

The Role of External Shocks in Emerging Market Crises

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Abstract

This dissertation attempts in three essays to contribute to the research on emerging market crises. A particular focus is set on problems associated with sudden stops of capital inflows, which appear to have been the cause of many recent emerging market crises. The main contributions to the existing literature are: (1) the empirical investigation of the effects of sudden stops and currency collapses using bank- and firm-level data, and (2) the development of micro-founded theoretical models which explain the transmission and amplification of unexpected external shocks in emerging market economies in an open economy framework.

The first essay investigates in a cross-country study how domestic bank credits are affected during sudden stops. A particular focus is set on the asymmetric effects across individual banks. In the empirical investigation of 14 recent sudden stops that occurred in 11 Latin American and Asian countries, we find that sudden stops are associated with reductions in the domestic lending volume in the order of 10-15% of GDP. The magnitude of this decline depends on the structure of the domestic banking sector, especially, on the degree of bank capitalization and foreign bank participation.

The second essay investigates the channel between currency depreciations, liability dollarization, and income distributions. In the empirical investigation on recent currency collapses in Argentina, Brazil, and Mexico, we find that income and wealth transfers from borrowing firms to lenders increased substantially with the currency depreciations, especially in Argentina. Moreover, the currency depreciations had asymmetric effects on firms. Most affected were non-exporting firms with high fractions of foreign-currency denominated liabilities. The distributive issues of currency depreciations are further analyzed within a partial equilibrium model of firms with varying income and debt structures.

Finally, the third essay develops a two-sector general equilibrium model of a small open economy to explore the transmission mechanisms of external financial shocks. We set up a cash-in-advance model with limited participation augmented with financial frictions in the form of a 'fundamentals-related' risk premium on external funds. The friction amplifies the economic effects of external financial shocks, especially, when the economy

is highly indebted in foreign currency. For a set of Latin American economies, the theoretical model is calibrated to match the empirical impulse responses of output, investment, trade balance, and domestic credits in response to a shock to the country risk premium.

The dissertation is organized as follows. In Chapter 1, we present a survey of the existing literature on sudden stops and embed the three essays of this dissertation in the literature on EM crises (Section 1.6). The three essays are presented in Chapters 2 to 4.

Chapter 1

Lessons from sudden stops

1.1 Introduction

In the process of globalization, emerging market (EM) economies get increasingly integrated with the international economic and financial system. Global players ranging from non-financial firms, banks, to investment funds have increased substantially their activities in EMs throughout the last century to participate in their growth potential and to open up the underdeveloped markets. In many EM economies, foreign-owned enterprises and banks have become the largest players in the host countries promoting economic growth and stability. To grow faster than in financial autarky, EM economies can borrow external funds on international capital markets to finance investment and increase economic growth. The underlying risk in this process is that borrowers systematically underestimate certain risks, accumulate too much external debt, and rely on dangerous forms of borrowing. Such structural weaknesses make EM economies vulnerable to external shocks and are often the source of EM crises. An important and repeatedly observed concomitant of the globalization process is the Sudden Stop phenomenon, advanced by Calvo (1998b), which is seen as the triggering factor of the recurrent currency and financial crises that occurred in Latin America and Asia throughout the 1990s and the early 2000s.

In a sudden stop, an economy that has been the recipient of foreign capital inflows, all of a sudden, stops receiving them, and instead faces withdrawals of investments and the inability to roll over the part of external debt that is falling due. Such unexpected and massive reductions in the supply of foreign capital are the result of an overreaction on financial markets. In many cases, the capital flight appears to be the result of increased investors' uncertainty about the credit worthiness of the balance sheet of the particular economy, and its exchange rate. The incertitude may originate from questions about either the balance sheet, or the exchange rate, but when there is a question about one, the

implied capital flight makes it a question about both (Dornbusch (2001)). To the extent that there are limitations in the domestic supply of capital, sudden stops spread out to the whole economy. More precisely, when individuals perceive the risk of an upcoming crisis, they lower their demand for assets denominated in domestic currency and try to convert foreign-currency into domestic-currency denominated liabilities (Calvo (1998b)). As a result, the initial shock is amplified by a drop in domestic asset prices. When the domestic banking sector is subject to important capital withdrawals, a sudden stop can trigger a banking crisis and have damaging effects on investment and growth. When the capital withdrawals are large relative to international reserves, a sudden stop can trigger a currency collapse. When, in addition, the economy is highly indebted in foreign currency, a sudden stop can result in a debt crisis. Both the size of the sudden stop and its economic effects depend ultimately on factors such as an economy's trade openness, the structure of its balance sheet, and the confidence in domestic policy (Calvo, Izquierdo, and Mejia (2004), Calvo, Izquierdo, and Talvi (2006), and Mendoza (2006b)).

Sudden stops are not a new phenomenon. As Bordo (2006) points out, the recent episodes of sudden stops are similar to a series of crises during the late 19th century in which several emerging countries were affected by massive declines in capital flows from the countries of Western Europe. A series of currency, banking, and debt crises occurred during that time. The pattern of these episodes is similar: There is too much credit in the run up to the crisis and too little once the crisis hits (Taussig (1928) and Dornbusch (2001)). International contagion seems to be an important source of sudden stops. In several papers, Calvo argues that Systemic Sudden Stops originating in global capital markets are a key determinant of the financial and economic turbulence in EM economies (Calvo (1998a), Calvo, Izquierdo, and Mejia (2004), and Calvo and Talvi (2005)). International contagion has been at play during the Tequila crisis of 1994-95, the Asian crisis of 1997, the Russian crises of 1998, and the Argentine crisis of 2001-02. In each case, the contagion had different origins (Sachs, Tornell, and Velasco (1996), Baig and Goldfajn (1999), Baig and Goldfajn (2000), and Calvo and Talvi (2005)). For instance, common creditor linkages coupled with increased risk aversion on global capital markets appear to have triggered a general cutback in lending to EM economies following the Russian crisis. In many EM economies, the external shock and its amplification led to important current account reversals, currency collapses, and contractions in GDP, investment, and domestic credits.

Ultimately, EM economies must be prepared for such situations of market turbulence, since they constitute a recurrent phenomenon of the globalization process. The solution is to design domestic and global policies that minimize the likelihood that initially small shocks culminate in sudden stops and full-blown crises. And the key to the solution is the complete understanding of the origins and the dynamics of EM crises. In the following,

we present an overview of the existing literature on sudden stops.

This chapter is organized as follows. Potential sources of sudden stops are discussed in Section 1.2. In particular, we focus on domestic factors which make countries vulnerable to sudden stops and on different forms of international contagion. Moreover, we discuss recent systemic sudden stop episodes in EM economies and present the main empirical findings of the existing literature on the determinants of sudden stops. Section 1.3 discusses the macroeconomic effects of sudden stops and analyzes the causality between sudden stops, twin crises, and debt crises. The main results of the theoretical literature on sudden stops are summarized in Section 1.4. Domestic and global policy challenges are discussed in Section 1.5. In the final section, we embed the three essays of this dissertation in the existing literature and line out our contributions.

1.2 Sources of sudden stops

In the mid 1990s, a period of recurrent EM crises has been initiated ending, for the time being, with the Argentine crisis in 2001-02. In a recent paper, Calvo, Izquierdo, and Talvi (2006) point out that many of these crises had a systemic component, because a wide range of EM countries was hit by sudden stops at approximately the same time. This points to the fact that international contagion is at the heart of many sudden stops (Baig and Goldfajn (2000), Calvo (1998c), and Kaminski, Reinhart, and Vegh (2003)). The main theme of the sudden stop literature is that international contagion plays a key role in triggering sudden stops, but that a country's own structural weaknesses and policy mistakes create the underlying vulnerability. In the following, we describe the most important sources of sudden stops taking into account these two dimensions: (1) the structural weaknesses that make countries vulnerable to a sudden stop (internal factors); and (2) different forms of international contagion (external factors). Thereafter, we describe recent series of sudden stops in Latin America and Asia to highlight whether structural vulnerabilities and/or contagion have been at the center of the considered episodes. The sections from 1.2.1 to 1.2.3 draw largely on Roubini and Setser (2004), Chapter 2, and Fischer (2001).

1.2.1 Internal vulnerabilities

As noted, many sudden stops are the result of market overreactions in which international investors rush to withdraw their funds from a particular economy. The literature has fixed the following domestic vulnerabilities which appear to increase the likelihood of sudden stops. First, large and persistent macroeconomic imbalances, such as current account and

fiscal deficits, lead to the accumulation of large stocks of public and external debt. This increases an economy's debt burden and is likely to increase investors' uncertainty about the repayment capacity of that economy. Second, financing these deficits with short-term and foreign-currency debt makes the economy vulnerable to a liquidity run and increases the risk of a currency depreciation that triggers a debt crisis, because of the depreciation's balance sheet effect (Roubini and Setser (2004)). For instance, when an economy's level of international reserves is significantly smaller than its short-term obligations, a run on the economy's securities can result in a currency collapse or debt crisis. Investors are aware of such mechanisms and are likely to be more sensitive to bad news in economies that suffer from such balance sheet mismatches. Balance sheet mismatches can result for several reasons. Maturity mismatches often result from the fact that external lenders are not willing to borrow long-term funds to EM economies, and firms or banks in EMs tend to finance their longer-lasting investment projects by rolling over short-term funds. A borrower, who falsely expects a stable macroeconomic environment, may be unable to roll over his existing debt and be forced to liquidate ongoing investment projects. Currency mismatches in EM economies arise, because external creditors tend to prefer to lend in hard currencies (Eichengreen, Hausmann, and Panizza (2002) and Calvo, Izquierdo, and Mejia (2004)). In other cases, the domestic banking system is not willing to lend in local currency at reasonable prices (Honig (2005)), as was the case in Argentina prior to its crisis. Domestic banks transferred the currency risk to domestic firms which borrowed in dollars and had local-currency income. Since financial market participants know that such mismatches are a source of financial fragility, they are likely to be more sensitive to rumors in countries that are subject to such weaknesses. Third, doubt about the credibility of a government's commitment to take the policy steps that assure its long-term credit worthiness tends to increase investors' uncertainty and the likelihood of a liquidity run (Roubini and Setser (2004)). Fourth, fixed exchange rates increase the possibility that borrowers underestimate currency risk and rely on too much foreign-currency debt. Moral hazard considerations play an important role in this context. In the case of an exchange rate devaluation, firms may be unable to repay their loans and expect a bailout by the government. And finally, poor banking regulation, implicit or explicit government guarantees, and other microeconomic distortions can lead to excessive investment and overreliance on dangerous forms of borrowing. Particularly in Asia, the expectation of government guarantees seem to have encouraged domestic banks to take on excessive risks in the form of large stocks of external short-term credits (Roubini and Setser (2004)). Combined with poor regulation and supervision, this can result in important financial vulnerabilities of particular sectors. Countries that are subject to such structural weaknesses generally have little capacity to respond to adverse, temporary shocks by borrowing on international capital markets. On the contrary, the initial shock is likely to be amplified by adverse balance

sheet effects and the resulting capital flight (Roubini and Setser (2004)). Given these weaknesses, sudden stops can be triggered by both domestic or external shocks be it, for example, upcoming elections, weakening governments, deteriorations in terms of trade, interest rate changes in the world's major financial centers, or changes in the willingness of international investors to invest in EM assets.

1.2.2 International contagion

Having discussed the structural weaknesses which make EM economies vulnerable to sudden stops, we discuss in the following different forms of international contagion. First, trade linkages and pressures for competitive devaluations are potential sources of international contagion. More precisely, when a country devalues, its trading partner will lose competitiveness. In this case, investors may put pressure on the trading partner's currency, or policymakers in this country may decide to devalue to prevent losing the export market share (Roubini and Setser (2004)). The prospect of this can trigger massive capital flight from this country. Such pressures seem to have been present in Argentina following Brazil's currency devaluation of 1999, and in Asia following Thailand's currency devaluation of 1997. Second, the onset of a crisis in one country can highlight the risks of a certain financial vulnerability, a so-called 'wake-up call' (Roubini and Setser (2004)). When investors are sensitive to such news, they may decide to reduce their exposure to countries with similar financial vulnerabilities. Third, common creditor linkages are important sources of contagion. International investors typically have exposure to many different EM economies. Losses, or their prospects, in one country may lead the investor to sell other EM assets, in order to restore liquidity or to decrease the risk of his portfolio. This process can drive EM asset prices down and produce losses for all investors with similar positions triggering other rounds of sales. Such mechanisms were present in the aftermath of the Russian debt crisis, especially, in Latin America (Calvo and Talvi (2005) and Roubini and Setser (2004)). Finally, imperfect information about the state of an economy and herd behavior among investors are important factors of contagion (Calvo and Mendoza (2000) and Roubini and Setser (2004)). For instance, some investors may have inferior information than others and may not know whether some key investors are selling their EM assets, because of a margin constraint, or because of superior information about an upcoming crisis. Such information asymmetry can result in an amplifying process, if enough uninformed investors follow the actions taken by a particular group of investors. The prospect of this can trigger massive capital flight, since each investor will try to withdraw his funds before the others do (self-fulfilling prophecy).

1.2.3 Recent series of sudden stops

In this section, we analyze recent sudden stop episodes in which several countries have been affected at approximately the same time. Our main purpose is to clarify which domestic vulnerabilities and which form of international contagion can explain the spillovers to other countries. In particular, we consider four episodes of systemic sudden stops in Latin America and Asia. At the center of these episodes have been the crises in Mexico 1994-95, Thailand 1997, Russia 1998, and Argentina 2001-02. The Mexican, Thai, Russian, and Argentine crises are in some aspects similar. In Mexico, Thailand, and Argentina a persistent current account deficit combined with a pegged exchange rate increased over time investors' uncertainty about the credibility of the exchange rate arrangement (Fischer (2001) and Roubini and Setser (2004)). Neither in Mexico nor in Thailand there was a fiscal problem, although both governments were facing large costs during the crisis resolution (Roubini and Setser (2004)). In each case, particular sectors were subject to balance sheet mismatches and vulnerable to a liquidity run and currency depreciation. The associated crises spread out to a variety of EM economies in terms of exchange rate systems, capital controls, fiscal stance, growth performance, and balance sheet mismatches. In the following, we discuss the four episodes in more detail.

Lessons from 1995

In the case of Mexico, concerns about the exchange rate and a persistent current account deficit increased the possibility of a devaluation (Roubini and Setser (2004)). Moreover, the economy inherited important structural weaknesses in the form of currency mismatches on the private sector's balance sheet. In addition, Mexico faced increased country risk caused by a number of political shocks (Chiapas revolt and assassination of a presidential candidate) and an external shock in form of an increase in US interest rates (Roubini and Setser (2004)). The shocks seem to have triggered the increased unwillingness to invest in Mexican assets and resulted in an important decrease in the roll-over rate of outstanding debt. The final result was an important sudden stop and a current account reversal of 9% of GDP. Output, consumption, and investment fell by magnitudes that exceeded their business cycle standard deviations by a factor of three (Mendoza (2006b)). Because the devaluation was postponed by shortening and dollarizing debt (Tesobonos), the adverse balance sheet effects of the currency depreciation were large, especially, for the public sector. A bailout program was implemented for crisis resolution with important financial support from the United States (Roubini and Setser (2004)). The devaluation and depth of the Mexican crisis raised concerns about other EMs' exchange rate arrangements and financial stability triggering a short-lived reversal in capital flows to a particular group

of EM economies (Sachs, Tornell, and Velasco (1996)).¹ It seems that the contagion had elements of a wake-up call which increased the investors' unwillingness to invest in a set of countries with similar fundamentals and financial profiles. The lesson of this episode is that even if the long-term capacity to pay is sufficient to cover obligations, economies can get into serious solvency problems, if a critical mass of investors refuses to roll over short-term bonds (Mexico), or withdraws bank deposits (Argentina) (Calvo and Talvi (2005)).

Lessons from 1997

At the beginning, the Thai crisis looked similar to the Mexican crisis: Thailand was defending a pegged exchange rate in the face of a large current account deficit, increasing perceived country risk, and a vulnerable financial sector (Fischer (2001) and Roubini and Setser (2004)). Concerns about the sustainability of Thailand's exchange rate peg increased over time. Moreover, a large stock of short-term debt made Thailand vulnerable to a liquidity run. The resulting sudden stop was immense and appear to have triggered the abandonment of the exchange rate peg. The regional markets faced increasing pressure in the aftermath of the baht devaluation, and concerns about the exchange rate arrangements and financial stability raised in the neighboring countries. As the situation worsened, intense foreign exchange and stock market turmoil spread out in the entire region culminating in sudden stops and currency collapses in Malaysia, Indonesia, and Korea (Baig and Goldfajn (1999)).² Recurrent news of economic and political distress, particularly bank and corporate fragility, increased the uncertainty throughout the year 1998. Many of the currency collapses seem to have involved speculative attacks caused by contagion (Fischer (2001)). The discussion suggests that the contagion originated from devaluation pressures following the baht devaluation, and an across the board loss of confidence which seem to have been triggered by concerns about common financial vulnerabilities of regional private sectors (Baig and Goldfajn (1999)). The lesson of this episode is that crises can hit countries with high growth records, and that liquidity crises are not only possible in the case of bonded debt, but also in the case of foreign bank loans to the private sector (Calvo and Talvi (2005)).

¹Most affected have been Argentina and Brazil.

²The contagion hit, as in the case of Indonesia and Korea, economies with relatively small current account and fiscal deficits, however, with serious financial and corporate sector weaknesses in the form of a large stock of debt and important currency mismatches. The Asian crisis hit most Thailand, Indonesia and Korea, while the Philippines, Singapore, Taiwan and Hong Kong experienced minor recessions. Malaysia is the intermediate case.

Lessons from 1998

The Russian crisis involved doubts about the credibility of its exchange rate peg and concerns about solvency in light of important maturity and currency mismatches on the highly leveraged financial and public sectors' balance sheets (Roubini and Setser (2004)). As a result of the increasing concerns, Russia faced important capital flight at the beginning of 1998 culminating in the devaluation and the sovereign debt default (mainly on ruble-denominated treasury bills (GKOs)). Following the Russian crisis another round of capital flight from EM economies occurred, especially, in Latin America (Baig and Goldfajn (1999) and Calvo and Talvi (2005)). Sudden stops occurred in Argentina, Bolivia, Brazil, Chile, Colombia, Ecuador, and Peru.³ It seems that the contagion came through the common creditor channel whereby highly leveraged investors in EM economies (several EM hedge funds such as LTCM) suffered important losses from the Russian default. The subsequent liquidity crunch caused a general 'sell off of EM bonds across the board at fire sale prices to meet margin calls' (Calvo and Talvi (2005)). The refusal of the IMF to bailout the Russian government added to the overreaction on global capital markets. The lessons of this episode are that a country can experience a combined currency, banking, and sovereign debt crisis in the absence of a current account deficit (Roubini and Setser (2004)), and that highly leveraged EM hedge funds with unexpected losses from one market can transmit crises through the common creditor channel and trigger a run on EM securities (Calvo and Talvi (2005)).

Lessons from 2001-02

The Argentine crisis originated in 1998, when capital flows to EM economies slowed down, and it became increasingly difficult to finance the accumulated external debt, especially of the public sector (Calvo and Talvi (2005)). Moreover, the currency board resulted in an overvalued currency and important currency mismatches on the corporate and public sectors' balance sheets (Roubini and Setser (2004)). Given a largely dollarized economy, the deteriorated growth outlook put in question the solvency of the economy, and the prospect of a highly dangerous devaluation triggered massive capital flight in 2001. At the end of 2001, the government was forced to abandon the currency board and to impose capital controls and banking holidays. The Argentine crisis culminated in a payment suspension on parts of the outstanding external sovereign debt. The adverse balance sheet effects of the currency collapse affected principally the corporate sector, but also the banking sector experienced important distress by a combination of bank runs,

³The Brazilian crisis, for instance, was centered on a large stock of short-term debt which was in many cases dollar-linked. The devaluation prospects increased doubts about solvency and appear to have culminated in a sudden stop and a currency collapse.

increased loan defaults, and the asymmetric 'pesification' of loans and deposits (Barajas, Basco, Juan-Ramon, and Quarracino (2007)). Moreover, firms were not able to adjust their prices in response to the devaluation as the government imposed price freezes in particular sectors. The Argentine crisis seem to have triggered a series of sudden stops in Latin America including countries like Bolivia, Brazil, Uruguay, and Paraguay.⁴ The regional contagion had elements of devaluation pressures and common creditor linkages which resulted in increased concerns about the regional stability. At the center of the Argentine crisis was the misaligned macroeconomic policy that resulted in high levels of domestic liability dollarization (foreign-exchange denominated debt contracts in the domestic capital market) and an uncredible exchange rate (Calvo and Talvi (2005)).

1.2.4 Empirical findings

After having discussed qualitatively potential determinants of sudden stops, we summarize the empirical evidence of investigations conducted for three large panels of countries. First, we discuss the empirical identification of sudden stops, before summarizing the econometric results on the determinants of sudden stops.

Sudden stop identification

Sudden stops are extreme events, more precisely, unexpected and large drops in foreign capital inflows. An aggregate measure of capital inflows is the financial account balance, a summary of net capital flows. It is composed of net foreign direct investment, net portfolio investment, and other investments excluding official transfers associated with IMF programs. In most empirical work, sudden stops are identified by considering the first and second moments of the financial account series: Sudden stops are defined as periods in which capital inflows fall one (or two) standard deviation(s) below its long-term average. This measure, however, should be augmented with additional information since, in absence of external intervention, changes in the financial account are offset by changes in the current account and vice versa. For instance, given a constant level of international reserves, the financial account may drop because of an export boom.⁵ Inferring

⁴Brazil also faced a political shock in the form of upcoming presidential elections in face of a large stock of external public debt. In Uruguay, bank deposits fell by 30%, and a large part of this fall can be attributed to deposit withdrawals by Argentine residents.

⁵From an analytical point of view, the current account may jump from a deficit to a surplus for three reasons: (1) From the intertemporal perspective, a transitory terms of trade or productivity gain may increase output more than expenditure; (2) the current account deficit may be unsustainable, e.g. due to a misaligned exchange rate; and (3) external causes may reduce capital inflows. The real exchange rate would depreciate and capital inflows would reverse in all cases, while output would suffer only in the last two cases.

causality gives rise to an identification problem and the central question is whether capital flows dominate the current account or the other way round (Goldfajn (2001)). Calvo, Izquierdo, and Mejia (2004) and Calvo, Izquierdo, and Talvi (2006) overcome this identification problem by either requiring that the sudden stop is associated with an output contraction, or a sharp increase in the country's external funding costs measured by J.P. Morgan's EM Bond Index (EMBI). Calvo, Izquierdo, and Mejia (2004) use quarterly data and identify sudden stops by the following three criteria: (1) the period includes at least one observation where the year-to-year fall in quarterly capital flows lies at least two standard deviations below its sample mean; (2) the sudden stop episode begins (ends) when the year-to-year fall (rise) in capital inflows falls (rises above) one standard deviation below its sample mean; and (3) there is an associated output contraction.⁶ Calvo, Izquierdo, and Talvi (2006) introduce a measure for systemic sudden stops (3S) in which the third criterion is replaced by a criterion that requires that there is an associated sharp increase in external funding costs. Eichengreen, Gupta, and Mody (2006), Guidotti, Sturzenegger, and Villar (2004) and Cavallo and Frankel (2004) who work with annual data use the mean and one-standard deviation band of the financial account to identify sudden stops, and are therefore subject to the mentioned identification problem. Recent sudden stops identified with these definitions are summarized in Table 1.1. Argentina and Turkey appear to be most vulnerable to sudden stops, since both countries experienced a sudden stop three times since the mid 1990s. Another interesting observation is that sudden stops are not restricted to crisis-prone economies, but also occur in countries with solid fundamentals like in Chile or Singapore. Finally, sudden stops are likely to affect more than one country at the same time which confirms that international contagion is a key determinant of sudden stops.

Determinants of sudden stops

Calvo, Izquierdo, and Mejia (2004), Cavallo and Frankel (2004) and Eichengreen, Gupta, and Mody (2006) investigate empirically the determinants of sudden stops for a large number of countries. Table 1.2 gives an overview of these studies. The common approach is to determine which structural factors significantly affect the probability of experiencing a sudden stop using Logit- or Probit-models for panel data. In all studies, the dependent variable is an indicator variable that identifies the sudden stop periods. The explanatory variables typically include measures for trade openness, the composition of debt, reserve adequacy, exchange rate systems, debt sustainability, relative prices, and

⁶The first and second moments of capital inflows are calculated using a rolling window including 12 quarters before each period to capture better the surprise element of sudden stops. For particular EM economies, Figure 1.1 shows for illustration potential sudden stops, i.e. periods in which the annual change in quarterly capital flows fell below the two-standard deviations band (red line).

other indicator variables.⁷ The mentioned studies find evidence in favor of the hypothesis that sudden stops are triggered by external factors. At the same time, however, the results suggest that the vulnerability to a sudden stop originates in domestic structural weaknesses. Calvo, Izquierdo, and Mejia (2004) find that a country's degree of openness and domestic liability dollarization are the most important determinants of sudden stops. Using a stylized model the authors demonstrate that the change in the real exchange rate associated with a sudden stop is larger in the case of economies with a small tradable goods sector. The reason for this is that an economy with a large tradable goods sector is in a better position to adjust to the curtailment in the supply of tradable goods caused by a sudden stop which decreases the pressures on the real exchange rate. When a large non-tradable goods sector borrows in hard currencies (in units of tradable goods), then a real depreciation's balance sheet effect increases an economy's financial burden. This process is likely to increase concerns about the economy's solvency triggering another round of capital flight. The econometric analysis confirms this presumption: liability dollarization increases the probability of a sudden stop, especially in economies with a relatively small tradable goods sector. Eichengreen, Gupta, and Mody (2006) investigate whether external interventions by the IMF are effective in reducing the probability of sudden stops. The authors find evidence that sudden stops are less likely when an IMF arrangement exists, especially in countries with strong fundamentals. This may point to the fact that IMF programs are on average effective in resolving liquidity crises and in calming down markets. Another interesting finding is that a large stock of foreign debt relative to GDP and fixed exchange rate arrangements increase the probability of sudden stops. Finally, Cavallo and Frankel (2004) find that both trade openness and the current account balance over GDP significantly decrease the probability of sudden stops. Overall, these studies confirm that macroeconomic weaknesses such as high levels of external debt, mismatches on balance sheets, and credibility considerations play a key role in creating a country's vulnerability to a sudden stop. In essence, investors' jitters or market overreactions which lead to collective capital withdrawals are more likely in countries which inhibit these vulnerabilities. To our surprise, the level of short-term external debt relative to international reserves does not show up significantly in the regressions. Moreover, it would be interesting to introduce measures on international shocks (news about currency collapses or liquidity crises in other EM countries) and political shocks (upcoming elections).

⁷The measures used are the size of current account deficit relative to the size of the traded goods sector, imports plus exports over GDP, the degree of liability dollarization, short-term debt in total debt, M2 over reserves, reserves over the current account deficit, a measure on the exchange rate regime, public debt over revenues, external debt over exports, terms of trade, and regional and institutional dummies.

1.3 Effects of sudden stops

As discussed in Section 1.2, sudden stops have affected a wide range of EM economies. The macroeconomic outcome, however, has been different across the affected economies ranging from mild economic recessions to widespread financial crises. The present section investigates the macroeconomic effects of sudden stops taking into account the heterogeneity of affected economies.

