 | 1991:2–1991:4; 1994:4–1995:1; 1996:3–1997:2 |

**Table A2. (continued)**

| | *Type of episode* | | | |
|---|---|---|---|---|
| *Country* | *Surge* | *Stop* | *Flight* | *Retrenchment* |
| Turkey | 1990:1–1990:4; 1992:3–1993:4; 2000:1–2000:3 | 1991:3–1991:4; 1994:2–1995:1; 2001:1–2001:4; 2007:4–2008:2; 2008:4–2009:4 | 1991:1–1991:2; 1995:4–1996:3 | 1994:3–1995:3; 2007:4–2008:2; 2009:2–2009:4 |
| United Kingdom | 1992:3–1993:4 | 1990:1–1990:3; 1991:3–1992:1; 1994:2–1994:4; 1998:1–1998:4; 2001:3–2002:2; 2008:2–2009:2 | 1992:4–1993:2; 2000:3–2000:4; | 1991:3–1992:2; 1998:1–1998:4; 2001:3–2002:2; 2008:2–2009:2 |
| United States | 1992:3–1992:4; 1993:3–1994:3; 1999:4–2000:3; 2006:4–2007:2 | 1989:4–1990:4; 1998:1–1999:1; 2007:4–2009:2 | 1986:2–1986:4; 1993:3–1994:2; 2004:1–2004:4; 2006:4–2007:3 | 1990:3–1990:4; 1998:1–1998:4; 2008:1–2009:2 |
| Venezuela | 2005:2–2005:4; 2007:2–2008:1 | 2006:2–2006:4 | 2005:2–2006:2 | 2001:1–2001:4; 2006:4–2007:1; 2008:4–2009:3 |

Source: Authors' elaboration.

## References


Abbas, A., N. Belhocine, A. ElGanainy, and M. Horton. 2010. "A Historical Public Debt Database." Working Paper 245. Washington: International Monetary Fund.

Beck, T. and A. Demirgüç-Kunt. 2009. "Financial Institutions and Markets across Countries and over Time: Data and Analysis." Policy Research Working Paper 4943. Washington: World Bank.

Calvo, G., A. Izquierdo, and L.F. Mejía. 2004. "On the Empirics of Sudden Stops: The Relevance of Balance-Sheet Effects." Working Paper 10520. Cambridge, Mass.: National Bureau of Economic Research.

Chinn, M. and H. Ito. 2008. "A New Measure of Financial Openness." *Journal of Comparative Policy Analysis* 10(3): 309–22.

Cowan, K. and J. De Gregorio. 2007. "International Borrowing, Capital Controls and the Exchange Rate: Lessons from Chile." In *Capital Controls and Capital Flows in Emerging Economies: Policies, Practices and Consequences*, edited by S. Edwards. University of Chicago Press for National Bureau of Economic Research.

Cowan, K., J. De Gregorio, A. Micco, and C. Neilson. 2008. "Financial Diversification, Sudden Stops and Sudden Starts." In *Current Account and External Finance*, edited by K. Cowan, S. Edwards and, R. Valdés. Santiago: Central Bank of Chile.

Faucette, J.E., A.D. Rothenberg, and F.E. Warnock 2005. "Outflows-Induced Sudden Stops." *Journal of Policy Reform* 8(2): 119–30.

Forbes, K. and F.E. Warnock. 2012. "Capital Flow Waves: Surges, Stops, Flight and Retrenchment." *Journal of International Economics* 88(2): 235–51.

Gourinchas, P.-O., R. Valdés, and O. Landerretche. 2001. "Lending Booms: Latin America and the World." *Economia* 1(2): 47–99.

Lane, P. and G.M. Milesi-Ferretti. 2007. "The External Wealth of Nations Mark II: Revised and Extended Estimates of Foreign Assets and Liabilities, 1970–2004." *Journal of International Economics* 73(2): 223–50.

McGuire, P. and N. Tarashev. 2006. "Tracking International Bank Flows." *BIS Quarterly Review* (December): 27–40.

————. 2007. "International Banking with the Euro." *BIS Quarterly Review* (December): 47–62.

Mendoza, E. and M. Terrones. 2008. "An Anatomy of Credit Booms: Evidence from Macro Aggregates and Micro Data." Working Paper 14049. Cambridge, Mass.: National Bureau of Economic Research.

Misina, M. 2003. "What Does the Risk-Appetite Index Measure?" Working Papers 03–23. Ottawa: Bank of Canada.

Ostry, J., A. Ghosh, M. Chamon, and M. Qureshi. 2011. "Managing Capital Inflows: The Role of Controls and Prudential Policies." Washington: International Monetary Fund.

Reinhart, C. and V. Reinhart. 2009. "Capital Flow Bonanzas: An Encompassing View of the Past and Present." In *NBER International Seminar in Macroeconomics 2008*, edited by J. Frankel and F. Giavazzi. University of Chicago Press for National Bureau of Economic Research.

Rothenberg, A. and F.E. Warnock. 2011. "Sudden Flight and True Sudden Stops." *Review of International Economics* 19(3): 509–24.

Schindler, M. 2009. "Measuring Financial Integration: A New Data Set." *IMF Staff Papers* 56(1): 222–38.

Wilmot, J., P. Mielczarski, and J. Sweeney. 2004. "Global Risk Appetite Index." *Global Strategy Research: Market Focus* (February). Credit Suisse First Boston.

Zhou, H. 2010. "Variance Risk Premia, Asset Predictability Puzzles and Macroeconomic Uncertainty." Finance and Economics Discussion Working Paper 2010–14. Washington: Federal Reserve Board.

# Capital Mobility and Monetary Policy

With this volume, the Central Bank of Chile series solidifies its status as the go-to source for state-of-the-art research on exchange rates, capital flows, and the cross-border repercussions of national monetary policy makers. For aspiring and committed researchers alike, there is no better place to start.

*Barry Eichengreen, George C. Pardee and Helen N. Pardee Professor of Economics and Political Science, University of California at Berkeley*

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*Guillermo Calvo, Professor of Economics, International and Public Affairs, Columbia University*

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*Michael Devereux, Professor of Economics, University of British Columbia*

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