1.3.1 Sudden stops, twin crises, and debt crises

Sudden stops in 2000-01 have been associated with currency and financial crises (twin crises) in Argentina and Turkey (Bordo (2006)). Argentina, in addition, experienced a sovereign debt crisis. In other economies as in Chile in 1998, or Brazil in 2002, sudden stops involved milder economic slowdowns. An even more striking case is Australia in 1998 which as Chile was hit by an adverse terms of trade and export demand shock. Australia, however, did not experience a sudden stop, on the contrary, Australia was able to rely on foreign borrowing to smooth out the effects of the external shocks. In terms of Caballero, Cowan, and Kearns (2004) Australia had both 'country trust', confidence by investors in the underlying soundness of its institutions, and 'currency trust', confidence in its commitment to a credible nominal anchor. As Bordo (2006) argues, Chile sent wrong signals to the market by tightening monetary policy opposed to Australia. This policy response seems to have increased investors' uncertainty about the Chilean peso and financial stability resulting in an important sudden stop. Calvo and Talvi (2005) compare the Chilean and Argentine experiences with sudden stops and argue that Argentina was more vulnerable to a full-blown crisis than Chile. They argue that this vulnerability stemmed from Argentina's higher liability dollarization and its smaller tradable goods sector. The involved dynamics are reminiscent of Fisher (1933)'s Debt-Deflation argument that unanticipated price changes can have important real effects, if they increase the stock of debt relative to income and wealth. The mechanism during a sudden stop is the following: Initially, the economy is forced to pay down parts of its accumulated external debt. When this debt is largely denominated in foreign currency (or in real terms in units of tradable goods), then the economy has to transfer more foreign currency to its lenders than expected. Given prices, this translates into an excess demand for tradable goods, which can be converted into exports and generate foreign-currency income. This process causes a real depreciation, i.e. an increase in the relative price of tradable and non-tradable goods, which tends to be higher in economies with a small tradable goods sector. To the extent that loans from abroad are denominated in units of a foreign currency, the real depreciation increases the value of liabilities relative to income, notably,

in economies that have small parts of foreign-currency income. Thus, for a given level of external foreign-currency debt, the adverse balance sheet effect and real depreciation are likely to be larger in economies with small tradable goods sectors acting as amplifiers of the initial shock. The inverse and amplifying relation between prices of income and liabilities is what reminds to Fisher (1933)'s argument. Moreover, depending on which sector is vulnerable, sudden stops can result in banking or sovereign debt crises. When the banking sector is subject to balance sheet mismatches and capital withdrawals, a sudden stop can cause a banking crisis. It can also lead to a sovereign debt (corporate debt) crisis for governments (corporate sectors), whose debts are in foreign currency, and whose tax revenues (income) to service the debt are in domestic currency. Both a banking and debt crisis can trigger a currency crisis as international reserves which serve to back the banking system's liabilities as well as the government's balance sheet are threatened (Bordo (2006) and Mishkin (2003)). Therefore, when the capital flow reversal is large relative to international reserves and the size of the tradable goods sector, the real depreciation is likely to be associated with a nominal depreciation. A controversial question in this context is whether currency or banking crises are caused by a sudden stop or vice versa, a problem of 'reverse causality'. Calvo, Izquierdo, and Mejia (2004) is the single study that investigates for a sample of EM economies whether recent sudden stops have preceded currency devaluations or not. They find evidence that, in about 2/3 of the cases in which a large currency depreciation was associated with a sudden stop, the sudden stop came first. With respect to banking crises, Joyce and Nabar (2007) find that 1/3 of sudden stops were associated with banking crises, while only 10% of all banking crises were associated with sudden stops. Therefore, the empirical evidence suggests that sudden stops are likely to be associated with currency crisis and to a lesser extent with banking crises. Moreover, sudden stops are not only the concomitant of currency crises, but in the majority of cases their cause. Overall, the discussion highlights that the subsequent economic adjustment depends on both internal (structural weaknesses, policy response) and external factors (lenders' behavior).

1.3.2 Empirical findings

In the following, we summarize the results of the empirical literature on the effects of sudden stops, based on three investigations which were conducted for large panels of countries. In several papers, Calvo has pointed out the following empirical regularities of sudden stops (Calvo (1998b), Calvo and Talvi (2005), and Calvo (2006a)): (a) most importantly, a sudden collapse in capital flows and sharp increase in the cost of foreign borrowing, (b) a reversal of the current account deficit, (c) downturns of domestic production and aggregate demand, (d) drops in domestic credits and investment, and

(e) increased volatility of relative prices, asset prices, and the exchange rate. Moreover, Calvo, Izquierdo, and Talvi (2006), Edwards (2005), and Guidotti, Sturzenegger, and Villar (2004) examine empirically the macroeconomic effects during and in the aftermath of sudden stops, see Table 1.3 for a summary. The mentioned studies find evidence that sudden stops have a strong negative impact on economic growth, and that financial factors are important determinants of the economic effects. Guidotti, Sturzenegger, and Villar (2004) find that sudden stops involve declines in capital flows from 6 to 20% of GDP with an average of 13%.⁸ The associated average current account reversal amounts to about 10% of GDP. Using growth regressions, the authors find that the countries' trade openness, the exchange rate regime, and the degree of liability dollarization are important determinants of growth, both during and in the aftermath of sudden stops. The largest effect on output performance has the exchange rate regime, i.e. a flexible exchange rate regime ahead of a sudden stop contributes to improve output performance during the sudden stop by 7% on average. Most probably, this can be explained by the fact that both borrowers and lenders perceive a higher currency risk in flexible exchange rates regimes, which tends to reduce unhedged foreign-currency liabilities. Moreover, lower liability dollarization and higher trade openness reduce significantly the output costs of sudden stops. In addition, the authors investigate which factors determine whether the associated current account adjustment is done via an export expansion or an import compression. They find that more open economies experience a higher export growth and, thus, less import contraction contrary to economies that suffer from liability dollarization. This confirms that during a sudden stop a large tradable goods sector can benefit and improve aggregate output performance. Calvo, Izquierdo, and Talvi (2006) investigate output collapses and recoveries triggered by systemic sudden stops. The main findings are that output recovers on average after about 3 years. They argue that the output drop as well as the recovery are largely explained by total factor productivity and a sudden 'capacity under-utilization', because changes in employment and the capital stock appear to account only for a small part of the variation in production. Another finding is that while domestic and external credits drop persistently, output recovers generally fast (Phoenix Miracle). Calvo, Izquierdo, and Talvi (2006) reason that an economy strives to develop new sources of financing its production, which lie outside the credit market, such as postponing investment projects or reducing dividend payments. Finally, Edwards (2005) investigates whether the extent of capital mobility affects a country's vulnerability to a sudden stop and whether it affects the subsequent economic adjustment. The author finds evidence that, once the sudden stop occurs, countries with a higher capital mobility face a higher cost in terms of growth declines. Overall, the empirical studies reveal that the structural weaknesses discussed

⁸In several African and Middle Eastern countries, the capital flow reversal exceeds 30% of GDP (e.g. Kuwait 1992, Yemen 1998, Angola 2000, and Republic of Congo 1995).

in the section on the determinants of sudden stops are equally important factors of the economic effects of a sudden stop.

1.4 Theory of sudden stops

A growing body of literature builds theoretical models to explain the sources and transmission mechanisms of sudden stops. In the following, we summarize briefly the results of this literature from the perspective of borrowers and lenders.

1.4.1 Lenders perspective

The theoretical literature on sudden stops from the perspective of lenders relies on the assumption of asymmetric and imperfect information on financial markets. Because information is assumed to be costly, part of the investors face a signal extraction problem and follow a herding strategy (Calvo (1999) and Calvo and Mendoza (2000)). The idea is similar to Diamond and Dybvig (1983) and Diamond and Rajan (2005) who study the mechanisms of bank runs. The difference with regard to sudden stops is that not an individual bank is affected, but rather an entire economy. The common mechanism is the following: If an investor expects that all other investors will withdraw their funds, then it is irrelevant whether a borrower is solvent in the long-run. Rather, the borrower will get into liquidity problems in the short-run. The only rational response for the investor is to withdraw his investments before the others do. The resulting liquidity run is a self-fulfilling prophecy, since each investor's incentive to withdraw his funds depends on what he expects the others will do. Put it differently, if enough investors expect the others to withdraw their funds, then all investors have an incentive to rush to be the first in the line.

1.4.2 Borrowers perspective

The conventional open economy general equilibrium models, i.e. the International Real Business Cycle Theory (IRBC) and New Open Economy Macroeconomics (NOEM), are unable to explain sudden stops, because of the assumption of perfect global capital markets (Mendoza (2006b)). This assumption implies that foreign capital is available to fulfill the financing role for households to smooth consumption, and for firms to finance production and investment, efficiently. An implication is that an economy responds to adverse, transitory shocks by borrowing on global capital markets to cushion the negative impact, i.e. capital inflows increase. During sudden stops, however, economies lose their access to global capital markets and capital inflows drop. This is at odds with the assumption

of perfect capital markets. Those open economy models that are able to explain sudden stops, typically, incorporate financial markets that are subject to frictions (Arellano and Mendoza (2003), Mendoza (2006b), Christiano, Gust, and Roldos (2004), or Cook and Devereux (2005)). The theoretical models build on an amplification mechanism which is similar to Fisher (1933)'s debt-deflation mechanism. The mechanism relates an economy's costs (or access) of credits with the economy's leverage (external debt relative to domestic assets). To the extent that external debt is largely denominated in foreign currency and that a sudden stop causes a real depreciation, sudden stops imply a negative wealth effect through the depreciation's balance sheet effect. The drop in net wealth increases in turn the economy's leverage and, therewith, worsens the economy's access to external finance. This mechanism ends up in a circle of amplification and is in line with Calvo, Izquierdo, and Talvi (2006):

"Sharp nominal (and real) currency devaluation in the presence of Liability Dollarization may have worked in EMs as a new version of Fisher's Debt Deflation syndrome and may be central in explaining output collapses."

Overall, the theoretical literature suggests that the scope of the involved economic adjustment depends on the structural factors highlighted in the previous sections: the size of the tradable goods sector, the degree of currency mismatch between an economy's assets and liabilities, and the level of indebtedness.

1.5 Policy challenges and options

In the previous sections, we discussed the sources and economic effects of sudden stops. First, the evidence highlighted that particular structural weaknesses are key determinants of both the occurrence of a sudden stop and the depth of the resulting crisis. Domestic policy could therefore take policy steps to reduce such vulnerabilities. Second, once a sudden stop hits, the right policy response can calm down markets.⁹ As sudden stops represent a curtailment in external credits and investments, there is also a potential to resolve the crisis by a rescue loan from an international financial institution, or by restructuring outstanding debt. Third, we have also discussed that international contagion is an important determinant of sudden stops. In such cases, domestic policy could be complemented by global policies, which are aimed to prevent systemic EM crisis. In the following, we will discuss the proposed policy remedies from these perspectives.

⁹The debate on optimal policy responses to sudden stops is on the top agenda in Latin America as documented by the research project 'Policies during Sudden Stops - Country Studies' of the Inter-American Development Bank (see Castillo and Rondan (2008), Garcia (2007), and Valdes (2007)).

1.5.1 Crisis resolution and debt restructuring

Roubini and Setser (2004) have put together a comprehensive investigation on the resolutions of financial crises in EM economies. Their primary focus lies on the policy options involved once the crisis hits, rather than on crisis prevention policies. Essentially, there are two options for an economy that faces an unexpected and collective curtailment in external credits. The first option is to demand a rescue loan from an international financial institution, or a major government, which is large enough to cover at least those debts that are falling due (bailouts). The IMF plays an important role in this context and is normally the first institution which is asked for guidance and financial support in times of distress. The second option for a crisis country is to negotiate with its creditors to roll over short-term liabilities, or to restructure outstanding debt such as increasing its maturity or reducing coupon payments (bail-ins). The second emergency option implies that a country breaks its contractual promises to repay in full and on time, and it tends to trigger a broader loss of confidence (Roubini and Setser (2004)). Recent EM crises which involved debt restructuring are Korea, Indonesia, Russia, Brazil, Ecuador, Argentina, and Uruguay. The crises in Russia, Ecuador, and Argentina involved a payments suspension on external debts (Roubini and Setser (2004), Table A.3).

1.5.2 Domestic policy

As discussed in Section 1.2, misaligned fiscal and monetary policy, and poor regulation and supervision of the corporate and banking sectors, that result in structural weaknesses are important determinants of sudden stops. The empirical evidence highlights the major structural weaknesses, and domestic policy should be aiming at reducing them (Calvo (2006a) and Calvo and Talvi (2005)). Of course, policy credibility and transparency are equally relevant in the context of sudden stops (Caballero, Cowan, and Kearns (2004) and Dornbusch (2001)). Once a sudden stop occurs, however, it is a difficult task to find the policy response that helps to restore confidence and to reduce adverse amplifier effects. In the following, we discuss the options for fiscal and monetary policy.

Fiscal policy, regulation and supervision

In the following, we discuss crisis prevention policies that are aimed at reducing the incidence of the structural vulnerabilities highlighted above. First, domestic policy can discourage firms and banks to take on large amounts of debt denominated in foreign currency. This could be achieved by levying a tax on total borrowing (not only external borrowing) denominated in foreign currency, or by introducing incentives that induce do-

mestic banks to shift from foreign-currency indexation toward some domestic price level, as in Chile the 'unidad de fomento' (Calvo (2006a)). These measures would reduce both foreign and domestic liability dollarization. Similarly, regulatory institutions can fix rules and limits on borrowing of the private sector and punish their noncompliance. The adoption of the Basel II framework is a possibility to improve existing regulatory frameworks of financial sectors by imposing capital requirements for banks that are more closely related to their underlying risks. Second, tariff and competitiveness policies that aim at trade opening and result in large tradable goods sectors can help to prevent a full-fledged crisis, since tradable goods can be transformed to exports, which can serve as a source of foreign currency (Calvo (2006a)). A controversial issue is whether capital controls on capital inflows and/or outflows can help to prevent a sudden stop. Calvo and Talvi (2005) demonstrate that even effective controls on capital outflows, as in Malaysia in 1997, can not prevent a sudden stop, since it entails lower capital inflows and not necessarily capital outflows. On the contrary, Edwards (2005) finds empirical evidence that capital controls tend to reduce the output costs of a sudden stop (see Section 1.2.4). Once the sudden stop hits, it is difficult to determine the right policy response, because of the difficulty to foresee the implied market reaction. Since the Asian crisis of 1997-98, there is a controversial debate about the question of whether fiscal and monetary policy should be tightened (as was recommended by the IMF) or not (Stiglitz (2002)). Calvo and Talvi (2005) argue that fiscal policy should not further constrain aggregate demand in the short-run, especially, when the crisis is systemic. In this case, tight fiscal policy is likely to translate into a further unnecessary contraction in aggregate demand. If, however, tight fiscal policy improves the economy's credibility and facilitates capital market access, tightening could be a solution. To reduce the need for a tightening of fiscal policy during times of distress, governments could create a stabilization fund, which grows during expansions and falls during downturns, as the Chilean Copper Stabilization Fund (Calvo and Talvi (2005)). Of course, a problem with this type of policy is moral hazard. When the private sector anticipates a bailout, it possibly will change its behavior and take on excessive risks (Calvo and Talvi (2005)). Therefore, bailouts should be made costly (Bagehot (1873)). Moreover, if public debt is small, governments may be in a better position to improve domestic credit conditions by borrowing at international financial institutions or governments.

Monetary policy

There is a controversial debate about the appropriate exchange rate regime for EM economies (Calvo and Reinhart (1999), Eichengreen and Hausmann (1999), Calvo (2001), and Calvo and Mishkin (2003)). The main theme of this debate is that pegged exchange rates tempt to increase the risk that borrowers underestimate currency risk and

rely too much on foreign-currency debt. Many EM economies used to peg the exchange rate, however, with the onset of the Asian crisis a view emerged that pegged exchange rates were part of the underlying problem (Fischer (2001)). According to this view, several major EM economies operate nowadays under an inflation-targeting framework in which price stability is the principal objective and a short-term interest rate the main monetary policy instrument to achieve the announced inflation target (as in Brazil, Chile, Colombia, and Mexico). Capital markets tend to be open and exchange rates tend to be flexible.¹⁰ Central banks may also put some weight on exchange rate stability in their decisions, especially, when an economy suffers from liability dollarization (fear of floating). In the extreme case, EM economies may also dollarize and adopt, e.g., the US dollar as domestic currency. Such strong pegs like the dollarization in Ecuador can help to reduce the incidence of external shocks, especially, those that filter through the capital account (Calvo and Reinhart (2000)). In a recent paper, Calvo (2006b) highlights that monetary policy during a sudden stop faces a dilemma: the conflict between the objectives of price stability and financial stability. Calvo casts doubt on the question whether price stability should be the principal objective during a sudden stop. He argues that 'a sudden stop is, first of all, a credit event and the economy as a whole, including the central bank and other public institutions, experiences a sudden curtailment of international credit'. Consequently, if existing, then international reserves could be made available to the public, and central banks could take on the role of a Lender of Last Resort (LOLR).¹¹ If international reserves are limited, however, central bank loans would have to be financed by seigniorage, which would interfere with a central bank's objective of price stability, and its ability to act as a LOLR would be restricted. To reduce this risk, a central bank could accumulate a critical level of international reserves that can be released in times of capital flight.¹² According to Calvo the central question is in which way international reserves should be made available, i.e. by Foreign Exchange Intervention (FXI) or by directed credit to critical sectors. FXI has the advantage that a central bank needs to have only limited information about the credit market participants. The disadvantage of FXI, however, is that reserves may become capital flight and not be used in the real economy. Calvo argues that 'if the central bank has better information than the market, it may be advisable for the central bank to channel international reserves directly to sectors which

¹⁰In open economies, governments have to choose two out of three options: (1) independent monetary policy, (2) free capital mobility, and (3) fixed exchange rates. So, many EM economies have chosen (1)+(2) combined with flexible exchange rates.

¹¹A LOLR is an institution that is able to lend at reasonable low rates of interest to sectors (private or public) that are seriously credit constrained.

¹²In many EM economies, central banks have acted according to this and accumulated larger stocks of international reserves. In Latin America, for instance, the stock of international reserves doubled with respect to pre-crisis levels, while in Asia the stock increased by a factor of three. See, for instance, Jeanne and Ranciere (2006) on optimal levels of international reserves in EMs.

have a positive marginal social return to the use of international reserves.¹³ Again, moral hazard is an important problem in this context, since the anticipation that a central bank will provide rescue loans during a sudden stop, may induce the private sector to take on excessive risks. Therefore, there should be some form of debt management regulation that relates a firm's financial practice during normal times with the commitment to credit lines during sudden stops (Calvo (2006b)). An effective LOLR has, thus, a high potential to cushion the adverse impacts of the curtailment in credits and, therewith, help to restore confidence and bring down the capital flight. As noted in the section on fiscal policy, there is a controversial debate about the question of whether monetary policy should be tightened or not during a sudden stop.¹⁴ For instance, several Asian central banks have been criticized to have amplified the real effects of the sudden stops by increasing interest rates, a response which was expected to counteract the capital flight and cushion the pressures on the domestic currency. According to many researches, this response was ineffective, since the capital flight continued and currencies collapsed. In driving up costs of domestic finance, high domestic interest rates worsen the effects of a credit crunch. Thus, it may be advisable to decrease domestic interest rates in order to improve domestic credit conditions and to calm down the market.

1.5.3 Global policy

As discussed before, domestic policy can help to prevent sudden stops, especially, when it is based on sound and credible institutions. When a sudden stop has a systemic component, however, domestic policy should be complemented by policies that are aimed at the global capital market (Calvo (2006a), Calvo and Talvi (2005), and Calvo (2002)). In his recent work, Calvo repeatedly encourages the international community to create an EM Fund (EMF) that complements the work of international institutions like the IMF in the resolution of liquidity crises. Calvo suggests that an EMF should not target individual countries as the IMF, but rather individual financial intermediaries that suffer from unexpected liquidity shortages. The strategy of an EMF would be similar to that of a central bank that faces a bank run: liquidity is provided to banks directly and not to the bank's individual debtors (Calvo (2006a)). Again, moral hazard constitutes a problem in this context. The creation of the Asian Bond Fund (ABF) in 2003, which is managed by the Bank of International Settlements and funded by the members' governments, is an example of an attempt to build up a regional LOLR. Equally important would be to foster the devel-

¹³A successful example of directed allocation of international reserves during a sudden stop is Brazil in 2002, when the central bank employed international reserves to make loans to the export sector intermediated through commercial banks.

¹⁴Christiano, Gust, and Roldos (2004) develop a general equilibrium model to analyze optimal interest rate responses to a sudden stop.

opment of international bond markets and financial instruments, which allow for a more efficient international risk sharing and move away from the mere dollar-indexation of debt instruments (Eichengreen, Hausmann, and Panizza (2002)). Moreover, international coordination of monetary policy can play an important role in preventing global and systemic shocks. As Calvo and Talvi (2005) argue, a global liquidity shortage that wipes out EM economies may be attenuated, when the central banks in major economies decrease interest rates, as eventually happened in response to the Russian crisis.

1.6 Contributions of this dissertation

In the previous sections, we have discussed the sudden stop phenomenon and presented evidence that many of the recent, major EM crises involved a sudden stop of capital inflows. In our work on EM crises, we set therefore a particular focus on those crises that originate in international capital markets. We have highlighted that particular structural weaknesses of economies are important causes of sudden stops, and EM crises, and that these weaknesses act as amplifiers of adverse shocks. The existing literature points to the importance of the structure of an economy's income and liabilities and, thus, as pointed out by Calvo, Izquierdo, and Mejia (2004) 'when analyzing sudden stops, careful consideration should be given to financial vulnerabilities to external shocks'. Ultimately, these vulnerabilities are generated at the micro-level and can best be analyzed by the use of firm- or bank-level data. As Roubini and Setser (2004) point out 'balance sheet analysis is particularly helpful for understanding the dynamics of crisis. It explains both how a crisis in one sector of the economy can snowball and lead to a broader crisis and how financial weaknesses (...) interact in a dynamic way with policy weaknesses as stress mounts'. In the first two essays of this dissertation, we have put together cross-country datasets with information on annual and quarterly financial statements of many individual banks and firms. We believe that our data brings more detailed information to understand the dynamics of EM crises, than data on the macro-level, which is usually considered. Moreover, our data allows a greater exploration of the relationships between firm and bank characteristics and macroeconomic dynamics. While the first essay "Sudden Stops and Bank Lending" focuses on the determinants of domestic bank lending during sudden stops, the second essay "Currency Depreciations, Financial Transfers, and Firm Heterogeneity" analyzes distributive aspects of currency collapses from the perspective of firms. In both empirical studies, we find evidence for a high degree of heterogeneity at the micro-level, essentially, arising from capital mismatches in the case of banks, and from currency mismatches in the case of firms. In the second essay, we complement the empirical analysis with the development of a micro-founded, dynamic model of a repre-

sentative firm, to explore the effects of currency collapses on firm dynamics and income distribution, in presence of currency mismatches. In the final essay "International Financial Shocks in Emerging Market Economies", we develop a dynamic stochastic general equilibrium model to explore the transmission and amplification mechanisms of external financial shocks in an open economy context. The three essays address particularly important aspects of EM crises. To our knowledge, our investigation on banks and sudden stops is the first attempt to explore the determinants of bank lending during sudden stops using bank-level data. Moreover, our study of currency collapses and income distribution between firms and lenders is one of the few existing attempts, to shed light on the distributive dimensions of currency crises using firm-level data. And finally, we have developed a general equilibrium model that helps to explore financial crises and financial amplifier effects in EM economies. The relevance of this study can be confirmed by Calvo and Talvi (2005), who note that 'unfortunately, false starts and painful crashes have not given rise to a solid academic literature comparable to the one dealing with problems in the North. (...) Thus, we strongly believe that a deeper understanding of financial crises in the region constitutes one of the most productive projects.'

1.7 Appendix

Table 1.1: Dates of sudden stops

Latin America ^a		Asia		Others	
Country	Year	Country	Year	Country	Year
Mexico	1995	Singapore	1994	Portugal	1992
Argentina	1995	Thailand	1996	Spain	1992
Venezuela	1995	Japan	1997	Sweden	1992
Costa Rica	1996	Korea	1997	Turkey	1995
Peru	1997	Malaysia	1997	Czech Republic	1996
Argentina	1998	Philippines	1997	Greece	1997
Chile	1998	Indonesia	1997	India	1997
Colombia	1998	Singapore	2001	Israel	1998
Bolivia	1999			New Zealand	1998
Ecuador	1999			Turkey	1998
Argentina	2001			Turkey	2001
Brazil	2002				
Bolivia	2002				
Paraguay	2002				
Uruguay	2002				

^a The particular dates are taken from Calvo, Izquierdo, and Mejia (2004), Eichengreen, Gupta, and Mody (2006), Guidotti, Sturzenegger, and Villar (2004), and Cavallo and Frankel (2004). Sudden stops in Africa are not considered. Note that bold letter indicate sudden stops that seem to have involved international contagion.

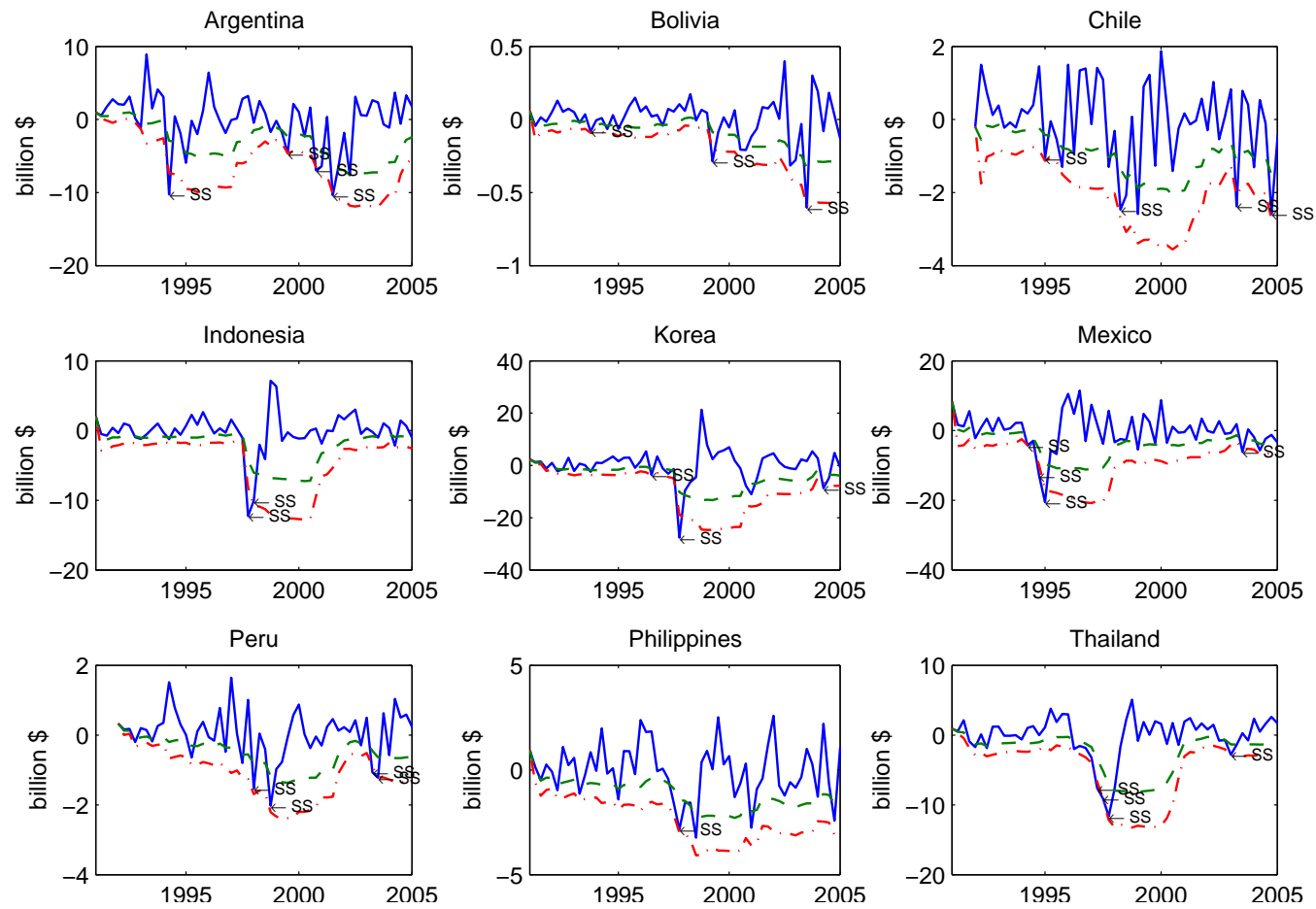
Table 1.2: Literature on the determinants of sudden stops

Authors	Sample	Methodology	Target variables	Results
Calvo, Izquierdo, and Mejia (2004)	32 countries 1990-2001	Logit Model	1) Domestic liability dollarization (DLD)	DLD and trade closeness increase the probability of sudden stops.
		Dependent variable: Sudden stop dummy	2) One minus the degree of trade openness (measures sensitivity of the real exchange rate to capital flows reversals)	The combination of high DLD and low trade openness is dangerous.
<i>Controls: exchange rate regime, reserves over current account deficit (CAD), credit growth, foreign direct investment (FDI), fiscal balance, terms of trade growth, public sector debt</i>				
26 Frankel and Cavallo (2004)	141 countries 1970-2002	Probit model	1) Trade openness	Openness decreases and CAD/GDP increases the probability of sudden stops.
		Dependent variable: Sudden stop dummy	2) Foreign debt over GDP 3) CAD/GDP	The level of foreign debt over GDP is not significant.
<i>Controls: GDP per capita, gov. budget over GDP, FDI/GDP short-term debt over total debt, and exchange rate regime</i>				
Eichengreen, Gupta, and Mody (2006)	24 countries 1980-2003	Probit model	1) Trade openness	IMF programs decrease and the level of foreign debt over GDP increase the probability of sudden stops.
		Dependent variable: Sudden stop dummy	2) Foreign debt over GDP 3) New (existing) IMF program	Openness has no significant impact.
<i>Controls: High yield spread, change in oil prices, GDP growth, debt servicing over exports, domestic credit over GDP</i>				

Table 1.3: Literature on the effects of sudden stops

Authors	Sample	Methodology	Target variables	Results
Calvo, Izquierdo, and Talvi (2007)	32 countries 1980-2004	Difference in means test: precrisis, trough and recovery	<ol style="list-style-type: none"> 1) Total factor productivity (TFP) 2) Investment/GDP 3) Credits/GDP 4) Current account/GDP 	<p>Output recovers without recovery in domestic and foreign credits (Phoenix miracle)</p> <p>Investment recovers very slowly. Firms delay investment project to restore liquidity.</p> <p>Financial factors are prominent in explaining the output collapse.</p>
Guidotti, Sturzenegger, and Villar (2004)	150 countries 1974-2002	<p>Pooled regression</p> <p>Dependent variable: GDP, export and import growth</p>	<ol style="list-style-type: none"> 1) Trade openness 2) Financial dollarization <p>Controls: change in terms of trade (ToT), exchange rate regime, size of capital account contraction, growth of world exports</p>	<p>Lower financial dollarization and higher trade openness reduce output costs of sudden stops.</p> <p>Flexible exchange rates improve output performance during sudden stops.</p> <p>More open economies experience higher export growth and lower import contraction.</p>
Edwards (2005)	157 countries 1970-2000	<p>Pooled regression</p> <p>Dependent variable: GDP per capita growth</p>	<ol style="list-style-type: none"> 1) Currency crisis dummy 2) Current account reversal dummy 3) Sudden stop dummy (interaction between 1) and 2)) <p>Controls: change in ToT, growth gap (difference between long-run and current growth rate of GDP per capita)</p>	<p>Currency crises and current account reversals have an adverse impact on growth.</p> <p>Sudden stops have a stronger, but short lived, adverse impact on growth.</p>

Figure 1.1: Annual changes in quarterly capital flows



Chapter 2

Sudden Stops and Bank Lending

Michael Brei ¹

Using annual financial statements of individual banks operating in 11 countries in Asia and Latin America, we investigate whether a strong domestic banking system and foreign bank participation help to insulate emerging market economies from the adverse effects of sudden stops by stabilizing the domestic credit supply. We use measures for bank size, asset liquidity, capitalization, currency mismatch, and the origin of the majority shareholder to identify the key determinants of domestic bank lending during sudden stops.

In most cases, we find that sudden stops are associated with reductions in the domestic lending volume in the order of 10-15% of GDP. Moreover, banking sectors with higher capitalization and foreign bank presence tend to attenuate the adverse effects of sudden stops on the domestic lending volume and strengthen, therewith, the affected economies.

Keywords: Sudden stop, international capital markets

JEL Classification: F34, F36, G21

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2.1 Introduction

In a sudden stop episode, an economy that has been the recipient of capital inflows, stops receiving such inflows and instead faces unexpected withdrawals of investments and the inability to roll over existing debt that is falling due. Most of the considered episodes in this paper exhibited elements of a self-fulfilling crisis in which capital withdrawals by some key investors resulted in a financial panic and unnecessarily deep recessions affecting particular regions entirely.

Goldfajn (2001) states with regard to sudden stops:

'I define a sudden stop as a very large change in the supply of capital. Of course, this sudden stop is always in the negative direction. There are also problems with big booms of capital inflows in the sense that you need to know what you are doing with the big influx. But the real problem is when you get billions of dollars less from one year to the other - on the order of 10 percent of gross domestic product (GDP) or so. And most of the countries that had crises faced this challenge: Mexico, Asia, Turkey, Brazil, all of them.'

The particular outcome of the unexpected capital flight can be manifold ranging from outright default, a rescheduling of debt payments, to bank runs, or to a rescue by a lender who provides new loans. The strength of the economic adjustment depends ultimately on several factors including, amongst others, the economy's foreign exposure, its degree of balance sheet mismatches and monetary policy. The banking sector plays a key role in determining the ability of an economy to attenuate the negative impact of sudden stops. Banks can cushion the impact, when they are in the position to grant additional loans to those sectors that found their credits cut. When banks themselves are in trouble, however, banks can even be forced to cut down lending and amplify the initial shock.

The present paper investigates recent sudden stop episodes from the perspective of individual banks that operate in the affected economies. Using information on annual financial statements, we address the question of whether and in which way banks are affected with a focus on bank lending. In particular, we explore a dataset for the period 1992-2004 comprising 507 banks in 11 Asian and Latin American countries and test for cross-sectional differences in the responses of banks to a total of 14 sudden stop episodes. To distinguish between banks with different financial positions and characteristics, we use measures for bank size, asset liquidity, capitalization, currency mismatch, and the origin of the majority shareholder. The following hypothesis is tested: A sudden stop has a disproportionately large and negative impact on the lending volume of small, domestic

banks with vulnerable balance sheets.²

Recent literature on sudden stops highlights the importance of the capital, maturity, and currency composition of balance sheets. According to this literature, sudden stops are often triggered by investors' uncertainty about the credit worthiness of the balance sheet of a significant part of the economy. A currency depreciation, in a mismatch situation, works as a new version of Fisher (1933)'s debt-deflation mechanism and increases the prospect of insolvency and, hence, the capital flight. Calvo, Izquierdo, and Talvi (2006) argue that currency depreciations in the presence of currency mismatches are central in explaining the observed output collapses during sudden stops. Sudden stops are often associated with large currency depreciations which, in the case of a currency mismatch, increase the local currency value of outstanding debt relative to income and assets. The associated reduction in net wealth which is used as a collateral in debt contracts increases in turn the cost of external finance and sets in motion an amplifying mechanism that is similar to the well-known debt-deflation mechanism. When the banking sector is subject to important currency mismatches, this mechanism can contribute to a banking crisis as the collateral backing bank loans deteriorates. Most of the existing literature, however, focuses on currency mismatches from the perspective of firms.³

A growing body of literature analyzes the relation between bank capital and bank lending. Bernanke, Lown, and Friedman (1991) and Gambacorta and Mistrulli (2004) find that bank capital is an important determinant of the propagation of different types of shocks to lending. Bernanke, Lown, and Friedman (1991), for instance, find that poorly-capitalized banks contracted their lending volume by more than well-capitalized banks during the U.S. recession in 1990. Bank capital can affect bank lending in several ways. On the one hand, bank capital tends to increase the capacity to raise non-deposit funding, because it gives investors signals about the bank's creditworthiness and serves as a collateral in debt contracts. Moreover, usually banks have to meet regulatory capital requirements that are linked to lending (as recommended in the Basel Accord). In such an environment, banks can be forced to reduce lending in order to meet the capital requirements, given equity issuance is restricted and bank capital falls below the minimal capital requirement, be it, because of a drop in income or an adverse balance sheet effect.

Another strand of literature examines the impact of the rising foreign bank presence in emerging market economies on the banking sectors in the host countries.⁴ The main theme of this literature is that foreign banks tend to improve a banking sector's efficiency and

²A bank is vulnerable when it is highly leveraged, especially, when the bank finances a domestic-currency denominated, illiquid asset portfolio with foreign-currency denominated, short-term debt.

³See Galindo, Panizza, and Schiantarelli (2003) for an overview of the empirical evidence.

⁴See Clarke, Martinez Peria, and Sanchez (2003) for an overview of this literature.

stability.⁵ The main argument is that foreign banks, through their global scope and higher diversification, tend to have lower default risks and lower funding costs, and to be less vulnerable to adverse financial shocks in a particular country since they are likely to have better access to foreign capital than domestic banks. Arena, Reinhart, and Vazquez (2006) find evidence that the lending and deposit volume of foreign banks in emerging market economies is less affected during financial crises than that of their domestic competitors. Peek and Rosengren (2000) find that many foreign banks in Latin America did not reduce their credit supply during economic recessions in the host country. More precisely, they argue that foreign banks view such situations as opportunities to expand by acquisition or by increasing funding to existing subsidiaries.

The present paper focuses on related issues, however, its specific contribution is the focus on bank lending in the context of a sudden stop, one of the most important sources of instability in emerging market economies. In particular, we find that both the lending and deposit volume in US\$ decline on average by 15-30% during sudden stops, and deposits recover more quickly than loans. Interestingly, lending of well-capitalized banks is significantly less affected during sudden stops, especially when sudden stops are associated with large currency depreciations. This finding indicates that bank capital increases the banks' ability to cushion the effect on lending of, be it, an adverse income shock, an adverse balance sheet effect, or deposit withdrawals. In the case of foreign banks, we reach similar results indicating that foreign banks contribute to stabilize domestic bank lending in times of sudden stops. The findings suggest that banking sectors with higher capitalization and higher foreign bank presence are less prone to sudden stops which are associated with drops in domestic bank lending. Our findings also suggest that bank size, maturity and currency mismatches on the banks' balance sheets are of second order importance, once bank capital and foreign ownership are taken into account.

The remainder of the paper is organized as follows. In Section 2.2, we present a structural description of the adjustment mechanism within the banking sector in response to a sudden stop. In Section 2.3, we describe the underlying dataset and present the empirical results. The final section concludes.

2.2 Sudden stops and the banking sector

When foreign investors collectively refuse to roll-over existing debt and withdraw investments, both the private and public sector in the affected economy may be involved but not all parts to the same degree. Initially, particular sectors face an unexpected curtailment

⁵See, amongst others, Claessens, Demirguc-Kunt, and Huizinga (2001), Martinez Peria and Mody (2004), and Dages, Goldberg, and Kinney (2000).

in foreign funds, later, increasing capital flight and effects on aggregate demand, prices, interest rates, and exchange rates affect the whole economy. As there are few papers on the effects of a sudden stop on banks, we discuss in the following the involved adjustment mechanism.⁶

2.2.1 Initial shocks

A critical mass of foreign investors reduces its exposure to the economy and cuts down credits and investments. Particular domestic investors are likely to follow. The capital flight translates for particular banks into a drop in external funds of short maturity such as particular bonds, credits and deposits.

2.2.2 Subsequent effects

The impact on individual banks depends ultimately on the bank's initial portfolio structure as well as on its costumers. The unexpected inability to roll over maturing and short-term debt can result in liquidity problems, especially when too much assets are long-term and entail large costs in the case of liquidation (maturity mismatch). The restricted access to global capital markets is likely to cause an overall increase in the costs of external finance, since the affected banks and firms increase their demand for domestic funds to smooth out the adverse shock. In addition, the risky environment causes on average a higher risk premium on external finance. On top, the deterioration in economic conditions leads to an increased credit default risk from the part of the banks' customers. A sudden stop is often associated with a large currency depreciation which, in a mismatch situation, increases the local-currency value of liabilities relative to local-currency assets and reduces equity (currency mismatch). Since equity usually serves as a collateral in debt contracts, the currency depreciation is likely to increase a bank's costs of external finance. Adverse balance sheet effects are likely to increase the prospect of insolvency, and concerned depositors may demand the bank for the disbursement of their deposits. In particular cases, this can result in severe liquidity problems and trigger a bank run. Moreover, shifts of deposits toward banks with a sounder financial structure or a better reputation can occur.

Several factors determine to which degree a banking sector is affected by a sudden stop, most importantly: (1) bank regulation prior to the sudden stop such as reserve, cap-

⁶A theoretical investigation on a related issue, i.e. on liquidity shortages of banks, is that of Diamond and Rajan (2005). The only empirical paper that focuses on sudden stops and banking crises is that of Joyce and Nabar (2007).

ital, and liquidity requirements that result in sound and reliable banking sectors; (2) the banking sector's average portfolio structure such as equity and liquid assets in excess of the minimal requirement, and the currency and maturity composition of the average balance sheet; and (3) a strong central bank can act as a lender of last resort during sudden stops and increase credits to particular banks at reasonable prices, improve domestic financial conditions, and reallocate liquidity within the banking sector.⁷

To underline the difficulties that a banking sector can face during a sudden stop, the statement of the IMF (1998) with respect to the situation in Indonesia is quoted:

'Following the closure of 16 insolvent banks in November last year, customers concerned about the safety of private banks have been shifting sizeable amounts of deposits to state and foreign banks, while some have been withdrawing funds from the banking system entirely... By mid November, a large number of banks was facing growing liquidity shortages, and were unable to obtain sufficient funds in the interbank market to cover this gap, even after paying interest rates ranging up to 75 percent. At the same time, another smaller group of banks [that is state and foreign owned banks] were becoming increasingly liquid, and were trading among themselves at a relatively low JIBOR (Jakarta Interbank Offer Rate) of about 15 percent (...) the Bank Indonesia was compelled to act. It provided banks in distress with liquidity support, while withdrawing funds from banks with excess liquidity.'

2.2.3 Banks' responses

Banks can sell liquid assets which is probably the cheapest alternative to meet the demand for the repayment of external funds and make up the increase in the cost of external finance. Alternatively, banks can attract new depositors or demand additional non-deposit funding on the interbank market or at the central bank. In this context, the central bank plays an important role, because it can act as the lender of last resort and allocate resources to the affected banks. Foreign-owned banks can demand additional resources from their parent banks. Banks can also do a recapitalization and issue additional equity. During sudden stops, however, only a few possibilities are a feasible option since in many cases banks have to deal with deposit withdrawals and tense situations on bond, interbank and

⁷An example of directed credit during a sudden stop is Brazil in 2002, when the central bank employed parts of its international reserves to make loans to the export sector through commercial banks. The Peruvian central bank increased banks' liquidity during the sudden stop in 1998 by introducing dollar credit facilities to banks and by reducing the reserve requirement of dollar deposits. In 1998, the Indonesian central bank provided banks in distress with liquidity support, while withdrawing funds from banks with excess liquidity.

stock markets. When banks are in trouble, they can even be forced to securitize and sell parts of their outstanding loans or to call outstanding loans before maturity.

The lending volume of banks can be affected through several channels, most importantly: (1) adverse shocks to the cost of external finance or withdrawals of deposits reduce a bank's ability to make additional loans; (2) adverse balance sheet effects reduce a bank's equity and may push the bank below the limit of its minimal capital requirement and reduce its ability to grant new loans given equity issuance is restricted; and (3) increases in the amount of non-performing loans reduce a bank's equity and restrict its ability to make additional loans.

The considerations above provide several testable hypotheses. The hypothesis tested in this paper is that the lending volume of large, well-capitalized and foreign banks, and that of banks with balance sheets that are not subject to maturity and currency mismatches, is less affected by a sudden stop than that of banks with the opposed characteristics. There are several reasons for this presumption: this group of banks may have a better reputation and, therewith, a more stable deposit base and better access to other forms of external finance; a binding capital constraint is less likely for well-capitalized banks; liquid banks are not subject to maturity mismatches and can build on a larger, better accessible stock of assets; foreign parent banks can allocate additional capital to their subsidiaries; and banks without a currency mismatch are not subject to adverse balance sheet effects.

2.3 Empirical results

The bank-level data comes from BankScope and the macroeconomic data from International Financial Statistics.⁸ The unbalanced dataset covers the period from 1992 to 2004 and 11 countries from Latin America (LA-6) and Asia (A-5).⁹ Overall, we have information on annual financial statements of 507 individual banks that add up to about 5600 bank observations distributed across countries as shown in Table 2.1. On average the banking sectors consist of 45 banks, most banks have been operating in Argentina, Indonesia and Malaysia.

We follow Calvo, Izquierdo, and Mejia (2004) and identify a sudden stop episode by the following three criteria: (1) the episode includes at least one observation where the year-to-year fall in quarterly (net) capital inflows lies at least two standard deviations below its sample mean; (2) the sudden stop episode begins (ends) when the year-to-year

⁸A more detailed data description is given in Appendix 2.5.

⁹LA-6 includes Argentina, Bolivia, Chile, Mexico, Peru, and Uruguay, while A-5 includes Indonesia, South Korea, Malaysia, Thailand, and the Philippines.

fall (rise) in capital inflows falls (rises above) one standard deviation below its sample mean; and (3) there is an associated output contraction.¹⁰

The particular dates and durations of the identified sudden stops are reported in Table 2.1. Argentina and Bolivia appear to be most vulnerable to sudden stops, both experienced a sudden stop more than once. The duration differs remarkably, the longer lasting sudden stops occurred in Argentina 1998, Uruguay, the Philippines and Thailand. Note also that the considered sudden stops bunch together, especially in the Asian region during the crises years of 1997-98 pointing to international contagion effects. The average reversal in capital inflows amounts to 8% of GDP being highest in Argentina 2001-02, Uruguay, and Thailand, see Figure 2.1.

BankScope provides information on bank history, bank specialization, foreign shareholders, and the balance sheet and income statements. A shortcoming is that there is no currency decomposition and in most cases no maturity decomposition of loans, deposits and non-deposit funding. BankScope reports consolidated and unconsolidated financial statements, here, we use unconsolidated figures to the extent possible to reduce variations arising from changes in a subsidiary's ownership and to work with comparable accounting data. The majority of banks reports the financial statement at the end of year, others report in March, June or September.¹¹ Central banks and observations for which the growth rate of particular balance sheet positions (loans, deposits and total assets) exceeds 300% in absolute terms are excluded from the sample.

Figure 2.2 shows over time the sum of bank loans for each country divided by GDP. In A-5, bank loans are on average more important reaching 150% in Malaysia and 100% in Korea as opposed to less than 60% in most Latin American countries. This highlights that the domestic leverage in A-5 is far greater than in LA-6. In most cases, our sample of banks represents about 80-90% of total domestic bank credit published in the IFS database. An interesting finding is that most of the sudden stops are associated with a drop in aggregate bank loans over GDP by 10-15% recovering after 3-5 years. Exceptions are Bolivia, Indonesia and Thailand where bank lending decreases permanently.

Figure 2.3 shows average capital inflows as a share of GDP and the dollar value of average loans and deposits per region over time. Interestingly, most of the systemic sudden stops, i.e. those that occurred during the period 1994-95 and 2001-02 in LA-6 and those of 1997-98 in A-5, are associated with sharp contractions in the average lending

¹⁰The first and second moments of capital inflows are calculated using a rolling window including the 12 previous quarters of each period to capture better the surprise element of sudden stops.

¹¹For the econometric investigation, macroeconomic variables are assigned to individual banks taking this into account by using annualized quarterly data to the extent possible. Equally, a bank-specific dummy variable is constructed that equals to 1 during a sudden stop period and 0 elsewhere. In addition, we required that the sudden stop lasted at least 2 quarters of the associated financial year.

and deposit volume ranging from 15-30%. Deposits recover in most cases after 1-2 years more rapidly than loans which take 3-5 years to come back to their level prior to the sudden stop. In both regions, the difference between deposits and loans becomes larger since 1997-98. On the one hand, this finding may be explained by supply-side factors such as banks' diminished capacity or increased unwillingness to lend. Several countries in these regions imposed risk-based capital requirements (Basel Accord) at that time which may have caused banks to shift their asset composition away from loans towards assets with a lower risk weight.¹² On the other hand, this finding may be driven by a fall in loan demand which could be triggered by the slowdown in economic activity.

To distinguish between banks with different financial positions and characteristics, we use measures for bank size, asset liquidity, capitalization, currency mismatch, and foreign ownership. The size of an individual bank in a given year and country is measured by the ratio of a bank's total assets to the country average of total assets in a given year. Asset liquidity is measured by the ratio of the sum of cash holdings, deposits with banks, and trading securities over total assets, and capitalization by the ratio of total equity over total assets. A dummy variable that identifies foreign banks is constructed based on the BankScope information on the origin of the majority shareholders. More specifically, a bank is categorized as a foreign bank, when a foreign parent company owns at least 50% of a bank's equity. As mentioned, there is no direct measure for the currency composition of assets and liabilities, and we construct a rough measure based on the following relationship: a difference between net income and the change in equity which is close to the associated currency depreciation times total liabilities indicates a full currency mismatch.¹³ To calculate the measure of currency mismatch, we consider all periods with currency depreciations that are larger than 10% and classify a bank as one with an important currency mismatch when the difference between net income and the change in equity lies in the interval between 0.5 and 1 times the product of the currency depreciation and total liabilities.

Differences in the average structure of the banking sectors in LA-6 and A-5 are highlighted in Figure 2.4, which shows over time the average bank size in terms of total assets in US\$, liquidity, capitalization, and the share of foreign bank assets in total assets. Firstly, the banks that operate in A-5 are larger on average than the Latin American banks with

¹²For the case of Latin America, see Barajas, Chami, and Cosimano (2005).

¹³Consider the example of a full currency mismatch: a bank grants all loans L in domestic currency and finances them with dollar debt D . Abstracting from other assets and external funds, the balance sheet in domestic currency can be written as $L = eD + E$, where e denotes the exchange rate and E equity. The resource constraint is given by $\dot{L} = \Pi + e\dot{D}$, where Π denotes net income and \dot{x} a change in x . Total differentiating the balance sheet identity and using the resource constraint leads to $e\dot{D} = \Pi - \dot{E}$, i.e. the adverse stock effect due to a depreciation can be measured by the difference of net income and the change in equity.

an increasing trend. The largest banks operate in the largest economies Korea and Mexico. For instance, the average Korean bank is more than 10 times larger than the average bank in Bolivia, Chile, Peru and Uruguay. In Table 2.2 are listed the 12 largest banks of each region, interestingly the 6 largest banks operate in Korea. Moreover, 9 out of the largest banks are owned by a foreign parent company. Average liquidity evolves similarly over time in the two regions rising from 16-18% in 1993 to 18-20% in 2002. In LA-6, banks from Bolivia and Uruguay hold on average less liquid assets (10%) than the other Latin American banks, while in A-5 this is the case in Indonesia and Thailand (15%). Average capitalization is increasing over time in both regions and higher in LA-6 than in A-5 reaching 23% and 19% in 2002, respectively. In Bolivia, Peru, Korea and Thailand, banks' average capitalization is lowest ranging from 10 – 15% over the whole sample. Finally, foreign bank participation is far greater in LA-6 (30%) than in A-5 (10%) and increasing over time. The market share of foreign banks in 2002 exceeds 50% in Argentina, Bolivia, Mexico and Peru. About 75% of foreign banks in LA-6 come from Spain and the United States, while the largest share of foreign banks in A-5 comes from Japan.

To test statistically for cross-sectional differences in the response of bank lending to sudden stops, the following fixed effects regression is estimated:

$$L_{i,c,t} = \alpha_i + \beta X_{c,t} + \gamma Z_{i,c,t} + \delta d_{i,c,t}^{ss} + \beta^* X_{c,t} d_{i,c,t}^{ss} + \gamma^* Z_{i,c,t} d_{i,c,t}^{ss} + u_{i,c,t}, \quad (2.1)$$

where $i = 1, \dots, N$ refers to individual banks, $c = 1, \dots, C$ to countries and $t = 1, \dots, T_i$ to the time dimension. The dependent variable $L_{i,c,t}$ denotes a bank's growth rate of real total loans (net of problem loans) and α_i bank-level fixed effects. The country-specific variables $X_{c,t}$ control for changes in economic and financial conditions.¹⁴ The bank-specific variables $Z_{i,c,t}$ include the measures for bank size, asset liquidity, capitalization, currency mismatch and foreign ownership.¹⁵ The sudden stop dummy variable is denoted by $d_{i,c,t}^{ss}$. Both the country- and bank-specific variables are interacted with the sudden stop dummy. The key issue is interpreting the coefficients γ^* . For instance, if we find after controlling for other bank characteristics that well-capitalized banks increase their real lending volume by more than poorly-capitalized banks, then the associated coefficient in the vector γ^* should be significantly larger than zero.

¹⁴In the estimations, we include real GDP growth, the real domestic money market rate, and a real 'international' interest rate (proxied by the federal funds rate). To control for changes in the domestic value of the lending volume caused by currency depreciations (due to the fact that parts of debt may be denominated in foreign currency), the period's currency depreciation is included.

¹⁵Due to potential endogeneity problems which would lead to inconsistent OLS estimates, three of these measures enter the regression with one lag. To be more precise, with regard to the size category there is a possible joint determination since a bank may become larger, precisely, because of a large loan growth. Similar problems arise with capitalization and asset liquidity.

Table 2.3 shows the estimation results for LA-6 and Table 2.4 for A-5. Three different specifications are considered: (1) all mentioned variables enter the regression except for the currency depreciation and the measure for currency mismatch; (2) specification (1) is augmented by the currency depreciation; and (3) all variables are included. First of all, the target coefficients γ^* and δ are largely robust across the three specifications. Other things equal, sudden stops are associated with a significant reduction in loan growth by 11% in LA-6 and 35% in A-5 after controlling for macroeconomic conditions and bank-specific characteristics. In the case of Latin American banks, we find evidence for significant cross-sectional differences. Other things equal, a 1% higher capitalization is on average associated with 0.6% higher loan growth during sudden stops. Given capitalization, foreign banks have a 12% higher loan growth rate during sudden stops than domestic banks. In the case of Asian banks, we reach the same conclusion with respect to foreign banks. Their loan growth is on average 14% higher than that of domestic banks during sudden stops. We find no evidence that asset liquidity, bank size, and currency mismatch are significant determinants of lending during sudden stops. During tranquil times, the coefficients associated with liquidity and capitalization are significantly positive in the two regions. Given the size of a domestic bank, loan growth is higher with higher levels of capitalization and liquidity. The coefficient associated with the size category is in both cases significantly negative indicating that the lending volume of larger banks grows less than that of small banks during tranquil times.

The same regressions are estimated for two distinct types of sudden stops, namely, those that are associated with major currency depreciations and those that are not.¹⁶ Table 2.5 shows the results for the sudden stops associated with major currency depreciations, and Table 2.6 shows the results for the remaining sudden stops. On average and other things equal, the reduction of loan growth during sudden stops is 3 times higher when there is an associated currency depreciation. Interestingly, we find in all specifications that loan growth of well-capitalized banks is significantly higher than that of poorly-capitalized banks given other things are equal. Foreign banks increase their lending volume significantly more than domestic banks, only, when sudden stops are not associated with large currency depreciations.

A similar investigation is conducted for the real growth rate of deposits and equity. The estimation results for specification (2) per region are shown in Table 2.7.¹⁷ Interestingly, in both regions foreign banks have a significantly higher growth rate of deposits during sudden stops than domestic banks, notably, after controlling for the currency depreciation. In A-5, we find similar results in the case of well-capitalized banks. More

¹⁶The sudden stops associated with major currency depreciations ($> 30\%$) are those in Mexico, Thailand, Indonesia, Uruguay, the Philippines, Malaysia and Korea.

¹⁷Note that the previous results obtained for loan growth are reproduced in the first column.

specifically, a 1% high capitalization implies a 1.3% higher growth rate of deposits during sudden stops given other things are equal. Both findings may be explained by 'reputation effects', which resulted in a more stable deposit base and explain why well-capitalized banks had a higher loan growth during sudden stops.

2.4 Conclusion

In the present paper, we test for cross-sectional differences in the way domestic bank lending is affected during sudden stops. As motivated in Section 2.2, the lending volume of large, liquid, well-capitalized, and foreign banks, and that of banks without a currency mismatch, is likely be less affected by a sudden stop than that of banks with the opposite features.

Our empirical investigation reached a few results that are worth summarizing. For the banking sectors as a whole, we find evidence that sudden stops are associated with contractions in the domestic lending volume in the order of 10-15% of GDP. Moreover, we find evidence that well-capitalized and foreign banks increase their lending volume relative to the other banks. In addition, we find evidence that this finding is partly due to the fact that these banks had on average a more stable deposit base during sudden stops than the other banks. Therefore, banking sectors with higher capitalization and foreign bank presence tend to attenuate the adverse effects of sudden stops on the domestic lending volume and strengthen, therewith, the affected economies. Our findings also suggest that bank size, maturity, and currency mismatches are of second order importance, once bank capital and foreign ownership are taken into account.

2.5 Appendix

Data:

Bank-level data comes from Fitch IBCA/Bureau van Dijk's BankScope database, versions 2002 and 2004. **Macroeconomic data** comes from International Financial Statistics, International Monetary Fund, version 2006. The included variables are: GDP (series 99B), GDP deflator (series 99BIP), money market rate (series 60B)¹⁸, financial account (series 78BJD), consumer price index (series 64ZF), federal funds rate (series 60B), and the market exchange rate (series RF)

¹⁸For the countries Bolivia, Chile, Peru, and Uruguay deposit rates (series 60L) were used instead, because of missing information on money market rates. Real interest rates were calculated by the difference in nominal interest rates and CPI inflation.

Table 2.1: Overview of the dataset and sudden stop episodes per country

Country	Bank year obs.	Av. number of banks	Average no. of obs. per bank	Sudden stops of capital inflows ^a
Argentina	1151	106	11	Q4/94-Q1/95 Q2/98-Q3/99 Q4/00-Q3/01
Bolivia	177	14	13	Q2/99-Q3/99 Q4/02-Q3/03
Chile	378	32	11	Q1/98-Q4/98
Mexico	486	47	10	Q4/94-Q1/95
Peru	270	32	8	Q3/97-Q1/98
Uruguay	280	38	7	Q2/02-Q3/03
Indonesia	860	66	13	Q3/97-Q1/98
Korea	454	35	13	Q3/97-Q1/98
Malaysia	738	63	12	Q3/97-Q1/98
Philippines	447	43	10	Q3/97-Q3/98
Thailand	412	31	13	Q2/96-Q4/97
Sum/average*	5653	507	11*	14

^a The sample period is 1992 to 2004. Sudden stops of capital inflows are identified as in Calvo, Izquierdo, and Mejia (2004).

Table 2.2: Largest banks in the sample as of 2003

Latin America ^a			East Asia		
Bank name		TA in mil.\$	Bank name		TA in mil.\$
BBVA Bancomer	MX	43,244.45	Kookmin Bank	KR	154,328.23
BANAMEX	MX	41,706.95	Woori Bank	KR	86,583.25
Banco Santander Serfin	MX	27,764.04	Hana Bank	KR	69,010.90
Nacional Financieras SNC	MX	20,932.95	Industrial Bank of Korea	KR	60,022.47
Banco Santander Chile	CL	19,878.45	Shinhan Bank	KR	58,752.14
HSBC Mexico	MX	18,013.53	Korea Exchange Bank	KR	52,447.68
Banco del Estado de Chile	CL	14,977.85	Chohung Bank	KR	49,615.63
BANORTE	MX	14,953.08	Malayan Banking	MY	37,776.61
Banco de Chile	CL	17,744.21	Citibank Korea	KR	36,056.18
BANOBRAS	MX	13,205.06	Bangkok Bank	TH	34,294.27
BCI	CL	10,635.82	Islamic Bank of TH	TH	29,381.16
Scotiabank Inverlat	MX	9,297.63	Bank Mandiri	ID	29,038.16

^a Bold letters indicate that a bank is partly owned by a foreign parent company.

Table 2.3: Estimation results for LA-6

Method: Panel least squares, Sample: 1992 2004			
Cross-section fixed effects			
Dependent Variable: ^a			
Growth rate of real total loans			
GDP growth	0.44**	0.44**	0.44**
money market rate	-0.54**	-0.56**	-0.56**
GDP growth(-1)	0.24**	0.23**	0.23**
money market rate(-1)	-0.31***	-0.32***	-0.32**
US money market rate	5.44***	5.62***	5.62***
depreciation	–	0.01	0.01
size(-1)	-0.07***	-0.07***	-0.07***
capitalization(-1)	0.87***	0.88***	0.88***
liquidity(-1)	0.64***	0.64***	0.64***
foreign	-0.24*	-0.24*	-0.24
size(-1)*SS	0.00	0.00	0.00
capitalization(-1)*SS	0.62***	0.58***	0.59***
liquidity(-1)*SS	-0.09	-0.11	-0.12
foreign*SS	0.12*	0.12*	0.09
high \$ debt*SS	–	–	0.06
SS	-0.08	-0.11*	-0.11*
R^2	0.11	0.11	0.12
Cross-sections	348	348	348
Observations	2069	2069	2069

^a SS indicates the sudden stop dummy variable, and (**, **, *) indicate significance at the 1%, 5% and 10% level based on robust standard errors. The included countries are Argentina, Mexico, Peru, Uruguay, Bolivia and Chile. Note that the coefficients associated with the interaction terms between the macroeconomic control variables and the sudden stop dummy are not reported.

Table 2.4: Estimation results for A-5

Method: Panel least squares, Sample: 1992 2004			
Cross-section fixed effects			
Dependent Variable: ^a			
Growth rate of real total loans			
GDP growth	1.85***	1.87***	1.86***
money market rate	0.15	0.19	0.19
GDP growth(-1)	0.72***	0.72***	0.72***
money market rate(-1)	-2.13***	-2.07***	-2.07***
US money market rate	2.53***	2.51***	2.52***
depreciation	–	-0.02	-0.02
size(-1)	-0.06***	-0.06***	-0.06***
capitalization(-1)	2.26***	2.25***	2.25***
liquidity(-1)	0.41***	0.41***	0.41***
foreign	0.08	0.09	0.09
size(-1)*SS	0.00	0.00	0.00
capitalization(-1)*SS	-0.17	-0.22	-0.25
liquidity(-1)*SS	-0.07	-0.02	-0.01
foreign*SS	0.18***	0.18***	0.19***
high \$ debt*SS	–	–	0.07
SS	-0.38*	-0.35*	-0.31
R^2	0.23	0.23	0.24
Cross-sections	384	384	384
Observations	2193	2193	2193

^a SS indicates the sudden stop dummy variable, and (**, **, *) indicate significance at the 1%, 5% and 10% level based on robust standard errors. The included countries are Thailand, Indonesia, Philippines, Malaysia and Korea. Note that the coefficients associated with the interaction terms between the macroeconomic control variables and the sudden stop dummy are not reported.

Table 2.5: Estimation results for sudden stops coupled with major depreciations

Method: Panel least squares, Sample: 1992 2004			
Cross-section fixed effects			
Dependent Variable: ^a			
Growth rate of real total loans			
GDP growth	1.48***	1.61***	1.61***
money market rate	0.32	0.56*	0.56***
GDP growth(-1)	0.13	0.15*	-0.15**
money market rate(-1)	-0.37***	-0.27**	-0.27**
US money market rate	1.64**	1.90***	1.91***
depreciation	—	-0.18***	-0.18***
size(-1)	-0.07***	-0.07***	-0.07***
capitalization(-1)	1.18***	1.16***	1.16***
liquidity(-1)	0.49***	0.48***	0.48***
foreign	0.09	0.09	0.09
size(-1)*SS	0.00	0.00	0.00
capitalization(-1)*SS	0.85***	0.87***	0.87***
liquidity(-1)*SS	-0.17	-0.15	-0.12
foreign*SS	0.10*	0.10*	0.11
high \$ debt*SS	—	—	0.05
SS	-0.28**	-0.34**	-0.36**
R^2	0.14	0.15	0.15
Cross-sections	495	495	495
Observations	2752	2752	2752

^a SS indicates the sudden stop dummy variable, and (**, *, *) indicate significance at the 1%, 5% and 10% level based on robust standard errors. The included countries are Mexico, Thailand, Indonesia, Uruguay, Philippines, Malaysia and Korea. Note that the coefficients associated with the interaction terms between the macroeconomic control variables and the sudden stop dummy are not reported.

Table 2.6: Estimation results for sudden stops coupled with minor depreciations

Method: Panel least squares, Sample: 1992 2004			
Cross-section fixed effects			
Dependent Variable: ^a			
Growth rate of real total loans			
GDP growth	0.17	0.34	0.33
money market rate	-1.02***	-1.21***	-1.20***
GDP growth(-1)	0.20	0.16	0.16
money market rate(-1)	-0.54***	-0.65***	-0.65**
US money market rate	5.80***	6.49***	6.46***
depreciation	–	0.05*	0.05
size(-1)	-0.09***	-0.09***	-0.09***
capitalization(-1)	0.80***	0.78***	0.78***
liquidity(-1)	0.62***	0.63***	0.63***
foreign	-0.24*	-0.23*	-0.23
size(-1)*SS	0.00	0.00	0.00
capitalization(-1)*SS	0.34*	0.35*	0.37*
liquidity(-1)*SS	-0.16	-0.16	-0.17
foreign*SS	0.17**	0.17**	0.18**
high \$ debt*SS	–	–	0.24
SS	-0.10	-0.11*	-0.13
R^2	0.13	0.13	0.15
Cross-sections	237	237	237
Observations	1510	1510	1510

^a SS indicates the sudden stop dummy variable, and (**, *, *) indicate significance at the 1%, 5% and 10% level based on robust standard errors. The included countries are Argentina, Peru, Bolivia and Chile. Note that the coefficients associated with the interaction terms between the macroeconomic control variables and the sudden stop dummy are not reported.

Table 2.7: Estimation results for deposits and equity

LA-6			
	Loans	Deposits	Equity
size(-1)	-0.07***	-0.07**	-0.05***
capitalization(-1)	0.88***	0.99***	-0.11
liquidity(-1)	0.64***	0.00	0.10
foreign	-0.24*	-0.19	-0.29**
size(-1)*SS	0.00	-0.00	-0.00
capitalization(-1)*SS	0.58***	-0.07	-0.12
liquidity(-1)*SS	-0.11	-0.16	-0.13
foreign*SS	0.12*	0.14**	0.11**
SS	-0.11*	-0.06	0.13**
R ²	0.11	0.07	0.06
Cross-sections	348	347	363
Observations	2069	2081	2156
A-5			
	Loans	Deposits	Equity
size(-1)	-0.06***	-0.03**	-0.05***
capitalization(-1)	2.25***	3.66***	-1.14***
liquidity(-1)	0.41***	-0.14*	-0.13*
foreign	0.09	0.06	0.13
size(-1)*SS	0.00	0.00	-0.00
capitalization(-1)*SS	-0.22	1.27***	-0.77*
liquidity(-1)*SS	-0.02	-0.82*	-0.01
foreign*SS	0.18***	0.16**	-0.07
SS	-0.35*	-0.04	-0.34*
R ²	0.23	0.11	0.11
Cross-sections	384	392	392
Observations	2193	2202	2202

^a The results of specification (2) are reported. Note that only the coefficients associated with the sudden stop dummy and the bank-specific variables are reported in this Table. As controls we use as before real GDP growth, the real interest rate, and currency depreciation. SS indicates the sudden stop dummy variable, and (***, **, *) indicate significance at the 1%, 5% and 10% level based on robust standard errors.

Figure 2.1: Annual net capital inflows per GDP

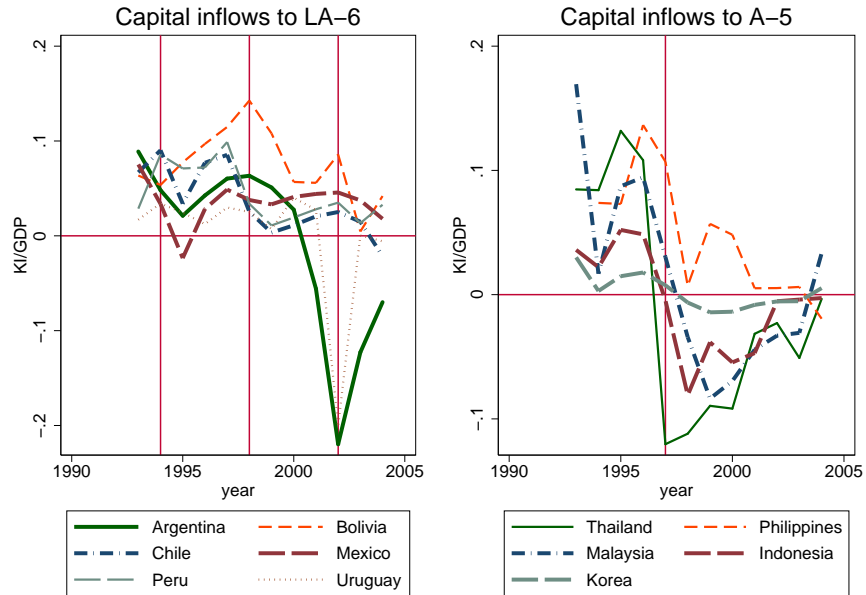


Figure 2.2: Bank loans over GDP

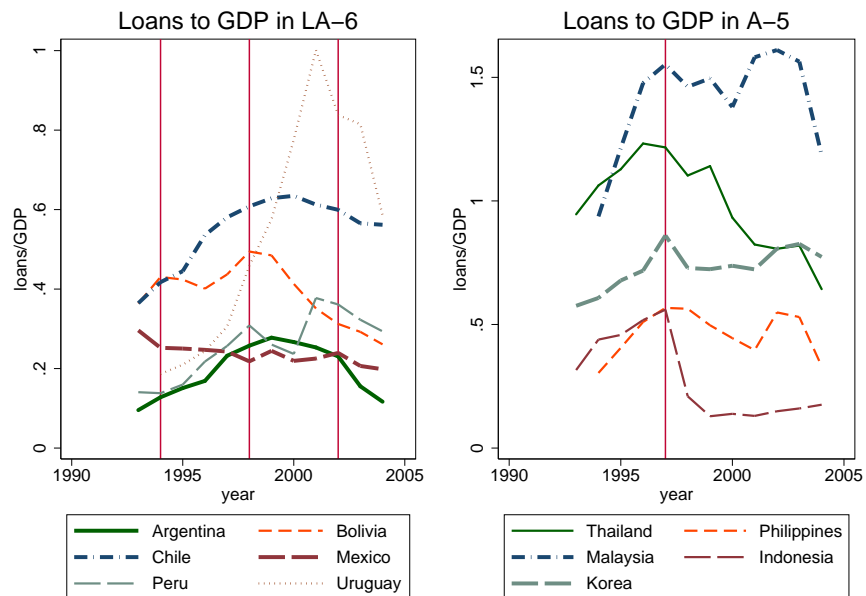


Figure 2.3: Capital flows and the average banks' lending and deposit volume

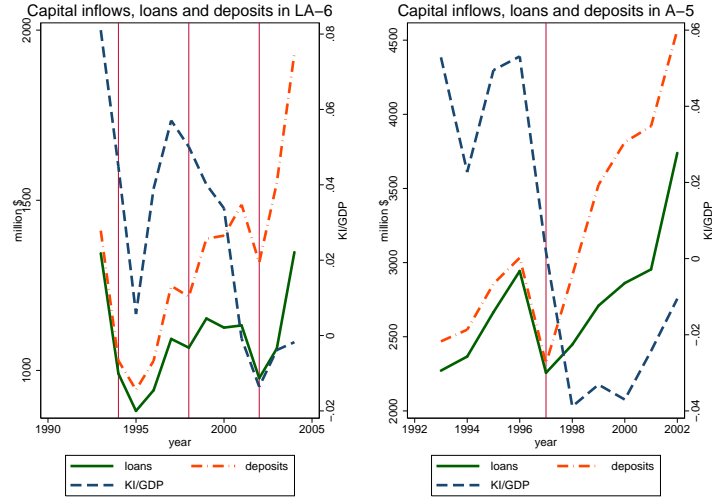
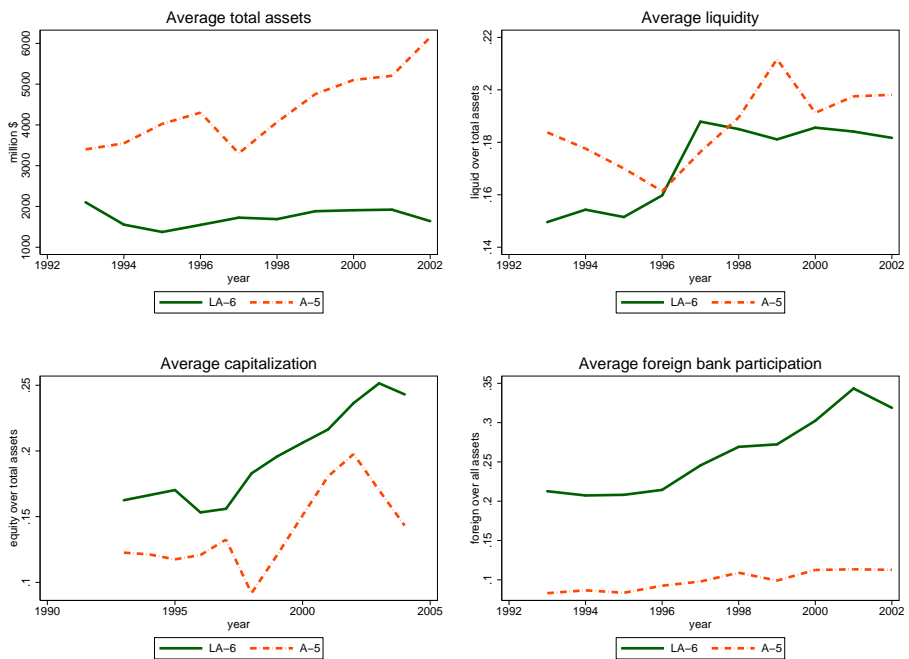


Figure 2.4: Average bank size, liquidity, capitalization, and foreign bank participation



Chapter 3

Currency Depreciations, Financial Transfers, and Firm Heterogeneity

Michael Brei and Matthieu Charpe ¹

In the present paper, we investigate the distributive aspects of currency collapses using financial statements of Argentine, Brazilian, and Mexican firms. We focus on two aspects, namely, on income transfers from borrowing firms to lenders as well as on firms' heterogeneity. These two aspects are addressed by decomposing firms' income into its real and financial components, and by making use of panel regressions to identify the determinants of firms' income during the currency collapses. We find evidence that income and wealth transfers increase substantially with the currency depreciations. Moreover, most affected are firms with foreign-currency debt and local-currency income. The distributive issues of currency depreciations are further explored within a partial equilibrium model of firms with varying income and debt structures.

Keywords: Currency crises, income distribution

JEL Classification: F34, E24

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3.1 Introduction

Despite the growing literature on currency crises, a central aspect has been understudied, namely the distributive aspect of currency crises.² Although theories that link the income distribution and macroeconomic dynamics are longstanding, their application to the case of currency crises has been largely unquestioned or left in the background. This paper studies the distributive aspects of currency depreciations and their impact on macro dynamics along two dimensions: (1) the effect of currency depreciations on the income distribution between borrowers and lenders, and (2) the role of borrowers' heterogeneity in explaining the associated effects on the income distribution.

First, currency crises involve distributive issues between borrowers and lenders both in terms of flows and stocks. Debt accumulation in foreign currency raises income transfers from domestic borrowers to foreign lenders. Moreover, an exchange rate depreciation raises the domestic-currency value of the stock of foreign-currency liabilities and translates into a transfer of wealth from domestic borrowers to foreign lenders. In addition, interest payments in domestic currency increase both due to the stock effect and an associated increase in the risk premium on external finance caused by the reduction in wealth (Bernanke, Gertler, and Gilchrist (1996)). In return, these transfers have macroeconomic feedback effects as they affect firms' investment decisions.³ Put differently, these transfers are not neutral as they take place from agents with a large propensity to spend toward agents with a large propensity to save. In this perspective, it shares similarities with Irving Fisher's and Hyman Minsky's theories of financial crises.⁴ Second, another distributive issue is related with firms' heterogeneity. Heterogeneity implies that firms are not affected evenly by currency crises and that there might be firms benefiting and firms losing from an exchange rate depreciation. It is therefore crucial to identify along the dimensions in which currency crises affect firm dynamics. In our work, two dimensions are stressed: the degree to which firms are indebted in foreign currency, and the degree to which firms have foreign-currency income.

The empirical part investigates and compares five episodes of large currency depreciations from the perspective of non-financial firms operating in Argentina, Brazil, and Mexico. We first decompose firms' profit statements. Compared to investment, which

²Halac and Schmukler (2003) is an exception.

³It is reminiscent to Fisher (1933)'s 'debt-deflation' argument that redistributions between creditors and debtors arising from unanticipated price changes can have important real effects. Indeed, Fisher argued that this kind of mechanism accounted for the depth of the Great Depression. To the extent that loans from abroad are denominated in units of a foreign currency, an exchange rate collapse redistributes wealth from domestic borrowers to foreign lenders.

⁴Minsky (1964) stresses the increasing income transfers linked with debt accumulation and interest payments.

is the usual variable considered, profitability has a distributive aspect as it measures the surplus generated by firms, and its components give a clear picture of the income distribution between the borrowing firms and their lenders. We find evidence that the currency depreciations are preceded and associated with sharply rising financial payments (transfers from firms to lenders), and that the firms' debt and income structure is central in explaining the asymmetric firm dynamics.

Second, we estimate panel regressions for each country to test whether the currency composition of income and finance affects significantly firms' income during large currency depreciations. In particular, we stress the impact of being indebted in foreign currency as well as being an exporter. This part shares some similarities with existing works by Bleakley and Cowan (2002) as well as Aguiar (2005). Our value added is that we make use of quarterly data for Argentina, Brazil, and Mexico, whereas the previous attempts relied on annual data and focused on a single economy. Our study has therefore a comparative dimension.

Third, we develop a partial equilibrium model of firms which links the firms' currency composition of income and finance, their income distribution, and firm dynamics. This part builds on general equilibrium models such as those of Aghion, Bacchetta, and Banerjee (2004) and Cespedes, Chang, and Velasco (2000), which stress the importance of microeconomic distortions, currency mismatches, and debt accumulation in explaining contractionary currency depreciations. Our model shares features with the partial equilibrium models developed in Cooper and Ejarque (2003) and Gilchrist and Sim (2007). The model is calibrated to reproduce the dynamics of firms' income in response to an unexpected currency depreciation as a function of the degree to which firms are indebted in foreign currency, and the degree to which firms have income in foreign currency.

The remainder of the paper is organized as follows. In Section 3.2, average profit is decomposed into its real and financial part and examined separately for the three economies over time. The profit decomposition is done as well for the following groups of firms: high versus low exporters, and firms with high versus low levels of foreign-currency debt. In Section 3.3, we present the econometric results, and in Section 3.4 the theoretical model. The final section concludes.

3.2 Income decompositions

In this section, firms' net income is decomposed into its real and financial parts measured by earnings before interest and taxes (EBIT) and net financial payments, respectively. This decomposition gives a clear picture of the income distribution between the borrow-

ing firms and their lenders during periods of exchange rate depreciations. Thereafter, firms' heterogeneity is taken into account by reproducing the former income decomposition for two groups of firms: high vs. low export firms, and firms with high vs. low levels of liability dollarization. This allows us to address the asymmetric effects of exchange rate depreciations on firms' income distribution. The investigation is conducted on five episodes of exchange rate depreciation:⁵ Argentina's crisis of 2001-02 with a depreciation of 200% with respect to the US\$; Brazil's currency crisis of 1998-99 and confidence crisis of 2002 with depreciations of 70% and 50%, respectively; and Mexico's Tequila crisis of 1994-95 and its milder economic slowdown of 1998 with depreciations of 125% and 20%.

The underlying firm-level data comes from *Economática* which is a quarterly database on firms' profit and balance sheet statements for particular Latin American economies.⁶ The data was merged with data from Kamil (2004). Overall, we have information on more than 10000 quarterly financial statements of about 230 Brazilian, 100 Mexican, and 80 Argentine publicly listed, non-financial firms over the period 1992-2004.⁷

Figure 3.1 shows average net income, EBIT and net financial payments as a proportion of total assets for each country.⁸ First, firms across the countries have in common that net financial payments increase by more than the real part in the run up to the crises. Net income decreases consequently before crises and firms are financially more fragile. Second, financial payments reach high levels during the crises episodes. By increasing the domestic value of foreign-currency debt and the external finance premium, the associated depreciations increase the average burden of financial payments. The ratio of net financial payments to total assets increases by much more during the Argentine crisis than that of Brazilian and Mexican firms reaching 15% opposed to 4% in Brazil and 2% in Mexico. From a distributive perspective this means that the rise in the financial burden increases the income flows from the borrowing firms to their lenders. Third, the exchange rate depreciations have contrasting effects on real profitability (EBIT over total assets) indicating that the relative sizes of export sectors differ across the considered economies. In Argentina

⁵Box 1 in Appendix 3.6 describes the considered episodes from the macroeconomic perspective with a focus on the key vulnerabilities of each economy.

⁶A more detailed description of the data can be found in Appendix 3.6.

⁷Although the number of firms is small, *Economática* is to our knowledge the largest firm-specific data set on Latin American firms that provides the required information for our analysis. For all countries, the sum of the firms' net operating revenues over GDP is about 30%. There is certainly a sample bias with respect to large enterprises with foreign participation.

⁸The aggregation method is as follows: we sum the particular variable at each date over all firms and divide it by the sum of total assets. Note that EBIT minus financial payments is not equal to net income as taxes are omitted. The investigation was also done using fixed assets and equity as scaling variable instead of total assets. The main conclusions hold. The Figures show weighted moving averages to remove seasonal variations.

the currency depreciation has a weak positive effect on EBIT, in contrast to Brazil and Mexico where EBIT increases substantially. This evidence explains in part the shapes of the economic rebound. In addition, Figure 3.1 shows aggregated firms' net wealth over total assets for each country. The exchange rate depreciations have a strong negative impact on net wealth in the presence of liability dollarization. The balance sheet effects involve a transfer of wealth from the borrowing firms to their lenders. The effects are strongest in Argentina and Mexico (in 1994-95) which are associated with drops in net wealth in the order of 15% of total assets. In Brazil, the balance sheet effect is much weaker with net wealth declining by 5% of total assets in 1999. The asymmetric effect across countries can be explained by the fact that the currency mismatch is larger in Argentina and Mexico where the average share of dollar-denominated liabilities in total assets reaches 75% in the event of crises opposed to the share of dollar-denominated assets and exports which amount to about 20% of total assets. In contrary, Brazilian firms have on average a relatively small currency mismatch where the share of dollar-denominated liabilities in total assets amounts to 25% in 1999 and dollar-denominated assets and exports to 10% of total assets. Finally, there is also evidence of an interest rate effect. Figure 3.1 shows JP Morgan's EMBI+ spread which is an aggregate measure of the country-specific risk premium on dollar denominated bonds. It contributed as well to amplify income transfers to lenders.

The previous graphs show that firms may face difficulties to meet financial commitments due to the exchange rate depreciation. Low dollar debt firms and exporting firms, however, may be relatively unaffected by the exchange rate depreciation. Consequently, currency crises are likely to have asymmetric effects at the firm level. This is confirmed by Figures 3.2 and 3.3, which compare the income decomposition between firms with high and low levels of liability dollarization, and between high and low export firms.⁹ In all countries, high dollar debt firms are more affected by exchange rate depreciations than low dollar debt firms. In Argentina, Brazil, and Mexico, financial payments of high dollar debt firms are twice as high as those of low dollar debt firms during crises. Moreover, the currency mismatch between income and liabilities differs among the affected economies. While the match between foreign debt and foreign income is absent in Argentina, it is strong in Mexico and in Brazil as EBIT of high dollar debt firms increases strongly from 4 to 6% and from 5 to 8%, respectively. One may conclude that Brazilian firms had some sort of natural hedge against exchange rate risk to the extent that firms with foreign-currency debt are those firms with a large fraction of income in foreign-currency. In all cases with the exception of Mexico in 1998 high export firms benefit from the depreciations and recover quickly reaching higher profits than before. In Argentina,

⁹In Section 3.3, there is a detailed description of our measures for the firm categories.

real profitability of high exporters increases from 6% in 2001 to 10% in 2002, in Brazil it increases from 5% in 1999 to 10% in 2002, and in Mexico from 4% in 1994 to 6% in 1995. While net income drops in the early stage of the crises, it rebounds quickly and goes beyond the pre-crisis level. If low export firms improve their real profitability, the change is much more modest.

Overall, we find evidence that the interaction between currency depreciation and finance generate important income and wealth transfers from borrowers to lenders. In addition, firms' trajectories become increasingly heterogeneous. In most cases, the sharp rise in financial payments dominates the evolution of the firms' profits, especially when low levels of exports are coupled with high levels of foreign-currency denominated debt as demonstrated in the case of Argentina. One might ask why did the firms take on foreign-currency debt and did not hedge their currency exposure with currency swaps or futures. First, fixed exchange rate systems increase the risk that borrowers underestimate currency risk and rely too much on foreign-currency debt (as has been the case in Argentina before 2002, in Brazil before 1999, and in Mexico before 1994). Second, appropriate hedge instruments might not be available because domestic financial markets are underdeveloped, or they might be too expensive in these countries. Moreover, if a crisis is systemic, firms in distress might expect a bailout by the government and take on excessive financial risks.

3.3 Econometric results

This section provides statistical tests of the evidence from the descriptive statistics presented in the previous section using dynamic panel regression techniques. We test for two distributive dimensions: firms-lenders income transfers and firms' heterogeneity. With respect to the first distributive dimension, we focus mainly on income transfers between domestic firms and foreign lenders, rather than on wealth transfers. In the regressions, the dependent variable is firms' profitability. The firm-specific explanatory variables capture both the currency composition of income and finance. With respect to the second distributive dimension, we test whether exporting firms and firms with low dollar debt benefited from the currency depreciations. As a matter of fact, we test to what extent the competitiveness and balance sheet effects explain the firms' trajectories in response to the currency collapses.

The following reduced form specification is estimated for each economy:

$$y_{i,t} = \alpha_0 + \alpha_i + \beta_1 y_{i,t-1} + \beta_2 x_t + \beta_3 z_{i,t} + \beta_4 d_t + \beta_3^* z_{i,t} d_t + u_{it}, \quad (3.1)$$

where i refers to an individual firm and t to the time dimension. Moreover, $y_{i,t}$ denotes

the annual change in the ratio of net income to total assets (profitability), x_t a vector of macroeconomic variables controlling for changes in economic and financial conditions, $z_{i,t}$ a vector of firm-specific variables, and d_t denotes a dummy variable that identifies the periods of depreciation.¹⁰ The vector of firm-specific characteristics is interacted with the crisis dummy, i.e. if there is significant asymmetry in the way firms' profitability is affected, β_3^* should be significantly different from zero. This specification allows us to extract the direct impact of the firm-specific characteristics on profits during the depreciations after controlling for aggregate macroeconomic conditions and other information related to profits from the previous periods.

We distinguish between the following groups of firms: small vs. large firms, high vs. low exporters, and high vs. low dollar debtors. As a measure for the *firm size*, we use the ratio of a firm's total assets to the country average of total assets in a given year. In the case of Argentina and Brazil, a dummy variable that identifies firms with a high fraction of *dollar debt* is constructed, because the information on the currency composition of liabilities is annual in most cases. In particular, a firm is categorized as highly indebted in foreign currency when its average ratio of dollar debt in domestic currency to total liabilities lies in the upper 50% quantile of the distribution of the ratios of all firms in the same country. In the case of Mexico, there is no lack of information and the ratio of dollar debt to liabilities is used directly for estimation. Similarly, in many cases Argentine and Brazilian firms do not report the quarterly amount of *exports*. Here, we follow the same approach as before and construct a dummy variable that distinguishes high from low exporters. In the case of Mexico, there is no lack of information and exports over sales is used instead of a dummy variable.

Three specifications are estimated. In the baseline case, the only regressors are lagged profits, the measures on dollar debtors and exporters, and their interactions with the depreciation dummy. Second, the domestic real interest rate enters the baseline case. The interest rate is intended to control for aggregate domestic financial conditions and possible interest rate defenses of the exchange rate which cause higher aggregate financial costs during crises. Third, real GDP growth enters the second specification to extract the information related to the aggregate business cycle. And finally, the third specification is augmented by the measure on firm size. The size of a firm is a variable commonly found in the micro literature on firm performance. The results are nevertheless mitigated, i.e. it is difficult to distinguish the advantages and disadvantages related to the size of firms. Large firms may have stronger links with the banking sector what may be an advantage in time of credit rationing. But small firms may be in a better position to react to large

¹⁰To identify the precise dates of large currency depreciations, we require that the period includes at least one observation in which the depreciation lies one standard deviation above its sample mean. Except for Mexico in 1998, the depreciation actually jumped beyond the two standard deviations band.

shocks.

To estimate the dynamic panel regression, we use the panel variant of the Generalized Method of Moments (GMM) estimator proposed by Arellano and Bond (1991). As instruments for the lagged dependent variable, we use its 2nd to 4th lag, depending on the Hansen test of overidentifying restrictions. The other variables serve as their own instruments.¹¹ In all specifications we use robust standard errors and examine the following tests on misspecification: the Arellano-Bond test on autocorrelation and the Hansen test on overidentifying restrictions. Moreover, we exclude outliers before estimation by examining the distributions of the dependent variable. In all cases we exclude the 1% and the 99% quantiles.

The final estimation results are summarized in Tables 3.1 to 3.3 in Appendix 3.6. Concerning the results for Argentine firms presented in Table 3.1, the baseline estimation shows that profitability is positively autocorrelated. An increase in profitability by 1% is followed, *ceteris paribus*, by an increase in profitability of about 0.8%. There are five additional results. First, high exporters have a 1% lower profitability than low exporters over the whole sample. This result is consistent with theories which point out that capital account liberalization leads to exchange rate appreciation and a loss of competitiveness for the external sector (Tornell and Westermann (2002)). In this perspective some models interact Dutch disease models with models of currency crises (Kalantzis (2007)). Second, the coefficient associated with high dollar debtors is positive but not significant indicating that the currency composition of debt does not affect profitability during normal times. This result may point to the fact that the choice between domestic or dollar debt is not motivated by the level of interest rate paid, but rather by the inavailability of peso denominated funds conform with the Original Sin theory (Eichengreen, Hausmann, and Panizza (2002)). Third, the crisis of 2001-02 has a large negative impact on firms' average profitability, to be more precise, it entails a reduction in profitability of 6% for low exporters and low dollar debtors. Fourth, the balance sheet effect is measured by the interaction of the high dollar debt and the depreciation dummy. Being indebted in dollars has, as expected, a negative and significant effect on profitability, to be more precise, high dollar debt firms have a 4% lower profitability during the depreciation than low dollar debt firms. The share of income accruing to firms drops at the benefice of the share of income accruing to their lenders. As mentioned before, this result stems from the currency mismatch: stagnating or decreasing earnings are coupled with an increasing stock of debt and, therewith, a rise in financial transfers to foreign lenders. Fifth, the interaction term associated with the export dummy captures the competitiveness ef-

¹¹We decided to use the lag of firm size due to a potential endogeneity problem. To be more precise, there is a possible joint determination of a firm's profitability and its size, since a firm is likely to expand with high profits.

fect. The associated coefficient is positive and significant indicating that exporters have benefited from the associated depreciation. Interestingly, while exporters were negatively affected by the exchange rate overvaluation during the period of capital inflows, being an exporter becomes an advantage during episodes of currency depreciation. On average, the profitability of high exporters is 10% higher during the depreciation than that of low exporters. Profitability of high exporters that are low dollar debtors increases by 4%, while profitability of low exporters that are high dollar debtors decreases by 10% during the crisis. Introducing the real domestic interest rate as a control variable does not change the main results.¹² The coefficient on the interest rate is slightly insignificant. In the third specification, the coefficient associated with real GDP growth is positive but insignificant. The target coefficients on the export and debt variables are robust to the inclusion of the macroeconomic control variables and remain largely unchanged. The fourth specification introduces the firm size. The interaction term of size and the depreciation is negative and significant indicating that larger firms are more adversely affected. The interaction between the depreciation and dollar debt is no longer significant. This is due to the fact that size is positively correlated with the dollar debt variable, i.e. large firms tend to have more debt in dollars.¹³

The estimation results for Brazil are shown in Table 3.2. Again, profitability is significantly, positively autocorrelated in all specifications and the crisis dummies are negative and significant. There is one main result that differs from the Argentinean case: There is no evidence of a balance sheet effect as the coefficients associated with the interaction of the depreciations and dollar debt are insignificant. The exchange rate depreciation did not generate large income transfers from domestic firms to financial institutions. This confirms our previous findings, i.e. Brazilian firms had a smaller currency mismatch between income and liabilities and some sort of natural hedge. As in Argentina, there is evidence in favor of a competitiveness effect. High exporters have been less affected by the depreciations, i.e. their profitability decreased only by 1% in 1999 and 2002. On the contrary, profitability of low exporters decreases by 7% and 4%, respectively, with the currency collapses. High and low dollar debtors are evenly affected and exports make the difference. Given that the depreciations have been smaller than in Argentina and that the financial crisis was rather limited, it is reasonable to find smaller balance sheet effects. Introducing the macroeconomic control variables does not change the main results. In the fourth specification, the size variable is negative and significant over the sample. Smaller firms are on average more profitable than large firms during normal times. Contrary to Argentina, the size of a firm has no influence on its profitability during the depreciations.

¹²Interest rate is calculated as money market rate minus WPI inflation.

¹³The correlation coefficient is 0.36 over the whole sample.

The estimation results for Mexico are shown in Table 3.3.¹⁴ Profitability is significantly autocorrelated across all specifications. As the macroeconomic control variables are significant and showing the expected sign, we refer in the following to the third and fourth specifications. There are two main results. First, similar to the Argentine and Brazilian case, high exporters have a lower profitability during normal times, while dollar debt has no significant impact on profitability. These results are well explained by the appreciation of the exchange rate linked with capital account liberalization and by the Original Sin theory. Second, as in the case of Argentina, dollar debtors are most adversely affected during both currency depreciations. A competitiveness effect is only present during the Tequila crisis. More specifically, profitability of firms that have no exports and no dollar debt decreases by 1% during both episodes. Moreover, a 10% higher dollar debt ratio implies a 0.12% and 0.7% lower profitability during the considered episodes. Exporters benefited from the depreciation in 1994-95, i.e. a 10% higher exports to sales ratio implies a 0.9% higher profitability.

To summarize, Argentina and Brazil constitute two opposite cases, while Mexico constitutes an intermediate case. In Argentina, there was a massive transfer of income from domestic firms to domestic and foreign banks, due to the fact, that firms were unable to borrow in domestic currency. Within borrowers, firms most adversely affected have been firms with high liability dollarization specialized in the production of domestic goods. Conversely, in Brazil income transfers from domestic borrowers to lenders have been more limited. Liability dollarization had no significant impact on firms. The Mexican case shares similarities with the Argentine case, since adverse balance sheet effects were present during both episodes of currency depreciations. The findings above also point to the importance of the macroeconomic feedback effects of these distributive dimensions.

3.4 The theoretical model

The descriptive statistics in Section 3.2 highlight that the economic rebound following the exchange rate depreciations was rather different in the three economies, and that the structure of firms' income and debt shaped firms' responses to the crises. In the following, we develop a theoretical model to explore the financial mechanisms of unexpected currency depreciations. In particular, we use a dynamic equilibrium model of a representative firm which is characterized by different degrees of foreign-currency income and liabilities. In our framework, unanticipated exchange rate depreciations might take place and affect both the transfers of income and wealth between firms and their lenders as well as the

¹⁴As mentioned, we do not use dummies for the export and dollar debt groups since we have continuous information on these variables.

firm's individual trajectory. In response, the firm adjusts production, investment, and employment decisions shaping the economic rebound. We use a partial equilibrium model of a firm that maximizes the expected present value of dividends subject to constraints on technology and finance. The firm produces domestically traded and exported goods using capital, labor, and imports as production inputs. In line with the Original Sin theory, the firm borrows external funds in foreign currency and domestic funds in local currency. The model is based on Cooper and Ejarque (2003) and Gilchrist and Sim (2007). Our model integrates elements that are missing in Cooper and Ejarque (2003), in particular, our production function incorporates labor and imports, two goods are produced, and foreign and domestic borrowing is allowed. With respect to the model developed by Gilchrist and Sim (2007), our framework specifies dividend adjustment costs and a Taylor rule for the domestic interest rate. We focus on the core mechanisms in a clear and stylized form and calibrate the theoretical model to match a set of financial characteristics of the average Argentine and Brazilian firm to compare the firms' responses to an unexpected currency depreciation.

3.4.1 Production and demand

The representative firm produces two goods that are sold in the domestic market Y_{Dt} and foreign market Y_{Ft} , subject to a Cobb-Douglas technology using the same type of capital:

$$Y_{it} = A_t K_{t-1}^\alpha (M_{it}^{\sigma_i} N_{it}^{1-\sigma_i})^{1-\alpha}, \quad i = D, F. \quad (3.2)$$

A_t denotes a stochastic productivity process and α the proportion of capital K_{t-1} used in the production of both types of goods. $\sigma_i(1 - \alpha)$ is the share of imported materials M_{it} and $(1 - \sigma_i)(1 - \alpha)$ that of labor N_{it} in the production of Y_{it} .

The firm sells the two differentiated goods in a monopolistic competition environment facing the following isoelastic demand functions:

$$y_{it} = Z_i p_{it}^{-\phi_i}, \quad i = D, F \quad (3.3)$$

where $\phi_i \geq 0$ is the price elasticity of demand, $Z_i \geq 0$ is a demand scaling variable, and p_{it} the goods' price in the local currency of the consumers.¹⁵ EBIT in period t can be expressed as follows:

$$\Pi_t = p_{Dt} Y_{Dt} + e_t p_{Ft} Y_{Ft} - w_N (N_{Dt} + N_{Ft}) - e_t w_M (M_{Dt} + M_{Ft}). \quad (3.4)$$

¹⁵The demand function can be derived from a consumer's perspective if its intertemporal utility function is separable and isoelastic in the consumption good.

The exchange rate e_t is assumed to follow a stationary AR(1) process in logs and is specified to match exchange rate dynamics during the crisis period:¹⁶

$$\ln e_t = \rho \ln e_{t-1} + \varepsilon_{et}, \quad \varepsilon_{et} \sim N(0, \sigma_e^2), \quad (3.5)$$

with ρ smaller than one in modulus. Wages and import prices w_N and w_M are assumed to be constant and equal across the two sectors, although we could incorporate factor supply functions similar to the demand functions for the two types of goods. Wages are denoted in domestic currency and import prices in foreign currency. Note that under the pricing assumptions, a currency depreciation translates one-to-one into domestic prices of exports and imported materials, and the firm faces contrasting effects on operating profits. The firm can invest $I_t = K_t - (1 - \delta)K_{t-1}$ in the capital stock which depreciates at a rate $0 \leq \delta \leq 1$. We assume that capital accumulation is subject to quadratic adjustment costs (as in Cooper and Ejarque (2003)):

$$C(K_t, K_{t-1}) = (\gamma/2)(I_t/K_{t-1})^2 K_{t-1}. \quad (3.6)$$

where $\gamma \geq 0$ denotes the adjustment cost parameter.

3.4.2 External finance

Our modeling of the firm's external financial opportunities follows Gilchrist and Sim (2007) with differences in the assumptions on domestic interest rates. In particular, we assume that the domestic interest rate is determined by a Taylor rule, rather than by an exogenous shock process as in Gilchrist and Sim (2007). We assume that the firm has access to domestic and foreign credits of one-period maturity. Domestic loans L_{Dt} are denominated in domestic currency and foreign loans L_{Ft} in foreign currency. Given the firm borrows domestic and foreign loans in period $t - 1$, it has to repay $R_{Dt-1}L_{Dt-1}$ and $e_t R_{Ft-1}L_{Ft-1}$ in period t . The domestic-currency value of total loans L_t is given by:

$$L_t = L_{Dt} + e_t L_{Ft} = \nu_t L_t + (1 - \nu_t) L_t, \quad (3.7)$$

where $\nu_t = L_{Dt}/L_t$ is the fraction of domestic loans in total loans.

We assume that the uncovered interest parity (UIP) condition holds:

$$R_{Dt} = E_t(e_{t+1}/e_t)R_{Ft}, \quad (3.8)$$

where R_{Dt} and R_{Ft} denote the domestic and foreign gross interest rates, respectively.

¹⁶In our notation a depreciation leads to an increase in e_t .

Since the UIP condition implies that both interest rates are equal in the deterministic steady state, it follows that the firm is initially indifferent between the currency composition of total credits. Therefore, in the deterministic steady state, we take the fraction of domestic loans in total loans as a fixed parameter, i.e. $\nu = L_D/L$, following Gilchrist and Sim (2007). Given the firm has outstanding foreign loans of L_{Ft-1} , it has to repay $e_t L_{Ft-1} = (e_t/e_{t-1})(1-\nu)L_{t-1}$ in period t .

Net new debt issuance in period t is given by:

$$\begin{aligned} & e_t L_{Ft} - R_{Ft-1} e_t L_{Ft-1} + L_{Dt} - R_{Dt-1} L_{Dt-1} \\ = & L_t - R_{Ft-1} (e_t/e_{t-1})(1-\nu)L_{t-1} - R_{Dt-1} \nu L_{t-1}, \end{aligned} \quad (3.9)$$

which is a function of total loans.

In line with the Financial Accelerator theory, domestic and foreign interest rates are inverse functions of the firm's net wealth $K_t - L_t$. In particular we assume that the interest rates consists of a risk-free component and an external finance premium:

$$R_{it} = (1 + r_{it})(1 + \mu_i(L_t, K_t)), \quad i = D, F. \quad (3.10)$$

The convex functions $\mu_i(\cdot)$ measure the external finance premium of loans. The risk-free foreign interest rate is assumed to be constant $r_{Ft} = r_F$. while the domestic risk-free interest rate follows a Taylor rule:

$$r_{Dt} = (1 - \rho_r)(r_F + \rho_\pi(\pi_t - \bar{\pi}) + \rho_Y(Y_{Dt} - \bar{Y}_D)) + \rho_r r_{Dt-1} + \epsilon_{rt}, \quad (3.11)$$

where ϵ_{rt} is a domestic financial shock, $0 < \rho_r < 1$ an autoregressive parameter, and \bar{x} denotes variable x in the deterministic steady state. We assume that the central bank sets the domestic interest rate conditional on deviations of domestic prices and production from their long-run levels. The parameter ρ_r can be interpreted as the central bank's interest rate smoothing preference, ρ_π its inflation aversion, and ρ_Y measures its preference to stabilize domestic production. Inflation is equal to $\pi_t = (p_{Dt} - p_{Dt-1})/p_{Dt-1}$. In the absence of deviations from steady state, it is assumed that the central bank sets the risk-free interest rate equal to the world's interest rate. For simulation the external finance premium is assumed to be common to domestic and foreign funds:

$$\mu(L_t, K_t) = \kappa \exp[E_t(e_{t+1}/e_t)(1-\nu)L_t + \nu L_t - \theta(1-\delta)K_t - (\bar{L} - \theta(1-\delta)\bar{K})], \quad (3.12)$$

where $\kappa > 0$ is a parameter which measures responsiveness of the external finance premium to expected changes in net wealth. The parameter $0 \leq \theta \leq 1$ measures the extent to which lenders are willing to accept the undepreciated capital stock as a collateral. In

steady state, the domestic and foreign interest rates are equal to $(1 + r_F)(1 + \kappa)$. The exchange rate depreciation could be endogenized with the collateral parameter θ . To be more precise, a shock that leads to a decrease in the willingness of foreign lenders to accept capital as a collateral, i.e. a decrease in θ , leads ceteris paribus to an increase in the foreign interest rate over the domestic interest rate and therewith to an exchange rate depreciation. In the presence of foreign credits, the depreciation would have an amplifying effect on the interest rates by reducing net wealth.

3.4.3 Equilibrium conditions

The firm chooses the amount of total loans L_t , capital K_t , and factor inputs $N_{Dt}, N_{Ft}, M_{Dt}, M_{Ft}$ to maximize the present value of future dividends F_t :

$$\max_{L_t, K_t, N_{Dt}, N_{Ft}, M_{Dt}, M_{Ft}} E_{t-1} \sum_{t=0}^{\infty} \beta^t F_t \quad (3.13)$$

$$F_t = \Pi_t - I_t - C(K_t, K_{t-1}) + L_t - RP_t - \Psi(F_t)$$

subject to the constraints (3.2-3.6, 3.10-3.12) and the market clearing conditions for both types of goods. The dividends F_t are expressed relative to the price of investment (normalized to one) consisting of earnings Π (eq. 3.4), the costs associated with investments, net new debt issuance $L_t - RP_t$, and costs associated with changes in dividend payments. RP_t denotes repayment value of outstanding debt and given by:

$$RP_t = R_{Ft-1}(e_t/e_{t-1})(1 - \nu)L_{t-1} + R_{Dt-1}\nu L_{t-1}. \quad (3.14)$$

The function $\Psi(F_t) = (\psi/2)(F_t - \bar{F})^2$ captures frictions in equity financing (Lintner (1956), Miller and Rock (1985), and Allen, Bernardo, and Welch (2000)) and reduces the substitution between debt and equity finance.

The optimality condition with respect to imported materials and labor in the production of the two types of goods requires that marginal costs are equal to marginal benefits:

$$e_t w_M = (1 - \alpha) \sigma_i Z_{it}^{\frac{1}{\phi_i}} [(\phi_i - 1)/\phi_i] Y_{it}^{\frac{\phi_i - 1}{\phi_i}} (1/M_{it}), \quad i = D, F, \quad (3.15)$$

$$w_N = (1 - \alpha)(1 - \sigma_i) Z_{it}^{\frac{1}{\phi_i}} [(\phi_i - 1)/\phi_i] Y_{it}^{\frac{\phi_i - 1}{\phi_i}} (1/N_{it}), \quad i = D, F. \quad (3.16)$$

Due to the assumption of monopolistic competition the firm internalizes the demand function. The intertemporal optimality condition with respect to capital equates costs and

benefits of an additional unit of capital:¹⁷

$$\begin{aligned}
& [1 + \partial C(K_t, K_{t-1})/\partial K_t][1/(1 - \psi(F_t - \bar{F}))] \\
& = E_t \beta \{ [\partial p_{Dt+1} Y_{Dt+1} / \partial K_t + e_{t+1} \partial p_{Ft+1} Y_{Ft+1} / \partial K_t \\
& + (1 - \delta) - \partial C(K_{t+1}, K_t) / \partial K_t \\
& - (e_{t+1}/e_t)(1 - \nu)(\partial R_{Ft} / \partial K_t) L_t - \nu(\partial R_{Dt} / \partial K_t) L_t] \\
& \cdot [1/(1 - \psi(F_{t+1} - \bar{F}))] \}.
\end{aligned} \tag{3.17}$$

On the right hand side, the expected benefits are composed of the marginal product of an additional unit of capital, its resale value after capital depreciation, its impact on capital adjustment costs, and its effect on the interest rate on loans. In particular, a higher capital stock in period t reduces both capital adjustment costs and interest payments in $t + 1$.

The intertemporal optimality condition with respect to loans implies that benefits are equal to the expected costs of an additional unit of loans:

$$\begin{aligned}
1/(1 - \psi(F_t - \bar{F})) & = E_t \beta \{ [(e_{t+1}/e_t)(1 - \nu)((\partial R_{Ft} / \partial L_t) L_t + R_{Ft}) \\
& + \nu((\partial R_{Dt} / \partial L_t) L_t + R_{Dt})] \\
& \cdot [1/(1 - \psi(F_{t+1} - \bar{F}))] \}.
\end{aligned} \tag{3.18}$$

The expected costs of an additional unit of external funds are equal to the sum of the repayment including interests and its effect on the interest rate on loans.

3.4.4 Calibration and simulation

In the following, the calibration and simulation results are summarized. In particular, we focus on steady state deviations of net income $NI_t = \Pi_t - FP_t$, and its real, Π_t , and financial components, $FP_t = (R_{Ft-1} - 1)(e_t/e_{t-1})(1 - \nu)L_{t-1} + (R_{Dt-1} - 1)\nu L_{t-1}$, net wealth $K_t - L_t$, and net new debt issuance $ND_t = L_t - RP_t$.

The model is calibrated as follows. In the first step, we fix the structural parameters to be conform with the existing literature on small open economies (Gilchrist and Sim (2007) and Mendoza (2006a)). The parameters β , r_F , and κ are restricted such that the firm is a net debtor in the deterministic steady state (see Appendix 3.6, eq. 3.22). The particular parameter values are summarized in Table 3.4. In the second step, the parameters $\xi = (Z_F, Z_D, \phi_D = \phi_F, \sigma_F = \sigma_D, w_N, w_M, \theta)$ are allowed to vary in a fixed interval such that the firm matches three long-run ratios in the steady state: a debt-to-capital ratio

¹⁷The partial derivatives can be found in the Appendix 3.6.

$\bar{X}_1 = \bar{L}/\bar{K}$, a ratio of financial payments to capital $\bar{X}_2 = \bar{F}P/\bar{K}$, and an exports-to-sales ratio $\bar{X}_3 = \bar{e}\bar{p}_F\bar{Y}_F/(\bar{e}\bar{p}_F\bar{Y}_F + \bar{p}_D\bar{Y}_D)$. The target ratios are determined with our data on firms prior to crisis. We do this exercise for Argentine and Brazilian firms separately and compare the resulting responses to an unexpected depreciation. These two countries are interesting cases, because the firms have polar income and liability structures. The parameters $(Z_F, Z_D, \phi_D = \phi_F)$ determine the relative demand for the foreign and domestic good, while $(\sigma_F = \sigma_D)$ and (w_N, w_M) determine the import share in production and relative costs of labor and imports, respectively. Finally, the collateral parameter θ controls for the responsiveness of the risk premium to changes in the capital stock. The matching is done numerically, to be more precise, first the steady state of the model is written in terms of structural parameters, and then the following objective function is minimized:¹⁸

$$\min_{\xi} a_1(\bar{X}_1 - b_1)^2 + a_2(\bar{X}_2 - b_2)^2 + a_3(\bar{X}_3 - b_3)^2, \quad (3.19)$$

where a_i denote weights that are inverse functions of the variance of ratio b_i .

The target steady state debt-to-capital ratios are $b_1 = (0.5, 0.6)$ for Argentina and Brazil, respectively.¹⁹ Moreover, the targets of the financial payments to capital ratio are equal, i.e. $b_2 = (0.02, 0.02)$. The main difference between Argentina and Brazil is captured by the fraction of dollar debt in total debt, $1 - \nu$, which is equal to 0.6 and 0.2, respectively, as well as by the fraction of exports in sales, b_3 , which is equal to 0.05 and 0.14. The resulting parameter estimates and steady state ratios are shown in Table 3.4.

Based on the parameter estimates, we simulate the model numerically using a second-order Taylor approximation around the deterministic steady state. We abstract from technology shocks focusing on the effect of a shock to the exchange rate. In both cases, we set the persistence parameter of the exchange rate process to $\rho = 0.9$. As we are interested in reproducing quantitatively the firms dynamics during the actual currency depreciations, we consider an unexpected depreciation of 200% in the Argentine case, and of 50% in the Brazilian case.

The resulting impulse responses are shown in Figure 3.4. The distributive aspects highlighted in the previous sections appear clearly in the simulations. In Argentina, the devaluation increases interest payments by much more than in Brazil, i.e. by 7% over capital in Argentina opposed to 1% in Brazil. Moreover, the increase in financial payments is more pronounced in Argentina reaching its steady state level after 30 quarters.

¹⁸The steady state for $\phi_i = \phi$ and $\sigma_i = \sigma$ is derived in Appendix 3.6. As starting values, we take the parameters from Table 3.4. A constrained nonlinear minimization is performed, i.e. the parameters are required to be in a fixed interval around the starting value.

¹⁹The target ratios are calculated as the average ratio of all firms in our sample before the currency depreciation.

This constitutes a higher transfer of income from the firm to its lenders. Interest payments increase both as a result of the higher domestic value of the debt stock and the higher risk premium. Given the relatively small export sector in Argentina, the firm's earnings do not increase as much as financial payments, and net income drops to -10% of capital after one quarter. Contrastingly, export income improves over time by more than financial payments in Brazil resulting in an increase of net income above steady state. The depreciations also have balance sheet effects. Net wealth decreases with the depreciations, and the resulting wealth transfer depends on the fraction of foreign debt in total debt. In Argentina, net wealth drops by 120% while in Brazil the decrease is much more modest. The drop below 100% in Argentina can be explained by an important reduction in external borrowing combined with a contraction in the capital stock.

Overall, income and wealth transfers increase by more in the case of the Argentine firm. For a given level of exchange rate depreciation, the result is explained by two financial mechanisms: (1) the higher fraction of dollar debt in Argentina has a higher, adverse impact on the firm's balance sheet and risk premium, and (2) the higher export share in Brazil increases earnings counteracting the adverse financial impact of the depreciation.

3.5 Conclusion

In this paper, we investigated some of the distributive aspects associated with currency depreciations from an empirical and theoretical point of view. We mainly focused on two aspects that seemed the most important according to us: borrower and lender transfers as well as firm heterogeneity.

These two aspects are addressed by decomposing firm profitability into its real and financial components and by making use of panel regressions to identify the real and financial variables that explain firms' profitability. Lastly, these two distributive issues are analyzed within a partial equilibrium model. There are three main results.

First, we identified three channels through which currency depreciations increase transfers from borrowers to lenders. There is a balance sheet channel as the currency depreciation reduces borrowers' net wealth. The net wealth to asset ratio decreases between 5 to 15 percentage points, depending on the country taken into account. There is as well a flow channel as higher liabilities raise financial payments to lenders. Financial payments peaked to 15% of total assets in Argentina. In addition, high dollar debt firms experienced a 3% to 12% drop in profitability in the three affected economies. Eventually, there is an interest rate effect as the country risk premium reached 20% to 80%.

Second, we identified two levels of heterogeneity. At the firm level, those firms that

benefited from the devaluation have been specialized in the export sector, while having a rather low levels of foreign-currency debt. On the other hand, firms losing from the devaluation were specialized in the domestic sector, while having a high level of foreign liabilities. In Argentina, winning firms experienced a 4% increase in profitability, while losing firms experienced a 10% decrease in profitability. At the country level, Argentina, Brazil, and Mexico display three contrasting examples. Argentina is an economy with a large currency mismatch, Brazil has some sort of natural hedge, and Mexico occupies an intermediate position. Consequently, the wealth and income transfers have been three time higher in Argentina than in Brazil.

Third, the theoretical model enables us to reproduce the empirical evidence concerning these distributive issues. As a result of the currency depreciation, firms indebted in foreign currency experience a drop in net wealth, and an increase in interest payments as a result of both, a higher debt burden and increased interest rate payments.

3.6 Appendix

Data

Firm-level data: Source – *Economática*, Version 2003Mar07. *Economática* tracks information on the financial reports of publicly listed firms from US, Mexico, Venezuela, Columbia, Peru, Brazil, Chile and Argentina. For our sample of countries, *Economática* provides information on about 300 Brazilian, 80 Argentine and 150 Mexican firms. We exclude financial companies from the sample.

Herman Kamil provided us additional data from Kamil (2004) which we merged with the information from *Economática*. The database consists of firm-level data for public and non-publicly traded companies in Latin America and presents detailed and comparable information on the currency composition of assets and liabilities.

Macroeconomic data: Source – *International Financial Statistics*, 2006. Included variables: GDP (series 99B), GDP deflator (series 99BIP), money market rate (series 60B), consumer price index (series 64ZF), wholesale price index (series 63ZF), market exchange rate (series ZF)

Boxes

Box 1: The crises from a macroeconomic perspective^a

Mexico:

The vulnerability in 1994 stemmed from the following factors: (1) the fixed exchange rate and capital inflows resulted in a real appreciation of the peso and a large and growing current account deficit; and (2) the private and public sector had important currency mismatches on their balance sheets (Roubini and Setser (2004)). Fiscal deficits were moderate. Several political shocks hit the country: the Chiapas revolt; the assassination of the appointed presidential candidate; and the electoral uncertainty. External shocks, notably, the increase in US interest rates reduced investors' willingness to finance the current account deficit. The government replaced domestic peso-denominated debts (cetes) with domestic dollar-linked bonds (tesobonos), because it was difficult to sell peso debt in the face of concerns about the exchange rate. The overvalued currency and the need to balance the current account made the devaluation unavoidable. During the crisis, households with foreign-currency denominated mortgages, as well as firms that had dollar liabilities but lacked export revenues, were not able to service their foreign-currency debts and the government implemented a bailout program (Fobaproa) costing around 20% of GDP (Roubini and Setser (2004)). The financial distress of many private borrowers was one reason why Mexico's banking system had a severe crisis. The Mexican government went into the crisis with a relatively low level of debt and bore the costs of the firm and bank bailout and the higher real burden of its own foreign-currency debt. After a strong recovery, Mexico was hit again by external shocks in 1998 that pushed the economy into lower-than-expected growth and higher-than-expected inflation. First, the Asian financial crises and Russia's debt default resulted in a significant decrease in capital inflows across emerging market economies on the whole, including Mexico. And second, the drop in oil prices affected adversely the government's income as oil revenues represented about a third of its revenues (Roubini and Setser (2004)).

Brazil:

Brazil experienced two crises: one in 1998-99 and a second in 2001-02. As Roubini and Setser (2004) argue, the governments' choices in its first crisis created the vulnerabilities that led to the second crisis. The vulnerability in 1998 stemmed from two factors: (1) the overvalued currency, resulting from the pegged exchange rate and the inflation inertia, generated an increasing current account deficit which was increasingly financed by cross-border bank borrowing; and (2) the large fiscal deficit.

^aThe survey is largely based on Roubini and Setser (2004).

Box 1 (continued)

These factors contributed to the current account imbalance and led to the accumulation of domestic and external debt. At the beginning of 1998, Brazilian banks and firms were subject to important maturity and currency mismatches on their balance sheets (Roubini and Setser (2004)). A currency devaluation would have had a severe impact on the private sector's balance sheets. The central bank, however, sold more than 40 billion dollars of reserves to defend the peg. This allowed many private financial and corporate firms to hedge their currency exposure - either by increasing their holdings of foreign assets or by paying down their external debt (Roubini and Setser (2004)). The government also increased its issuance of domestic dollar-linked debt helping banks and firms to hedge against the risk of a devaluation. The currency collapse, consequently, resulted in a large increase in public debt. But the economy retained significant vulnerabilities. The stock of public debt to GDP rose from 40% in 1997 to over 72% in 2002, despite a significant fiscal adjustment (Roubini and Setser (2004)). As Argentina's crisis deepened, the government renewed the issuance of foreign-currency linked debt to meet the demand for hedging products and to intervene in the foreign exchange market. The combination of investors' increased risk aversion following Argentina's crisis and concerns about the upcoming election and future policy resulted in a significant fall in foreign financing and an important depreciation of the real.

Argentina:

Argentina's crisis stemmed from four main vulnerabilities: (1) the currency board resulted in an increasingly overvalued currency as the dollar appreciated and, particularly, after the Brazilian currency depreciation of 1999; (2) the external imbalances created by the overvalued currency were increasingly difficult to finance, especially since 1998; (3) persistent fiscal deficits led to the accumulation of a large stock of public debt; and (4) the corporate sector was subject to an important liability dollarization. More than 70% of domestic and external government debt was denominated in dollars. Moreover, domestic Argentine bank deposits were denominated in dollars, similarly most of the loans granted to domestic firms and households. The banking system's currency mismatch was moderate, but not its currency risk since it transferred the currency risk to the borrowing firms. The crisis resulted from these structural vulnerabilities and a series of external shocks: (1) Russia's debt default in 1998 caused a significant increase in the costs of external bonds; (2) the fall in global commodity prices worsened the country's terms of trade; (3) Brazil's devaluation in 1999 made Argentina's exports less competitive; and (4) the appreciation of the dollar from 1998 to 2001 resulted in a nominal and real appreciation of the peso relative to Argentina's other trading partners (Roubini and Setser (2004)). After the run on domestic securities and the domestic banking system, the government decided to devalue and to impose capital controls (corralito).

Tables and Figures

Table 3.1: Estimation results for Argentine non-financial firms

Method: One-step system GMM				
Dependent variable: ^a				
Annual difference of net income over total assets				
y(-1)	0.83***	0.82***	0.82***	0.82***
export	-0.01**	-0.01**	-0.01**	-0.01**
\$_debt	0.01	0.01	0.01	0.01
mm_rate	–	-0.02	-0.01*	-0.01
gdp	–	–	0.04	0.05
size(-1)	–	–	–	0.002
depreciation	-0.06*	-0.05**	-0.05*	-0.06**
depreciation*export	0.10***	0.10***	0.10***	0.08***
depreciation*\$_debt	-0.04*	-0.05*	-0.05*	-0.01
depreciation*size(-1)	–	–	–	-0.03***
observations	2232	2232	2232	2232
cross-sections	84	84	84	84
AR(2)	0.70	0.73	0.73	0.70
Hansen	0.16	0.23	0.24	0.25

^a The dummy variable *depreciation* equals to 1 during the period Q1/02-Q4/02. In all specifications, the included explanatory variables and the 2nd to the 4th lag of the dependent variable were used as instruments. The significance tests are based on autocorrelation and heteroscedasticity robust standard errors. (***, **, *) indicate significance at the 1%, 5% and 10% level. 'AR(2)' shows the p-value of the Arellano-Bond test on second-order autocorrelation, and 'Hansen' the p-value of the Hansen test of overidentifying restrictions.

Table 3.2: Estimation results for Brazilian non-financial firms

Method: One-step system GMM				
Dependent variable:				
Annual difference of net income over total assets				
y(-1)	0.70***	0.69***	0.70***	0.70***
export	-0.01**	-0.01**	-0.01**	-0.01**
\$.debt	-0.002	-0.002	-0.002	0.003
mm_rate	–	-0.08***	-0.07***	-0.07***
gdp	–	–	-0.02	-0.02
size(-1)	–	–	–	-0.002*
depreciation1	-0.07***	-0.07***	-0.07***	-0.08***
depreciation1*export	0.06***	0.06***	0.06***	0.07***
depreciation1*\$.debt	0.03	0.03	0.03	0.05
depreciation1*size(-1)	–	–	–	-0.01
depreciation2	-0.04**	-0.04**	-0.03**	-0.04**
depreciation2*export	0.03**	0.03**	0.03**	0.03**
depreciation2*\$.debt	0.01	0.01	0.01	-0.001
depreciation2*size(-1)	–	–	–	0.04
observations	3701	3701	3701	3701
cross-sections	192	192	192	192
AR(2)	0.35	0.36	0.36	0.37
Hansen	0.34	0.33	0.54	0.61

^a The dummy variable *depreciation1* equals to 1 during the period Q1/99-Q4/99 and *depreciation2* during Q1/02-Q4/01. In all specifications, the included explanatory variables and the 2nd and 3th lag of the dependent variable were used as instruments. The significance tests are based on autocorrelation and heteroscedasticity robust standard errors. (***, **, *) indicate significance at the 1%, 5% and 10% level. 'AR(2)' shows the p-value of the Arellano-Bond test on second-order autocorrelation, and 'Hansen' the p-value of the Hansen test of overidentifying restrictions.

Table 3.3: Estimation results for Mexican non-financial firms

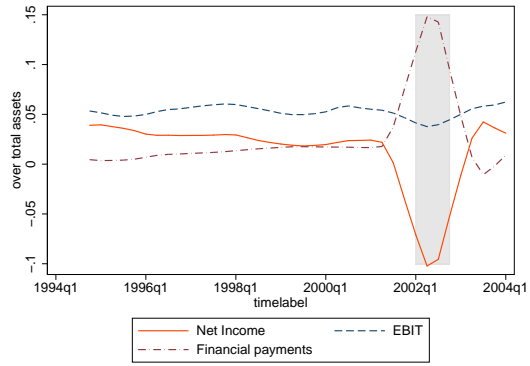
Method: One-step system GMM				
Dependent variable:				
Annual difference of net income over total assets				
y(-1)	0.22***	0.20***	0.20**	0.20***
export	-0.01*	-0.01	-0.01	-0.01*
\$.debt	0.003	0.002	0.002	0.005
mm_rate	–	-0.09***	-0.08***	-0.09***
gdp	–	–	0.09***	0.09***
size(-1)	–	–	–	-0.001
depreciation1	-0.03***	-0.01	-0.02**	-0.01**
depreciation1*export	0.06	0.09***	0.08**	0.09***
depreciation1*\$.debt	-0.02	-0.09***	-0.09***	-0.12***
depreciation1*size(-1)	–	–	–	0.01***
depreciation2	-0.03	-0.01	-0.01*	-0.01*
depreciation2*export	0.01	0.01	0.01	0.01
depreciation2*\$.debt	-0.07***	-0.07***	-0.07***	-0.07***
depreciation2*size(-1)	–	–	–	-0.01
observations	3709	3709	3709	3709
cross-sections	100	100	100	100
AR(2)	0.38	0.09	0.12	0.26
Hansen	0.25	0.25	0.25	0.26

^a The dummy variable *depreciation1* equals to 1 during the period 94/Q4-95/Q4 and *depreciation2* during Q4/97-Q3/98. In all specifications, the included explanatory variables and the 2nd lag of the dependent variable were used as instruments. The significance tests are based on autocorrelation and heteroscedasticity robust standard errors. (***, **, *) indicate significance at the 1%, 5% and 10% level. 'AR(2)' shows the p-value of the Arellano-Bond test on second-order autocorrelation, and 'Hansen' the p-value of the Hansen test of overidentifying restrictions.

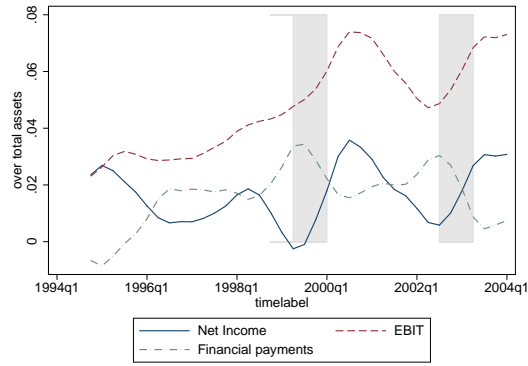
Table 3.4: Structural parameters and the steady state

Parameters	Value	Interval	Results		Description
			Arg.	Bra.	
<i>Production</i>					
β	0.96				time preference
α	0.4				capital share in production
δ	0.012				capital depreciation
γ	0.5				capital adjustment cost
w_N	0.5	[0.4,0.6]	0.47	0.50	cost of labor
w_M	0.5	[0.4,0.6]	0.49	0.50	cost of imports
σ_F, σ_D	0.2	[0.15,0.25]	0.20	0.21	import share in F-production
<i>Finance</i>					
ν			0.4	0.8	fraction of domestic in total debt
κ	0.02				financial friction parameter
r_F	0.01				risk free interest rate
ψ	0.5				dividend adjustment cost
θ	0.1	[0.05, 0.15]	0.09	0.1	collateral parameter
<i>Demand</i>					
Z_F	0.1	[0.01,0.15]	0.01	0.03	scale parameter foreign demand
Z_D	0.4	[0.3,0.5]	0.5	0.46	scale parameter domestic demand
ϕ_D, ϕ_F	1.5	[1.1,1.9]	1.58	1.49	price elasticity of demand
<i>Monetary policy</i>					
ρ_r		0.5			AR(1) coefficient Taylor rule
ρ_π		1			inflation coeff. in Taylor rule
ρ_Y		0.05			output coeff. in Taylor rule
<i>Shock process</i>					
ρ		0.9			AR(1) coefficient exchange rate
σ_e			2	0.5	size of the depreciation
<i>Steady states</i>					
	Target		Results		
	Arg.	Bra.	Arg.	Bra.	
\bar{L}/\bar{K}	0.5	0.60	0.51	0.61	debt over assets
$\bar{F}P/\bar{K}$	0.02	0.02	0.015	0.018	financial payments over assets
$\frac{\bar{e}\bar{p}_F\bar{Y}_F}{\bar{e}\bar{p}_F\bar{Y}_F+\bar{p}_D\bar{Y}_D}$	0.05	0.14	0.07	0.14	exports over sales

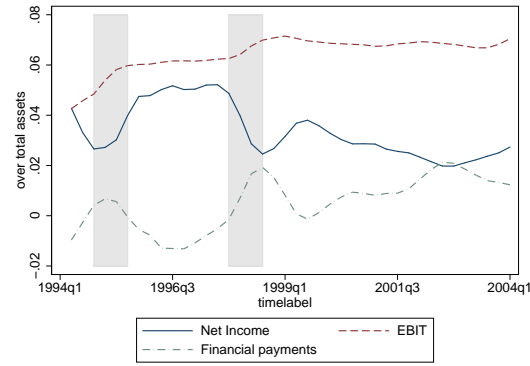
Figure 3.1: Flow, stock, and price effects of the currency collapses



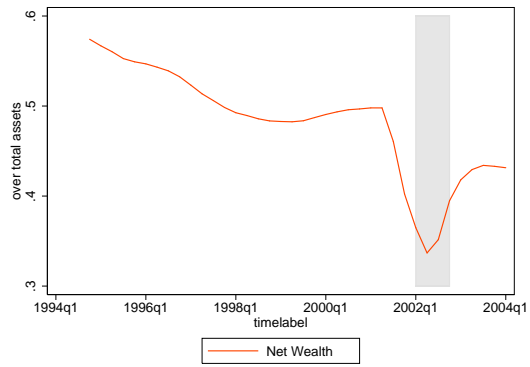
(a) Argentina income decomposition



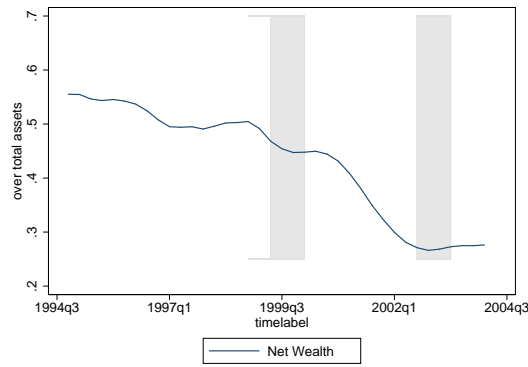
(b) Brazil income decomposition



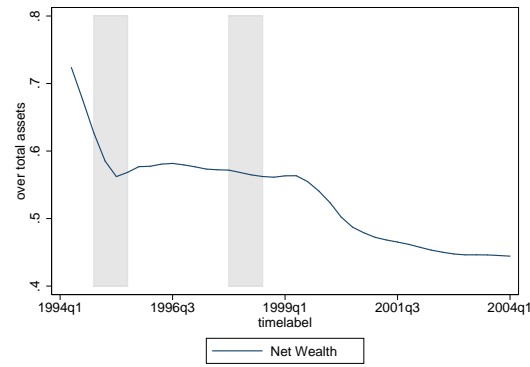
(c) Mexico income decomposition



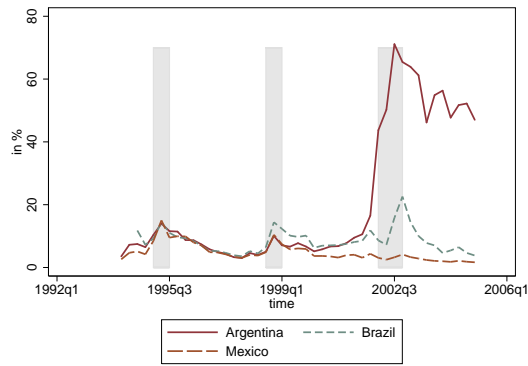
(d) Argentina wealth effect



(e) Brazil wealth effect

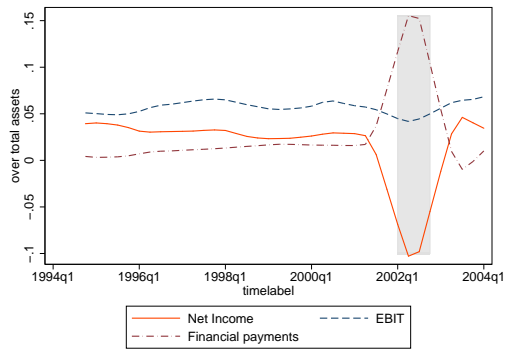


(f) Mexico wealth effect

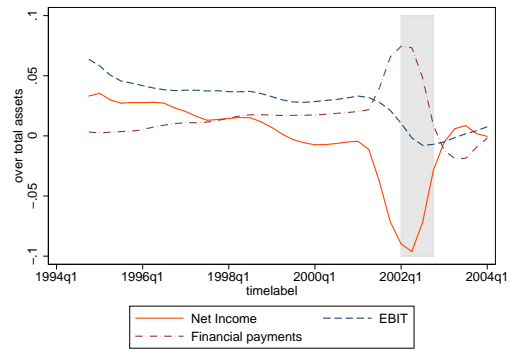


(g) Country risk premium per country

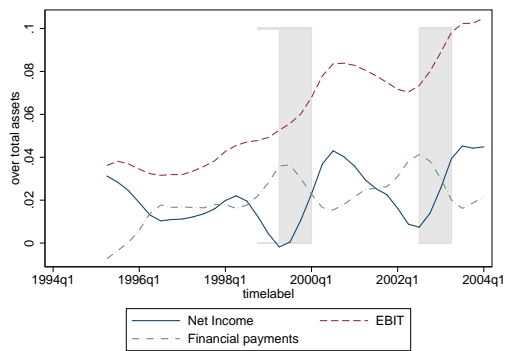
Figure 3.2: Income decomposition for high and low dollar debt firms



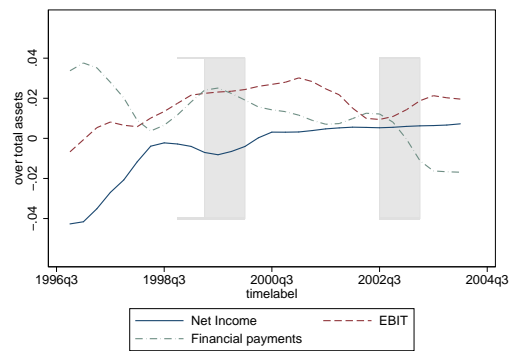
(a) Argentina high \$ debt



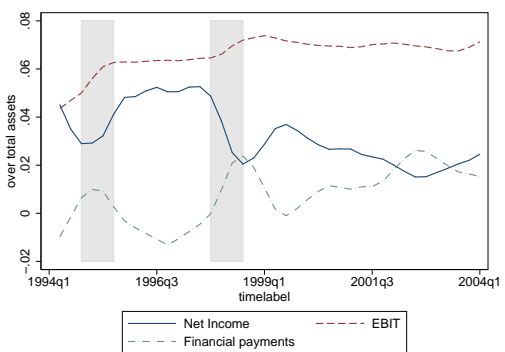
(b) Argentina low \$ debt



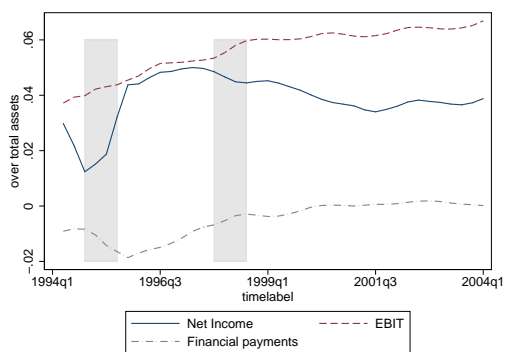
(c) Brazil high \$ debt



(d) Brazil low \$ debt

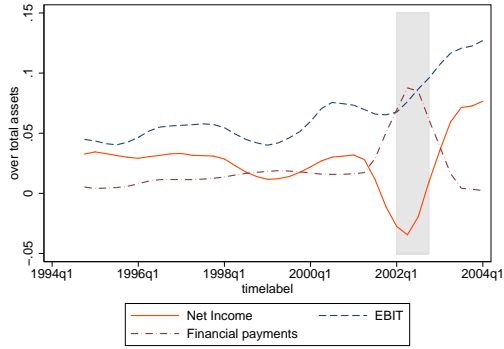


(e) Mexico high \$ debt

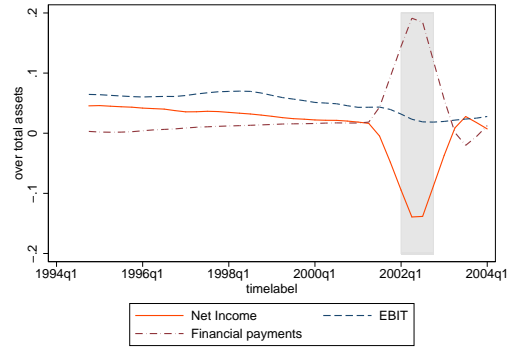


(f) Mexico low \$ debt

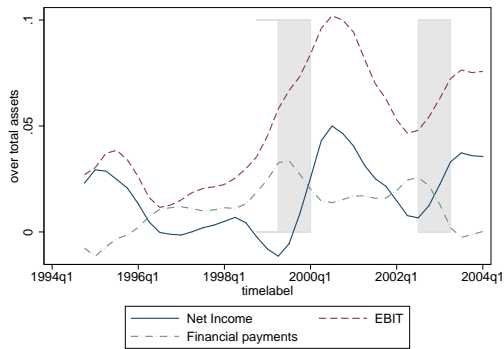
Figure 3.3: Income decomposition for high and low export firms



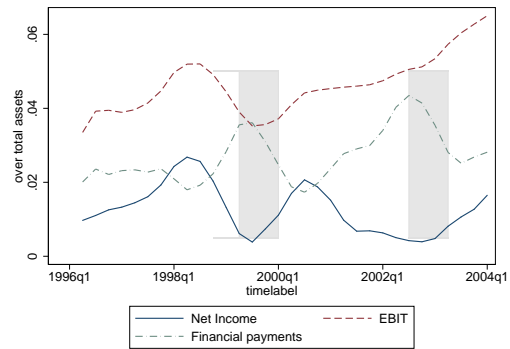
(a) Argentina high exports



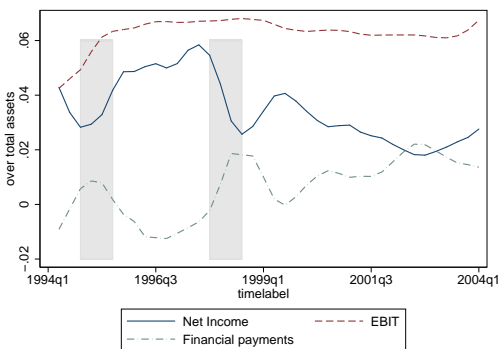
(b) Argentina low exports



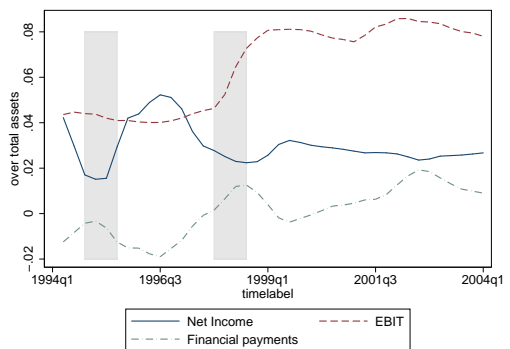
(c) Brazil high exports



(d) Brazil low exports

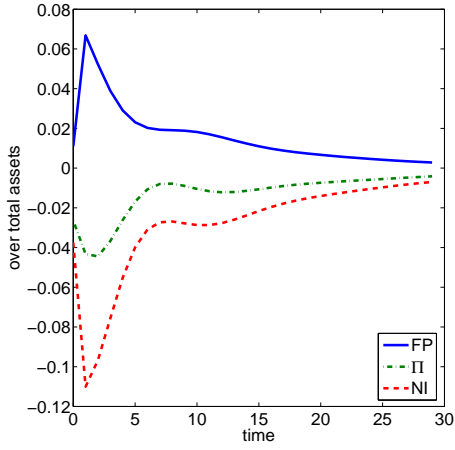


(e) Mexico high exports

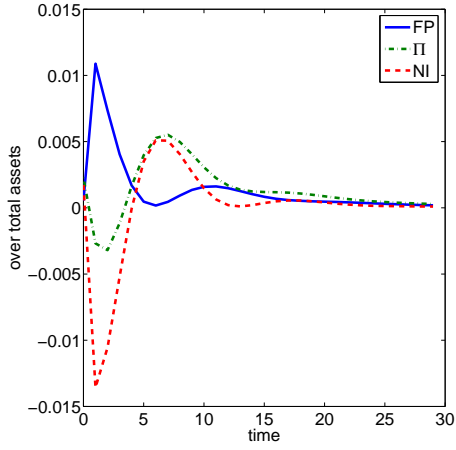


(f) Mexico low exports

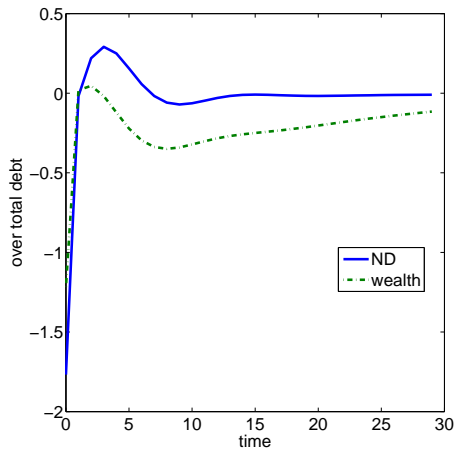
Figure 3.4: Simulations for Argentina and Brazil



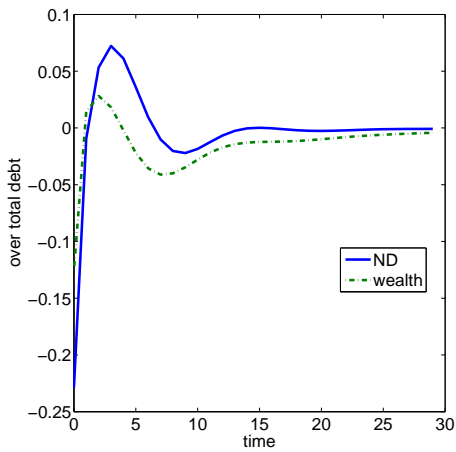
(a) Profit decomposition, Argentina



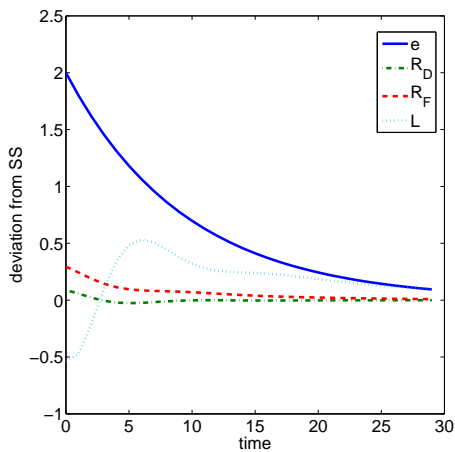
(b) Profit decomposition, Brazil



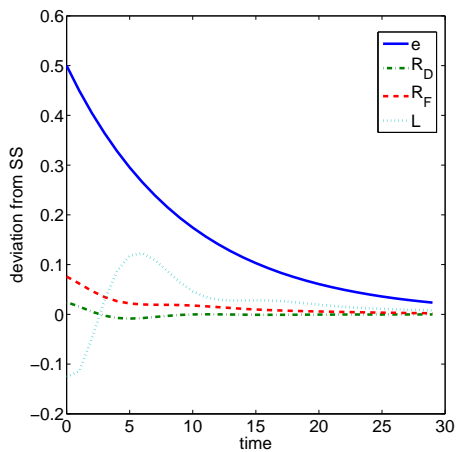
(c) Wealth and debt issuance, Argentina



(d) Wealth and debt issuance, Brazil



(e) Exchange rate and finance, Argentina



(f) Exchange rate and finance, Brazil

Theoretical Appendix

Derivatives

The partial derivatives in the intertemporal optimality condition for capital (eq. 3.17) are the following:

$$\begin{aligned}
\frac{\partial p_{it+1} Y_{it+1}}{\partial K_t} &= \alpha \frac{\phi_i - 1}{\phi_i} Z_i^{\frac{1}{\phi_i}} \frac{Y_{it+1}^{\frac{\phi_i-1}{\phi_i}}}{K_{it}}, \quad i = D, F \\
\frac{\partial R_{Ft}}{\partial L_t} &= (1 + r_F) \kappa \exp\left[\frac{e_{t+1}}{e_t} (1 - \nu) L_t + \nu L_t - \theta(1 - \delta) K_t\right. \\
&\quad \left. - (L_{ss} - \theta(1 - \delta) K_{ss})\right] \left(\frac{e_{t+1}}{e_t} (1 - \nu) + \nu\right) \\
\frac{\partial R_{Ft}}{\partial K_t} &= -(1 + r_F) \kappa \exp\left[\frac{e_{t+1}}{e_t} (1 - \nu) L_t + \nu L_t - \theta(1 - \delta) K_t\right. \\
&\quad \left. - (L_{ss} - \theta(1 - \delta) K_{ss})\right] \theta(1 - \delta) \\
\frac{\partial R_{Dt}}{\partial L_t} &= (1 + r_{Dt}) \kappa \exp\left[\frac{e_{t+1}}{e_t} (1 - \nu) L_t + \nu L_t - \theta(1 - \delta) K_t\right. \\
&\quad \left. - (L_{ss} - \theta(1 - \delta) K_{ss})\right] \left(\frac{e_{t+1}}{e_t} (1 - \nu) + \nu\right) \\
\frac{\partial R_{Dt}}{\partial K_t} &= -(1 + r_{Dt}) \kappa \exp\left[\frac{e_{t+1}}{e_t} (1 - \nu) L_t + \nu L_t - \theta(1 - \delta) K_t\right. \\
&\quad \left. - (L_{ss} - \theta(1 - \delta) K_{ss})\right] \theta(1 - \delta) \\
\frac{\partial C(K_t, K_{t-1})}{\partial K_t} &= \gamma \frac{I_t}{K_{t-1}} \\
\frac{\partial C(K_{t+1}, K_t)}{\partial K_t} &= \gamma \frac{I_{t+1}}{K_t} \left(\frac{1}{2} \frac{I_{t+1}}{K_t} - \frac{K_{t+1}}{K_t}\right)
\end{aligned}$$

Steady state

In this section, we derive the steady state for the symmetric case, i.e. $\phi_F = \phi_D = \phi$ and $\sigma_F = \sigma_D = \sigma$. Note that the time subscripts are omitted. From the UIP condition it follows:

$$R_F = R_D. \quad (3.20)$$

The foreign gross interest rate is given by:

$$R_F = (1 + r_F)(1 + \kappa). \quad (3.21)$$

Using this and the optimality condition for external funds (eq. 3.18) it follows:

$$L = \frac{1}{(1 + r_F) \kappa} \left(\frac{1}{\beta} - (1 + r_F)(1 + \kappa)\right). \quad (3.22)$$

This implies that the firm borrows external funds, when it is more impatient than the credit market, i.e. $1/\beta > (1 + r_F)(1 + \kappa)$. This gives rise to parameter restrictions on κ , r_F and β since a firm that is a net borrower is analyzed.

From the optimality condition for capital (eq. 3.17) it follows:

$$\begin{aligned}
1 + \gamma\delta &= \beta[-(1 + r)\kappa\theta L \\
&+ e\alpha\frac{\phi - 1}{\phi}Z_F^{\frac{1}{\phi}}Y_F^{\frac{\phi-1}{\phi}}\frac{1}{K} + \alpha\frac{\phi - 1}{\phi}Z_D^{\frac{1}{\phi}}Y_D^{\frac{\phi-1}{\phi}}\frac{1}{K} \\
&+ (1 - \delta) - \gamma\delta(\frac{1}{2}\delta - 1)].
\end{aligned} \tag{3.23}$$

In the following, we derive an expression for Y_i as a function of K only. From the optimality conditions for imports (eq. 3.15) it follows:

$$\begin{aligned}
M_i &= a_{Mi}Y_i^{\frac{\phi-1}{\phi}}, \quad i = D, F \\
a_{Mi} &= \frac{1}{ew_M}(1 - \alpha)\sigma Z_i^{\frac{1}{\phi}}\frac{\phi - 1}{\phi}.
\end{aligned} \tag{3.24}$$

For labor (eq. 3.16) it holds:

$$\begin{aligned}
N_i &= a_{Ni}Y_i^{\frac{\phi-1}{\phi}}, \quad i = D, F \\
a_{Ni} &= \frac{1}{w_N}(1 - \alpha)(1 - \sigma)Z_i^{\frac{1}{\phi}}\frac{\phi - 1}{\phi}.
\end{aligned} \tag{3.25}$$

Using $Y_i = AK^\alpha(M_i^\sigma N_i^{1-\sigma})^{1-\alpha}$, it follows that output can be written as a function of K :

$$\begin{aligned}
Y_i &= (AK^\alpha(a_{Mi}^\sigma a_{Ni}^{1-\sigma})^{1-\alpha})^{\frac{1}{1-(1-\alpha)\frac{\phi-1}{\phi}}} \\
&= (AK^\alpha X_i^{1-\alpha})^z, \text{ where} \\
X_i &= a_{Mi}^\sigma a_{Ni}^{1-\sigma} \text{ and } z = \frac{1}{1 - (1 - \alpha)\frac{\phi-1}{\phi}}.
\end{aligned} \tag{3.26}$$

Using the optimality condition for capital from above eq. 3.23 it follows:

$$\begin{aligned}
1 + \gamma\delta &= \beta[-(1+r)\kappa\theta L \\
&\quad + e\alpha \frac{\phi-1}{\phi} Z_F^{\frac{1}{\phi}} ((AK^\alpha X_F^{1-\alpha})^z)^{\frac{\phi-1}{\phi}} \frac{1}{K} \\
&\quad + \alpha \frac{\phi-1}{\phi} Z_D^{\frac{1}{\phi}} ((AK^\alpha X_D^{1-\alpha})^z)^{\frac{\phi-1}{\phi}} \frac{1}{K} \\
&\quad + (1-\delta) - \gamma\delta(\frac{1}{2}\delta - 1)] \\
&= \beta[n + m((AK^\alpha X_F^{1-\alpha})^z)^{\frac{\phi-1}{\phi}} \frac{1}{K} \\
&\quad + o((AK^\alpha X_D^{1-\alpha})^z)^{\frac{\phi-1}{\phi}} \frac{1}{K} + u],
\end{aligned}$$

where

$$\begin{aligned}
n &= -(1+r)\kappa\theta L \\
m &= e\alpha \frac{\phi-1}{\phi} Z_F^{\frac{1}{\phi}} \\
o &= \alpha \frac{\phi-1}{\phi} Z_D^{\frac{1}{\phi}} \\
u &= (1-\delta) - \gamma\delta(\frac{1}{2}\delta - 1).
\end{aligned}$$

Let $q = z^{\frac{\phi-1}{\phi}}$, then the steady state capital stock can be expressed as a function of the parameters:

$$K = \left(\frac{1}{mA^q X_F^{(1-\alpha)q} + oA^q X_D^{(1-\alpha)q}} \left(\frac{1+\gamma\delta}{\beta} - n - u \right) \right)^{\frac{1}{\alpha q - 1}}. \quad (3.27)$$

This determines the firm's steady state. Prices are equal to:

$$p_F = Z_F^{\frac{1}{\phi}} Y_F^{-\frac{1}{\phi}}, \quad (3.28)$$

$$p_D = Z_D^{\frac{1}{\phi}} Y_D^{-\frac{1}{\phi}}. \quad (3.29)$$

Chapter 4

International Financial Shocks in Emerging Market Economies

Michael Brei and Almira Buzaushina ¹

In the present paper, we develop a two-sector general equilibrium model of a small open economy to explore the transmission mechanisms of external financial shocks. In particular, we use a cash-in-advance model with limited participation augmented with a financial friction in the form of a 'fundamentals-related' risk premium on external funds. The friction amplifies the economic effects of external financial shocks, especially, when the economy is highly indebted in foreign currency. For a set of Latin American economies, the theoretical model is calibrated to match the empirical impulse responses of output, investment, trade balance, and domestic credits in response to a shock in the country risk premium.

Keywords: Financial crises, international capital markets

JEL Classification: F34, F36, G21

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4.1 Introduction

Over the past two decades, a number of major emerging market (EM) economies have experienced serious financial crises. Many of these crises appear to have been triggered by systemic sudden stops in which massive capital outflows and skyrocketing EM bond spreads affected a wide range of EM economies at approximately the same time. Many of these crises have been associated with large and persistent drops in investment and growth. These observations are illustrated in Figure 4.1 which plots country spreads and investment of five Latin American economies (LA-5).² Remarkably, the countries' external spreads (EMBI+ spreads) are highly correlated across countries and increase sharply during the major crisis periods of 1994-95, 1998, and 2001-02. The exception is Ecuador's currency crisis in 2000 which had no major impact on the other countries. Moreover, domestic investment drops in most cases with the onset of the financial shocks. Calvo, Izquierdo, and Talvi (2006) emphasize that such external shocks can be followed by a painful adjustment and sharp reduction in economic growth, or, become a minor recession. The particular outcome depends ultimately on the structure of a country's balance sheet and income sources, and the credibility of fiscal and monetary policy.

In the present paper, we explore the associated adjustment mechanisms in response to an unexpected, adverse shock to the costs of foreign funding in a dynamic stochastic general equilibrium model (DSGE) of a small open economy that faces financial market frictions. The initial shock is incorporated exogenously in the risk premium on foreign-currency denominated funds of the corporate sector and is amplified as the associated currency depreciation increases both the domestic value of outstanding debt (adverse balance sheet effect) and the 'fundamentals-related' part of the risk premium (adverse interest rate effect). We simulate the model and match the theoretical impulse responses to the risk premium shock with the corresponding empirical impulse responses of output, investment, trade balance, and domestic credits resulting from a structural panel vector-autoregressive (VAR) model for the LA-5 countries.

The theoretical model can be applied to study the effects of systemic financial shocks originating in international capital markets on EM economies. Such systemic external shocks seem to have been at play during the Tequila crisis in 1994-95, the East Asian crisis of 1997, the Russian crisis of 1998, and the Argentine crisis of 2001-02 (Calvo (1998a), Calvo, Izquierdo, and Talvi (2006), and Kaminski, Reinhart, and Vegh (2003)). In all cases, a worse-than-expected crisis in one country spread out to a variety of economies in terms of exchange rate systems, capital controls, fiscal stance, growth performance, and balance sheet mismatches. The international contagion had different origins. Com-

²The countries include Brazil, Colombia, Ecuador, Mexico, and Peru.

mon creditor linkages seem to have been in the foreground during the Tequila and Russian crises, while pressures for competitive devaluations were present in Asia and Argentina after Thailand's devaluation of 1997 and Brazil's devaluation of 1999, respectively (Roubini and Setser (2004)). However, many EM economies are not innocent victims in this process. In many instances, domestic weaknesses such as currency mismatches on the economies' balance sheets and high levels of external short-term debt were the source of the underlying financial fragility and vulnerability to a financial crisis.

The theoretical literature on financial crises from the perspective of EM economies, typically, incorporates financial markets that are subject to frictions. There are two main approaches: models that include either a credit constraint (Arellano and Mendoza (2003), Mendoza (2006b), and Christiano, Gust, and Roldos (2004)), or an external finance premium (Cook and Devereux (2005) and Neumeier and Perri (2005)). Except for Cook and Devereux (2005), who study the response of an exogenous shock to the interest rate on foreign funds, the other papers use an approach which is similar to Fisher (1933)'s Debt-Deflation theory. The underlying mechanism relates the economy's costs (or access) of credits with the economy's level of external debt relative to its assets. In these models, the crisis occurs when the economy is hit by an adverse shock which triggers the borrowing constraint to bind. As a result, the economy is forced to repay parts of its outstanding external debt (financial leveraging). In a mismatch situation between the currency denomination of income, assets, and liabilities, the associated real depreciation increases the output value of outstanding debt, particularly, of the non-tradable goods sector whose income is in local-currency. The associated reduction in net wealth increases in turn the economy's real financial burden and worsens its access to external finance.

The present model is most related to the limited participation model of Christiano, Gust, and Roldos (2004). The representative firm produces tradable and non-tradable goods subject to working capital constraints on labor and imports. In addition, the firm can borrow external foreign-currency denominated funds to finance investment. There are, however, three main differences. First, we do not model the financial shock in the form of a binding borrowing constraint, rather we incorporate the shock in a debt-elastic risk premium on external long-term debt. In addition, the financial shock is allowed to be correlated with the risks associated with domestic bank loans and external short-term credits for imports. Second, not only the household is surprised by the financial shock, but also the firm which decides on production at the beginning of the period before the shock is realized. And third, we estimate the structural parameters of the model by matching theoretical with empirical impulse responses resulting from a VAR model. Our results show that the proposed model reproduces closely the dynamics of the LA-5 countries in response to adverse shocks to the country risk premium. Our framework also highlights that initially small financial shocks can be amplified and result in substantial sudden stops,

especially, when the economy inherits high levels of external foreign-currency debt and low levels of foreign-currency income.

The remainder of the paper is organized as follows. In Section 4.2, we discuss the theoretical model. In Section 4.3, we present the estimation results of the VAR analysis, the implied empirical impulse responses, and the simulation results of the theoretical model using the estimated structural parameters. The final section concludes.

4.2 The theoretical model

This section describes an economic environment that is characteristic for emerging market economies: a small open economy (SOE) borrows on international capital markets in foreign currency. In our environment, unexpected financial shocks originating in international capital markets may occur and affect the domestic real economy. To analyze the transmission mechanism of these shocks, we consider a SOE version of a cash-in-advance (CIA) model with limited participation augmented with a financial friction in the form of a debt-elastic risk premium on external funds.³ The theoretical framework is most related to Christiano, Gust, and Roldos (2004) who consider a SOE which is inhabited by four types of agents: household, firm, financial intermediary, and monetary authority. The representative firm produces tradable and non-tradable goods subject to working capital constraints on labor and imported materials. In addition to the two types of short-term credits for the prepayment of labor and imports, the firm can borrow on international capital markets long-term credits to finance investment. The international financial shock is modeled as an exogenous, adverse shock to the risk premium on external long-term credits. By the model's uncovered interest parity (UIP) condition, the shock is associated with a currency depreciation and is amplified by an adverse balance sheet effect and a 'fundamentals-related' increase in the risk premium on external long-term credits. Our framework also allows for correlations between the risks of the three types of credits, and it captures therefore the possibility of financial market contagion (Baig and Goldfajn (1999)).

³For a detailed description of CIA models, see Christiano (1991), Christiano and Eichenbaum (1992), and Christiano, Eichenbaum, and Evans (1997).

4.2.1 Household

A representative household derives life-time utility from a composite consumption good C_t and disutility from labor L_t :

$$\mathbf{U} = E_t \sum_{j=0}^{\infty} \beta^j U(C_{t+j}, L_{t+j}), \quad (4.1)$$

where

$$U(C_t, L_t) = \frac{(C_t - \frac{L_t^\mu}{\mu} C_t^\gamma)^{1-\sigma} - 1}{1-\sigma}, \quad \mu > 0, \sigma > 0, \sigma \neq 1, \gamma \geq 0, \quad (4.2)$$

and E_t is the expectations operator conditional on time t information. The preferences include as a special case ($\gamma = 0$) the preferences proposed by Greenwood, Hercowitz, and Huffman (1988), which rule out wealth effects on the labor supply. We incorporate this type of preferences to control for the strength of the wealth effect by choosing γ . The composite consumption good consists of a domestic tradable and a non-tradable good:

$$C_t = (n^{\frac{1}{\lambda}} C_{Tt}^{\frac{\lambda-1}{\lambda}} + (1-n)^{\frac{1}{\lambda}} C_{Nt}^{\frac{\lambda-1}{\lambda}})^{\frac{\lambda}{\lambda-1}}, \quad 0 < n < 1, \lambda > 0, \quad (4.3)$$

where n is the share of tradable goods in composite consumption and λ the constant elasticity of substitution between the consumption of tradable and non-tradable goods.

At the beginning of period t , the consumer receives the entire money stock from the previous period M_{t-1} , gets prepaid paychecks $W_t L_t$, and deposits a cash amount D_t with the financial intermediary. The CIA constraint requires that all consumption expenditures must be paid with cash available at the beginning of period t :

$$P_t C_t \leq M_{t-1} - D_t + W_t L_t, \quad (4.4)$$

where P_t denotes the price index for the composite consumption good given by:

$$P_t = (nP_{Tt}^{1-\lambda} + (1-n)P_{Nt}^{1-\lambda})^{\frac{1}{1-\lambda}}. \quad (4.5)$$

Maximizing composite consumption subject to total expenditures with respect to the consumption of tradable and non-tradable goods, we obtain the demand functions for trad-

ables and non-tradables:

$$C_{Tt} = n \left(\frac{P_{Tt}}{P_t} \right)^{-\lambda} C_t, \quad (4.6)$$

$$C_{Nt} = (1 - n) \left(\frac{P_{Nt}}{P_t} \right)^{-\lambda} C_t, \quad (4.7)$$

both are decreasing in the ratio of the good's price to the overall price index P_{it}/P_t , for $i = T, N$.

The budget constraint of the consumer who owns the firm and bank reflects the evolution of her assets: the cash at the beginning of period $t + 1$ is equal to the sum of net dividends that she receives from the firm (π_t^F) and the financial intermediary (π_t^B), interest earnings and repayed deposits loaned to the financial intermediary at the beginning of the period ($R_{Dt}D_t$), and any cash that is left from financing consumption expenditures:

$$M_t = \pi_t^F + \pi_t^B + R_{Dt}D_t + (M_{t-1} - D_t + W_tL_t - P_tC_t). \quad (4.8)$$

The household maximizes its life-time utility (eq.(4.1)) subject to the CIA (eq.(4.4)) and budget (eq.(4.8)) constraints. A period's deposit decision is made before the financial shock occurs, while the decisions on consumption and labor supply are made afterward.

The Euler equation associated with the labor decision implies that in the optimum the consumer chooses consumption and labor such that the marginal rate of substitution between consumption and leisure is equal to their relative price:

$$\frac{U_{C_t}}{U_{L_t}} = -\frac{P_t}{W_t}. \quad (4.9)$$

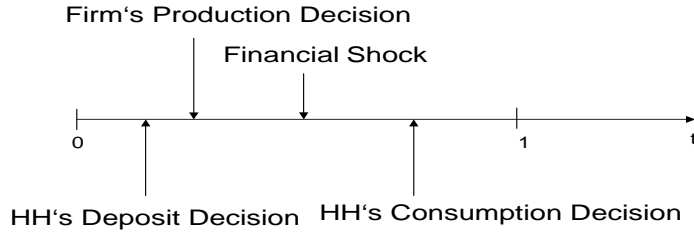
The intertemporal Euler equation associated with the deposit decision implies that marginal utility of consumption (or equivalently marginal utility of leisure) is equal between two consecutive periods:

$$E_t \beta \frac{U_{C_{t+1}}}{P_{t+1}} = \frac{U_{C_t}}{R_{Dt}P_t}. \quad (4.10)$$

4.2.2 Firm

The international financial shock affects the economy through the corporate sector. The representative firm produces two types of goods, tradables and non-tradables, using labor L_t , capital K_t , and imported materials IM_t as input factors. We assume that the firm has access to three types of credits. It borrows at the beginning of period t domestic short-

term credits, BL_t , from the financial intermediary to hire labor (bank loans), and foreign short-term credits, SF_t , to prepay imported materials (trade credits). The firm repays these loans including interest payments at the end of the period. In addition, we assume that the firm can borrow foreign long-term credits, FL_t , that have to be repayed at the beginning of the next period. These credits are used to finance investment. We assume that external debt is denominated in foreign currency, which is in line with the Original Sin theory (Eichengreen, Hausmann, and Panizza (2002)). Opposed to Christiano, Gust, and Roldos (2004), we assume that the firm decides on production at the beginning of period t , i.e. before the financial shock is realized, to capture that employment and investment decisions take time to plan. The timing in our model can be represented as follows:



It implies that the consumer decides on deposits and the firm on production, before the financial shock occurs. After the financial shock is realized at the end of the period t , the household makes its consumption decision and prices adjust such that all markets clear.

The production function of tradable and non-tradable goods is given by:

$$Y_{Tt} = A_{Tt} K_{Tt-1}^{\alpha_T} (IM_t^\nu L_{Tt}^{1-\nu})^{1-\alpha_T}, \quad 0 < \alpha_T < 1, \quad 0 < \nu < 1, \quad (4.11)$$

$$Y_{Nt} = A_{Nt} K_{Nt-1}^{\alpha_N} L_{Nt}^{1-\alpha_N}, \quad 0 < \alpha_N < 1, \quad (4.12)$$

where A_{Tt} and A_{Nt} denote stationary AR(1) technology processes.⁴ Note that α_i denotes the capital share in the production of each good and $\nu(1 - \alpha_T)$ the import share in the production of tradable goods. The labor shares in the production of tradables and non-tradables are given by $(1 - \nu)(1 - \alpha_T)$ and $(1 - \alpha_N)$, respectively. The firm accumulates two types of capital stocks:

$$K_{it} = I_{it} + (1 - \delta)K_{it-1}, \quad i = T, N, \quad (4.13)$$

where I_{it} denotes investment in period t and $0 < \delta < 1$ the rate of capital depreciation. We assume that changes in the stock of capital are subject to quadratic capital adjustment

⁴Note that all stochastic shock processes are presented in Section 4.2.6.

costs:

$$AC(K_{it}, K_{it-1}) = \frac{\gamma_i}{2} \left(\frac{K_{it} - (1 - \delta)K_{it-1}}{K_{it-1}} \right)^2 K_{it-1}, \quad i = T, N, \quad (4.14)$$

with an adjustment cost parameter denoted by $\gamma_i \geq 0$.

The firm starts each period with no cash, because all profits from the previous period are paid to the household. Implied by the assumption of advance-payments of labor and imports, the firm borrows domestic bank loans (BL_t) to hire labor, and foreign trade (SF_t) credits to prepay imported materials. In particular, the working capital constraints faced by the firm are given by:

$$BL_t \geq W_t L_{Tt} + W_t L_{Nt}, \quad (4.15)$$

$$SF_t \geq p_{IMt}^* IM_t, \quad (4.16)$$

where p_{IMt}^* denotes the price of imported materials expressed in foreign currency. Since domestic bank loans and foreign trade credits have to be repaid including interest payments at the end of each period, the effective costs of labor and imported materials in domestic currency are equal to $R_{Ft} W_t L_t$ and $e_t R_{St} p_{IMt}^* IM_t$, respectively. The nominal exchange rate e_t is denoted as the domestic price per unit of foreign currency and determined by the model's UIP condition (eq.4.27). R_{Ft} denotes the gross interest rate on domestic bank loans and R_{St} that of trade credits. We assume that R_{St} is equal to the risk-free interest rate on external long-term credits, $1 + r$, in the deterministic steady state following a stationary AR(1) process:

$$R_{St} = (1 - \rho_{RS})(1 + r) + \rho_{RS} R_{St-1} + \tilde{\varepsilon}_{St}. \quad (4.17)$$

The gross interest rate on foreign long-term credits R_{FFt} is composed of a risk-free component and a risk premium:

$$R_{FFt} = (1 + r) + \kappa(\exp(e_t FL_t - \bar{e} \bar{F} \bar{L}) - 1) + RP_t, \quad \kappa \geq 0. \quad (4.18)$$

The risk premium consists of a 'fundamentals-related' component, which increases with the firm's financial burden, and an 'international' component RP_t , which is assumed to follow a stationary AR(1) process. The specification is based on Schmitt-Grohé and Uribe (2003) with the difference that our specification takes into account financial amplifier effects of exchange rate depreciations. Note that $\bar{e} \bar{F} \bar{L}$ denotes the steady state level of foreign long-term credits denominated in domestic currency, and that the risk premium is equal to zero in the deterministic steady state. We assume that the SOE is hit by the international financial shock in the form of an unexpected, adverse shock to the risk premium RP_t .

The firm's optimization problem is to maximize the expected, discounted sum of future profits by choice of L_{Tt} , L_{Nt} , K_{Tt} , K_{Nt} , IM_t , BL_t , SF_t , and FL_t . Assuming that the firm is surprised by the financial shock, it solves the following optimization problem based on the information set of period $t - 1$:

$$\max_{L_{Tt}, L_{Nt}, K_{Tt}, K_{Nt}, IM_t, BL_t, SF_t, FL_t} E_{t-1} \sum_{j=0}^{\infty} \rho_{t,t+j} \pi_{t+j}^F, \quad (4.19)$$

where

$$\begin{aligned} \pi_t^F = & P_{Tt}Y_{Tt} + P_{Nt}Y_{Nt} - W_tL_{Tt} - W_tL_{Nt} - e_t p_{IMt}^* IM_t \\ & - P_{Tt}I_{Tt} - P_{Tt}AC(K_{Tt}, K_{Tt-1}) - P_{Nt}I_{Nt} \\ & - P_{Nt}AC(K_{Nt}, K_{Nt-1}) + BL_t - R_{Ft}BL_t \\ & + e_t SF_t - e_t R_{St} SF_t + e_t FL_t - e_t R_{FFt-1} FL_{t-1}, \end{aligned} \quad (4.20)$$

subject to the working capital constraints described above (eqs.(4.15)-(4.16)). We assume that goods and labor markets are perfectly competitive which implies that the firm acts as a price taker.

The optimality conditions with respect to labor in the production of tradable and non-tradable goods imply that expected effective marginal costs of labor are equal to their expected marginal products:

$$E_{t-1} R_{Ft} W_t = (1 - \alpha_T)(1 - \nu) E_{t-1} \frac{P_{Tt} Y_{Tt}}{L_{Tt}}, \quad (4.21)$$

$$E_{t-1} R_{Ft} W_t = (1 - \alpha_N) E_{t-1} \frac{P_{Nt} Y_{Nt}}{L_{Nt}}. \quad (4.22)$$

The intertemporal optimality condition with respect to capital in the production of both types of goods equates the expected costs and expected benefits of an additional unit of capital:

$$E_{t-1} \left(1 + \gamma \frac{I_{it}}{K_{it-1}} \right) = E_{t-1} \rho_{t,t+1} \left(\alpha_i \frac{Y_{it+1}}{K_{it}} + (1 - \delta) - \gamma \frac{I_{it+1}}{K_{it}} \left(\frac{1}{2} \frac{I_{it+1}}{K_{it}} - \frac{K_{it+1}}{K_{it}} \right) \right), \quad (4.23)$$

for $i = T, N$. Expected benefits on the right side are equal to the expected marginal product of an additional unit of capital, its resale value after capital depreciation, and associated capital adjustment costs. The costs in the current period are given by the unit of investment and associated capital adjustment costs.

The optimality condition with respect to imported materials implies that expected

effective marginal costs are equal to the expected marginal product:

$$E_{t-1}e_t R_{St} p_{IMt}^* = (1 - \alpha_T) \nu E_{t-1} \frac{P_{Tt} Y_{Tt}}{IM_t}. \quad (4.24)$$

The intertemporal optimality condition with respect to external long-term credits equates expected benefits and expected costs of an additional unit of long-term foreign funds:

$$E_{t-1}e_t = E_{t-1}\rho_{t,t+1}e_{t+1}\left(R_{FFt} + \frac{\partial R_{FFt}}{\partial FL_t} FL_t\right), \quad (4.25)$$

$$\frac{\partial R_{FFt}}{\partial FL_t} = \kappa \exp(e_t FL_t - \bar{e} \bar{FL}) e_t.$$

Expected costs on the right side are equal to the sum of repayment of interests and principle of an additional unit of foreign credits and its effect on the risk premium.

Since firm profits are distributed to the household at the end of the period, the firm's discount factor is equal to the subjective discount factor of the household:

$$\rho_{t,t+j} = \beta^j \frac{P_t}{P_{t+j}} \frac{U_{C_{t+j}}}{U_{C_t}}. \quad (4.26)$$

Using the expression for the firm's discount factor and combining the household's and firm's intertemporal optimal conditions (eqs.(4.10) and (4.25)), we obtain the model's UIP condition:

$$E_{t-1}R_{Dt} = E_{t-1} \frac{e_{t+1}}{e_t} \left(R_{FFt} + \frac{\partial R_{FFt}}{\partial FL_t} FL_t \right). \quad (4.27)$$

This condition differs from the usual UIP condition in two aspects: it includes a risk premium term (the second term on the right side) and it holds only in expectations conditioned on information at the end of period $t - 1$. The risk premium term stems from the fact that the interest rate on external long-term credits incorporates the debt-elastic risk premium. Note that with a positive level of foreign long-term debt, the domestic interest rate exceeds the foreign interest rate in the deterministic steady state and is given by:

$$\bar{R}_D = \bar{R}_{FF} + \kappa \bar{e} \bar{FL}. \quad (4.28)$$

The associated level of foreign debt in steady state is then equal to $\bar{e} \bar{FL} = \frac{1/\beta - (1+r)}{\kappa}$. The model's UIP condition is consistent with Lewis (1995) who finds empirical evidence for the existence of predicted interest rate differentials between home and foreign bonds which can be explained by differences in country risks. Moreover, realized and predicted interest rate differentials can deviate due to expectation errors. In our model, the actual

and predicted interest rate differentials coincide as long as there are no unexpected shocks in periods t and $t + 1$. If an unexpected shock occurs, the model's UIP condition deviates from the usual UIP condition in the initial period.

4.2.3 Financial Intermediary and Monetary Authority

The financial intermediary receives deposits, at the beginning of each period, and repays $R_{Dt}D_t$ at the end of each period. Moreover, the financial intermediary lends, at the beginning of the period, bank loans to the firm, and receives $R_{Ft}BL_t$ at the end of the same period. Moreover, we assume that the financial intermediary has a second source of funds measured by the change in domestic liquidity, $M_t - M_{t-1}$. Although a monetary authority could be introduced here, we abstract from monetary policy and assume that domestic liquidity follows a stationary AR(1) process that is subject to 'domestic' and 'international' liquidity shocks. The financial intermediary solves the following problem:

$$\max_{D_t, BL_t} = E_t \sum_{j=0}^{\infty} \rho_{t,t+j} \pi_{t+j}^B, \quad (4.29)$$

s.t.

$$\pi_t^B = M_t - M_{t-1} + D_t - R_{Dt}D_t - BL_t + R_{Ft}BL_t, \quad (4.30)$$

$$BL_t = D_t + M_t - M_{t-1}, \quad (4.31)$$

where eq.(4.31) represents the bank's balance sheet identity.

In equilibrium, the intermediation margin between bank loans and deposits is zero:

$$R_{Ft} - R_{Dt} = 0. \quad (4.32)$$

4.2.4 Rest of the World

The rest of the world supplies imports, which are employed in the production of tradable goods. We assume that imports are producer-currency priced, and that the supply is increasing in the price of imports p_{IMt}^* :

$$IM_t = Z_{IM}(p_{IMt}^*)^{\phi_{IM}}, \quad Z_{IM} > 0, \quad \phi_{IM} > 0, \quad (4.33)$$

where Z_{IM} is a positive scaling parameter and ϕ_{IM} the price elasticity of supply.

The rest of the world imports tradable goods produced in the SOE. In particular, we

assume that exports of the SOE are producer-currency priced and that export demand is decreasing in the price of tradable goods:

$$C_t^* = Z_T \left(\frac{1}{e_t} p_{Tt} \right)^{-\phi_T}, \quad Z_T > 0, \quad \phi_T > 0, \quad (4.34)$$

where Z_T , analogously, is a positive scaling parameter and $-\phi_T$ the price elasticity of the foreign demand for tradables.⁵

4.2.5 Market Clearing Conditions

The market clearing condition for non-tradable goods is given by:

$$Y_{Nt} = C_{Nt} + I_{Nt} + AC_{Nt}, \quad (4.35)$$

and that for tradable goods by:

$$Y_{Tt} = C_{Tt} + I_{Tt} + AC_{Tt} + C_t^*. \quad (4.36)$$

These two conditions equate production to absorption.

The market clearing condition for labor is:

$$L_{Tt} + L_{Nt} = L_t. \quad (4.37)$$

Combining the household's and firm's cash constraints with the financial intermediary's balance sheet identity, the money market clearing condition corresponds to:

$$M_t = P_t C_t. \quad (4.38)$$

This condition requires that actual cash balances equal desired cash balances.

The consolidated budget constraint of the whole economy results from combining the household's budget constraint with those of the firm and the financial intermediary:

$$\begin{aligned} & (P_{Tt} Y_{Tt} - P_{Tt} C_{Tt} - P_{Tt} I_{Tt} - P_{Tt} AC_{Tt}) + (P_{Nt} Y_{Nt} - P_{Nt} C_{Nt} \\ & \quad - P_{Nt} I_{Nt} - P_{Nt} AC_{Nt}) + (W_t L_t - W_t L_{Tt} - W_t L_{Nt}) \\ & - e_t p_{IMt}^* IM_t - e_t (R_{St} - 1) SF_t - e_t (R_{FFt-1} - 1) FL_{t-1} = -e_t (FL_t - FL_{t-1}). \end{aligned} \quad (4.39)$$

⁵The assumption of producer-currency pricing implies that the firm sells tradable goods for the same price on the domestic and foreign market, and that foreign demand increases with an exchange rate depreciation, depending on the demand elasticity. Since SOEs typically sell commodities for which prices are given, we restrict the elasticity to be small.

Using the market clearing conditions for goods and labor, the consolidated budget constraint reduces to:

$$P_{Tt}C_{Tt}^* - e_t p_{IMt}^* IM_t - e_t(R_{St} - 1)SF_t - e_t(R_{FFt-1} - 1)FL_{t-1} = -e_t(FL_t - FL_{t-1}), \quad (4.40)$$

and the economy's trade balance is given by:

$$TB_t = \underbrace{P_{Tt}C_{Tt}^*}_{\text{Exports}} - \underbrace{e_t p_{IMt}^* IM_t}_{\text{Imports}}. \quad (4.41)$$

Using the definition of the trade balance, the consolidated budget constraint can be expressed as:

$$\underbrace{TB_t - e_t(R_{St} - 1)SF_t - e_t(R_{FFt-1} - 1)FL_{t-1}}_{\text{Current Account}} = \underbrace{-e_t(FL_t - FL_{t-1})}_{-\text{Capital Account}}. \quad (4.42)$$

This condition represents the economy's balance of payments condition, which requires that the current account (sum of the trade balance and net foreign interest payments) is equal to the negative of the capital account (change in net foreign assets).

4.2.6 Stochastic Shocks

The economy faces five stochastic shocks, to be more precise, two real and three financial shocks. Our main focus is set on the transmission of the international financial shock to the risk premium on external long-term credits, RP_t . The financial shocks are allowed to be correlated with each other, but not with the real shocks.⁶ In particular, we assume that the financial shock to the risk premium on foreign long-term credits is persistent following a stationary AR(1) process:

$$RP_t = \rho_{RP} RP_{t-1} + \varepsilon_{RPt}, \quad \varepsilon_{RPt} \sim N(0, \sigma_{RP}^2). \quad (4.43)$$

The interest rate on foreign short-term credits is assumed to be autoregressive and to be subject to financial shocks:

$$\begin{aligned} R_{St} &= (1 - \rho_S)(1 + r) + \rho_S R_{St-1} + \tilde{\varepsilon}_{St}, \\ \tilde{\varepsilon}_{St} &= \varepsilon_{St} + \varepsilon_{IS_t}, \quad \varepsilon_{it} \sim N(0, \sigma_i^2), \quad i = S, IS. \end{aligned} \quad (4.44)$$

We assume that shocks to the interest rate on foreign short-term credits, $\tilde{\varepsilon}_{St}$, consist

⁶In the baseline case, which is considered here, we abstract from correlations of financial shocks.

of a component (ε_{St}) that is uncorrelated with the financial shock to foreign long-term credits (ε_{RPt}), and a component (ε_{ISt}) that is correlated with the external financial shock.

Domestic liquidity is assumed to follow a stationary AR(1) process in logs:

$$\ln M_t = \rho_M \ln M_{t-1} + \tilde{\varepsilon}_{Mt}, \quad (4.45)$$

$$\tilde{\varepsilon}_{Mt} = \varepsilon_{Mt} + \varepsilon_{It}, \quad \varepsilon_{it} \sim N(0, \sigma_i^2), \quad i = M, IM. \quad (4.46)$$

As in the case of short-term credits, $\tilde{\varepsilon}_{Mt}$ denotes a composed shock consisting of a 'domestic' liquidity shock (ε_{Mt}) that is uncorrelated with ε_{RPt} , and an 'international' liquidity shock (ε_{It}) that is correlated with the external financial shock.

Finally, technology in both sectors is assumed to follow a stationary AR(1) process in logs:

$$\ln A_{it} = \rho_{Ai} \ln A_{it-1} + \varepsilon_{Ait}, \quad \varepsilon_{Ait} \sim N(0, \sigma_i^2), \quad i = T, N. \quad (4.47)$$

The stationarity assumptions imply that the autoregressive coefficients, $\rho_i, i = AT, AN, M, S,$ and RP , are smaller than 1 in modulus.

4.2.7 Equilibrium

A rational expectations equilibrium of the whole economy is a set of processes for $\{C_t, C_{Tt}, C_{Nt}, L_{Tt}, L_{Nt}, L_t, IM_t, K_{Tt}, K_{Nt}, I_{Tt}, I_{Nt}, Y_{Tt}, Y_{Nt}, \rho_{t,t+1}, P_{Tt}, P_{Nt}, P_t, p_{IMt}^*, W_t, C_t^*, D_t, BL_t, SF_t, FL_t, R_{Dt}, R_{Ft}, R_{St}, R_{FFt}\}_{t=0}^{\infty}$, having the following properties: (1) for each time period and given prices, the quantities solve the optimization problems of the household, firm, and the financial intermediary, and (2) all markets clear. We solve the model by linearizing the equilibrium conditions around the deterministic steady state and solve the linearized system using numerical methods. In Section 4.3, we discuss the choice of parameter values and investigate the impulse responses to the external financial shock.

4.2.8 Transmission mechanisms of the financial shock

In the following, we describe qualitatively the transmission of the international financial shock for a particular set of structural parameters which are set to satisfy certain long-run ratios of the LA-5 economies and to match the empirical impulse responses as discussed in the next section.⁷ We focus hereby on the description of the baseline case, which rules out correlations between the financial risks.

⁷The parameters are shown in Table 4.2, and the impulse responses of the model variables are shown in Figures 4.3 and 4.4.

Initially, after having decided on its production, the firm faces an unexpected rise in the costs of borrowing external long-term credits by the magnitude of the exogenous shock to the risk premium. The assumption, that the household's deposit and firm's production decisions are made before the shock occurs, implies that all other variables are unaffected in the initial period. In particular, the domestic interest rate does not react, because the household's deposit decision and the firm's demand for domestic bank loans are pre-determined. The usual UIP condition is violated, because the model's UIP condition holds only in expectations (eq. 4.27). Since there is no predicted interest rate differential, the exchange rate is expected to remain constant and no actual currency depreciation occurs. Overall, only the foreign interest rate changes in the initial period without affecting other prices and quantities.

In the next period, the firm reduces *ceteris paribus* external borrowing implied by the initial financial shock. Given the domestic interest rate rises less than the foreign interest rate, the UIP condition implies a currency depreciation which is followed by an expected appreciation. The currency depreciation in turn results in an adverse balance sheet effect by increasing the domestic value of external debt. For a given level of external debt, the depreciation leads to an increase in the risk premium on long-term credits and the firm reduces further new borrowing. The firm faces contrasting effects on operating profits in the form of increasing costs of imports and increasing earnings from exports. Moreover, the firm responds to the increase in the costs of investment and imports, by increasing labor demand in the tradable goods sector. Given the higher demand for tradables, caused by the increase in the demand for exports, the firm finds it optimal to reallocate resources from the non-tradable to the tradable good sector. Other things equal, the financial shock translates into a negative wealth effect for the household as dividend payments from the firm decrease. To compensate the adverse wealth effect, the household increases its labor supply only if $\gamma > 0$. In our case with $\gamma = 0$, employment is fully determined by the firm's labor demand falling below its steady state level. For our set of parameters, production drops persistently in both sectors and prices increase.

4.3 Econometric and calibration results

In this section, we investigate the empirical impulse responses (IRFs) of particular emerging-market fundamentals to a country risk premium shock resulting from a structural panel vector-autoregressive (VAR) model. Moreover, the empirical IRFs are matched with the theoretical IRFs by minimizing their weighted distance as a function of particular structural parameters of the theoretical model.

4.3.1 Econometric results

The quarterly data covers the period from 1994 to 2007 and includes the LA-5 countries: Brazil, Colombia, Ecuador, Mexico, and Peru. The variables entering the VAR system are GDP, investment, trade balance, domestic bank credits, and J.P. Morgan's EMBI+ country spread.⁸ The EMBI+ is a composite index of different liquid dollar-denominated debt instruments such as Brady bonds, Eurobonds, and traded loans by sovereign entities, and we use it as a measure for the country risk premium of external funds. Note that the underlying approach follows closely Uribe and Yue (2006) who analyze the effects of country spread shocks on business cycles in EM economies. The main differences are the choice of variables in the VAR system and the estimation method.⁹

The empirical model takes the form of a first-order VAR system:¹⁰

$$\mathbf{A}x_t = \mathbf{B}x_{t-1} + \varepsilon_t \quad (4.48)$$

$$\mathbf{A} = \begin{pmatrix} 1 & 0 & 0 & 0 & 0 \\ a_{21} & 1 & 0 & 0 & 0 \\ a_{31} & a_{32} & 1 & 0 & 0 \\ a_{41} & a_{42} & a_{43} & 1 & 0 \\ a_{51} & a_{52} & a_{53} & a_{54} & 1 \end{pmatrix}, x_t = \begin{bmatrix} y_{jt} \\ i_{jt} \\ tb_{jt} \\ c_{jt} \\ r_{jt} \end{bmatrix}, \varepsilon_t = \begin{bmatrix} \varepsilon_{jt}^y \\ \varepsilon_{jt}^i \\ \varepsilon_{jt}^{tb} \\ \varepsilon_{jt}^c \\ \varepsilon_{jt}^r \end{bmatrix},$$

where t refers to the time dimension and j to cross-sections. Moreover, y_{jt} denotes real GDP, i_{jt} real investment, tb_{jt} the trade balance to GDP ratio, c_{jt} real domestic credits, and r_{jt} the country spread.¹¹ Output, investment, and domestic credits are expressed in log-deviations from their log-linear trend. Moreover, all variables except for domestic credits and the country spread are seasonally adjusted. The included variables represent important macroeconomic aggregates describing EM-fundamentals, and they have been identified in the literature as being highly related to EM country spreads (Uribe and Yue (2006) and Tornell and Westermann (2003)). Our key interest hereby is to investigate whether our theoretical model is able to reproduce the economies' trajectory in response to a country risk premium shock of 5% per quarter (p.q.).

The structural shock to the country risk is identified by imposing restrictions on the

⁸A more detailed description of the data sources and definitions can be found in the Appendix.

⁹As Uribe and Yue (2006), we use a five-variable VAR system. The only difference is that we include domestic credits instead of the US interest rate. As the authors, we estimate the system equation-by-equation, but use the system GMM estimator instead of the Anderson-Hsiao estimator.

¹⁰We estimate the VAR model for the lag lengths $\{1, 2, 3, 4\}$ and calculate the corresponding Schwarz information criteria on lag order selection which are equal to $\{-34.69, -34.98, -34.68, -34.31\}$, respectively. Since they are of equal magnitude, we select the most parsimonious specification with one lag.

¹¹Real variables are calculated by dividing the particular variable with the GDP deflator.

matrix A , that is, by restrictions on the contemporaneous effect of the financial shock. Note that the restrictions reflect the relation between the considered variables implied by the theoretical model.¹² The identification scheme implies that innovations in the country spread affect the real variables with one-period lag, and that innovations in the real variables affect the country spread contemporaneously. As Uribe and Yue (2006), we are convinced that the identification strategy is reasonable since decisions on employment, consumption, and investment take time to plan and to be implemented. Equally, it seems reasonable to assume that financial markets react more rapidly to changes in the state of the economy. It is important to note that we are only interested in identifying the structural shock to the country risk premium. There are no restrictions on the coefficient matrix B .

A difficulty that arises from the specification of the empirical model is an endogeneity problem between the dependent variables and their lags, and the first-differences of the contemporaneous variables and those of the error term. To account for this problem, we estimate the VAR system (eq. 4.48) equation-by-equation using the Generalized Method of Moments (GMM) estimator for dynamic panel data (Arellano and Bover (1995)). The estimation results are reported in Table 4.1. The AR(2) tests indicate that there is no incidence of autocorrelation in the level equations. Most of the estimated coefficients show the expected signs. In particular, the variables are positively autocorrelated with autoregressive coefficients between 0.72 and 0.91. With a lag, output and domestic credits decrease significantly in response to an increase in the country spread. Investment and the trade balance do not react significantly to the lag of the country risk premium, rather the effect is transmitted through the lagged decline in GDP, which significantly affects investment in the same period. In return, the implied adverse response of investment leads to an increase of the trade balance in that period.

Based on the moving average representation of the VAR system, we calculate the IRFs to a country spread shock of 5% (p.q.). The results are shown in Figure 4.2. The dotted lines indicate 10% and 90% bootstrap intervals based on 1000 replications of estimation.¹³ In response to the innovation in the country spread, the country spread increases and reverses steadily toward zero. The half life of the country spread response is approximately one year and a quarter. Output, investment, and credits respond negatively with a lag to the country spread shock. The trade balance improves with a lag indicating that domestic absorption deteriorates more than domestic output. The IRFs of the trade balance,

¹²In an earlier version of this model, the variables responded contemporaneously to the risk premium shock. In order to be able to identify the structural financial shock using this VAR specification, we imposed that the firm decides on production before the financial shock realizes.

¹³More precisely, in each replication we generate artificial data using the estimated coefficients and re-sampled residuals of the original VAR system, and re-estimate the VAR system and the corresponding IRFs. The bootstrap intervals are the 10th and 90th percentile of the resulting distribution of IRFs.

however, are not significant, since the zeroline lies within the bootstrap interval. Another finding is that output and the trade balance recover generally faster than investment and domestic credits. Investment decreases approximately by 15% from trend after 2 years, while output drops by 8% from trend after 1 year. The trade balance improves by approximately 2% of GDP, and domestic credits decrease by 10% from trend. While output, the trade balance, and the country risk premium recover after about 7 years, the recovery of the investment and domestic credits takes 10 years.

4.3.2 Calibration results

In the next step, we match the empirical IRFs with those implied by the theoretical model as a function of a set of structural parameters. Two groups of model parameters have to be distinguished.

The first group contains parameters for which values are chosen such that our economy satisfies certain long-run characteristics in the steady state that are in line with the empirical evidence on EMs and the related literature. In particular, the economy's impatience measured by the discount factor β is set to 0.95 implying an annualized domestic interest rate of about 20%. Moreover, we set $r = 0.01$ which implies an annual risk-free foreign interest rate of 4%. We restrict the parameters $\{n, \alpha_T, \nu, \alpha_N, \delta\}$ such that the tradable goods sector makes up about 40% of overall production following Ruhl and Kehoe (2007) and Arellano and Mendoza (2003). In particular, the share of tradable goods in composite consumption is set to $n = 0.3$ and the rate of capital depreciation to $\delta = 0.026$ implying an annual rate of 10%. As Christiano, Gust, and Roldos (2004), we assume that tradable production is more capital intensive and we set $\alpha_T = 0.4$ and $\alpha_N = 0.3$. Moreover, we set the import parameter in tradable production to be equal to $\nu = 0.3$ which implies a share of imports in overall production of 7% and a share of wage income of 54%. The financial friction parameter is set to $\kappa = 0.04$ which results in a steady state ratio of external long-term debt to annual production of 20%.¹⁴ Overall, this set of parameters implies that the trade balance to GDP ratio is equal to 1% in the steady state. Finally, the household's intertemporal elasticity of substitution of consumption is set to $\sigma = 1.001$, and its intertemporal elasticity of substitution of labor supply to 2 implying $\mu = 1.45$ as in Mendoza (1991) and Uribe and Yue (2006).

The second group of parameters includes the remaining structural parameters and those describing the stochastic processes. These parameters are allowed to vary on a fixed interval and are estimated by matching the IRFs. The structural parameters include the

¹⁴For instance Mexico, Brazil, and Colombia had net external debt to GDP ratios between 20-40% prior to their crises based on Lane and Milesi-Ferretti (2006).

capital adjustment cost parameters, γ_T and γ_N , the elasticities of imports and exports ϕ_{IM} and ϕ_T , the elasticity of substitution between tradables and non-tradables λ , and the preference parameter γ which controls for wealth effects on labor supply. The parameters of the stochastic processes consist of the autoregressive coefficients $(\rho_{RP}, \rho_S, \rho_M, \rho_{AT}, \rho_{AN})$ and the variances and covariances of the stochastic shocks. In the baseline case, however, we estimate only the parameters of the financial shock process of long-term credits (ρ_{RP}, σ_{RP}) and set the parameters of the other shock processes to zero.

The empirical and theoretical IRFs are matched by minimizing a measure of the distance between the empirical IRFs, IR^e , stemming from the VAR analysis and the corresponding theoretical IRFs, IR^t . The theoretical counterparts of the VAR variables are real output $(P_T Y_T + P_N Y_N)/P$, real investment $(P_T I_T + P_N I_N)/P$, trade balance over production TB/PY , real domestic bank loans BL/P , and the risk premium on foreign long-term credits $R_{FF} - (1 + r)$. We match 20 quarters of the impulse responses of each variable by minimizing the following distance function with respect to $\xi = (\gamma_T, \gamma_N, \phi_{IM}, \phi_T, \lambda, \gamma, \rho_{RP}, \sigma_{RP})$:

$$\min_{\xi} [IR^e - IR^t(\xi)]' \Sigma^{-1} [IR^e - IR^t(\xi)], \quad (4.49)$$

subject to $\underline{\xi} \leq \xi \leq \bar{\xi}$.¹⁵ The weighting matrix Σ^{-1} is calculated as the inverse of the covariance matrix of the IRFs resulting from the 1000 bootstrap replications. The starting values of the parameters ξ are set according to the related literature and actual data (Ruhl and Kehoe (2007) and Arellano and Mendoza (2003)). Table 4.2 shows the starting values, interval bands, and the resulting parameters. Most of the estimated coefficients lie well inside the interval band, with the exception of the elasticity of substitution between the consumption of tradables and non-tradables and the wealth parameter in the utility function, which converge to their boundaries, i.e. $\lambda = 0.1$ and $\gamma = 0$. The size of the exogenous financial shock ε_{RP} is estimated to be 1%. Figure 4.3 compares the empirical IRFs with those resulting from the model. Most of the points belonging to the theoretical IRFs lie inside the bootstrapped confidence intervals. Although we estimate only 8 parameters to match 100 points of impulse responses, the theoretical model reproduces the qualitative features of the empirical IRFs described above reasonably well: output, investment, and domestic credits drop, while the trade balance improves. The initial responses of the trade balance and investment, however, are overestimated. On the contrary, output and domestic credits do not react as much as in the VAR model.¹⁶ Over time, theoretical

¹⁵The constrained nonlinear minimization is done numerically. The convergence criterion, i.e. the change in the distance, is set to 10^{-4} .

¹⁶We have done the estimations allowing for a correlation between the international financial shock and the shock to domestic liquidity. The estimated correlation turned out to be negative improving the overall fit of the model.

and empirical IRFs get closer. To check our model, we investigate the responses of other particularly important model variables, see Figure 4.4. Interest rates are shown in percentage points and the other variables in percent deviations from steady state. All model variables respond as expected. The interest rate R_{FFt} increases by about 3 percentage points, mainly, driven by the fundamentals-related component. The associated currency depreciation amounts to 60%. External long-term credits decrease by approximately 2% returning to the pre-shock level after about 4 years. Associated with this are drops in investments and imports (-20%), and an increase in exports by about 30% (equivalent to 3.2% of tradable production). The capital stock in the tradable sector drops by 4% and in the non-tradable sector by 2%. Moreover, labor is shifted from the non-tradable (-8%) to the tradable goods sector (+10%) as earnings from exports increase. As a result, the shock leads to a decline in total output of 3%, while the drop in the tradable goods sector is smaller (-2%), than in the non-tradable goods sector (-5%). Total consumption drops by 4% which is dominated by a decrease in the consumption of tradable goods (-5%) caused by the increase in exports.

Summing up, the model reproduces the qualitative and quantitative features of the empirical IRFs. The initial risk premium shock is amplified by the currency depreciation and results in important contractions in economic activity and domestic absorption. Most of the 100 points belonging to the theoretical impulse responses of output, investment, trade balance, domestic credits, and country risk premium lie inside the bootstrapped confidence interval, except for the initial periods.

4.4 Conclusion

The aim of this paper was to investigate, from the perspective of EM economies, the transmission and amplification mechanisms of unexpected international financial shocks in the presence of foreign-currency denominated corporate debt. In particular, we developed a cash-in-advance model with limited participation and matched the implied impulse responses with empirical impulse responses of 5 Latin American economies.

There are two main results. First, the theoretical model reproduces the qualitative and quantitative features of the empirical IRFs by the estimation of a parsimonious set of parameters. Second, the resulting implications with regard to the transmission of the international financial shock are the following: The financial shock enters initially the risk premium of foreign credits. Given domestic interest rates, the exchange rate depreciates, and the real effects of the initial shock are amplified by an adverse balance sheet effect and a 'fundamentals-related' increase in the risk premium of foreign credits. The financial amplifier effects are more pronounced in economies with high levels of foreign-

currency debt and low levels of foreign-currency income, because the associated exchange rate depreciation is larger, when a large stock of external debt has to be adjusted. In our framework, the capital account dominates the balance of payments, and the current account has to adjust. The involved reduction in foreign capital, is partly offset by a shift of resources from the non-tradable to the tradable goods sector, and the associated export expansion counteracts the reduction in imports. When the financial shock is associated with a liquidity shortage in the banking sector, then the output drop is amplified.

The theoretical framework allows to explore monetary policy responses to international financial shocks, but we leave this to future work. Monetary policy faces a difficult task, when the financial shock occurs: If the monetary authority injects additional liquidity to the banking sector, this reduces the domestic interest rate, but increases the currency depreciation. On the contrary, if the monetary authority increases the domestic interest rate, it counteracts the associated exchange rate depreciation, but deteriorates domestic financial conditions (fear of floating). Ultimately, the optimal policy response depends on the degree of foreign-currency debt relative to the economy's foreign-currency income.

4.5 Appendix

Data

The data consists of quarterly data for 5 Latin American economies: Brazil, Colombia, Ecuador, Mexico, and Peru. The sample periods vary from country to country: Brazil 1995:1-2007:4, Colombia 1994:1-2007:4, Ecuador 1995:2-2002:1, Mexico 1994:1-2007:4, and Peru 1994:1-2007:4. Totally, the dataset includes 203 observations.

Quarterly series for GDP, gross domestic investment, trade balance, and domestic credits are from IMF's International Financial Statistics. GDP, investment, and trade balance are seasonally adjusted. GDP, investment, and domestic credits are deflated using the GDP deflator. Because of lack of the series for GDP deflator for Brazil, we use the CPI series instead. For the country spread series, we used J.P. Morgan EMBI+ stripped spread from the database 'Datastream'. We expressed GDP, investment, and domestic credits as log deviations from a log-linear trend, and the trade balance ratio as a ratio of nominal trade balance to nominal GDP.

Tables and Figures

Table 4.1: Results of the panel VAR estimation

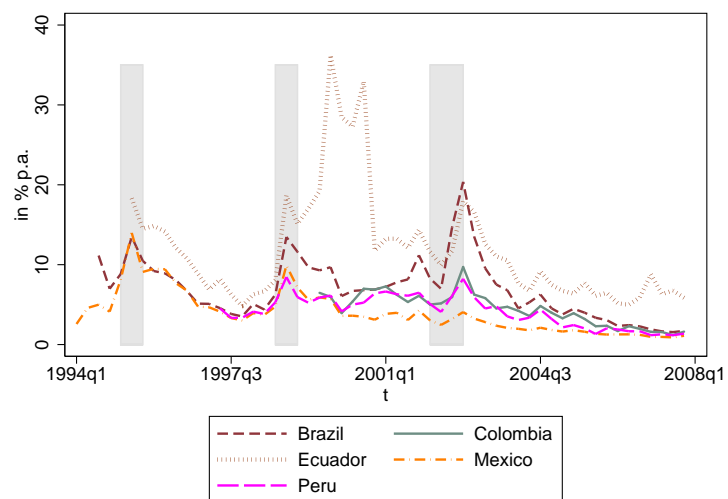
Estimation method: System GMM					
Independent variable	Dependent variables: ^a				
	y_t	i_t	tb_t	c_t	r_t
y_t	–	1.18**	0.08	0.05	-0.14
y_{t-1}	0.72***	-0.89	-0.01	-0.27***	0.12
i_t	–	–	-0.16**	-0.02	0.01
i_{t-1}	0.08***	0.88***	0.12**	0.11	-0.03
tb_t	–	–	–	0.43	0.24***
tb_{t-1}	0.28***	0.09	0.91***	-0.39	-0.19**
c_t	–	–	–	–	0.06
c_{t-1}	-0.02*	0.01	0.01	0.91***	-0.03
r_t	–	–	–	–	–
r_{t-1}	-0.15**	-0.08	0.01	-0.22**	0.76***
Observations	203	203	203	203	203
AR(2)	0.62	0.64	0.36	0.20	0.27

^a Note that (***, **, *) indicate significance at the 1%, 5% and 10% level. The included countries are Brazil, Colombia, Ecuador, Mexico, and Peru. The constant is not reported.

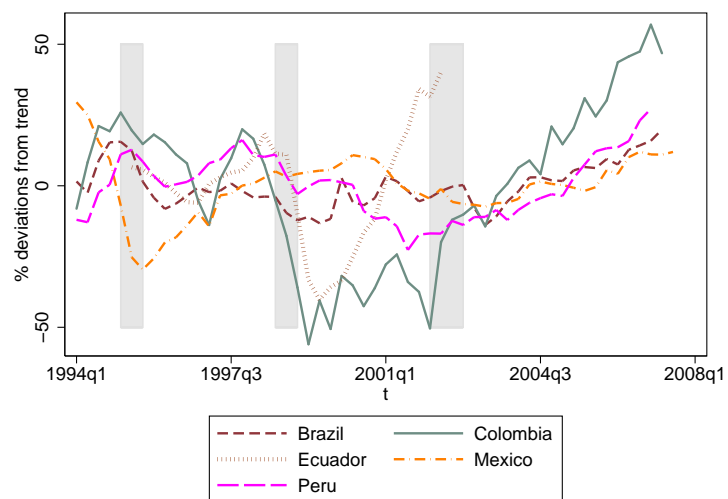
Table 4.2: Structural parameters and steady state ratios

Parameter	Starting value	Interval	Estimation result	Description
β	0.95			time preference
μ	1.45			consumption-labor in utility
σ	1.001			intertemporal EoS
n	0.3			share of C_T in C
λ	0.14	[0.1,0.2]	0.1	EoS between C_N and C_T
γ	0	[0,0.5]	0	disutility of labor
α_T	0.3			capital share in Y_T
α_N	0.4			capital share in Y_N
δ	0.028			capital depreciation
r	0.01			risk-free interest rate
κ	0.04			risk premium parameter
ν	0.3			share of imports in Y_T
γ_T	0	[0,20]	16.97	K_T adjustment costs
γ_N	0	[0,20]	4.26	K_N adjustment costs
Z_{IM}	0.1			import supply parameter
Z_T	0.1			export demand parameter
ϕ_{IM}	0.7	[0.5,0.9]	0.84	price elasticity of import supply
ϕ_T	0.7	[0.6,0.8]	0.68	price elasticity of export demand
σ_{RP}	0.03	[0,0.03]	0.01	std. deviation of ε_{RP}
ρ_{RP}	0.6	[0.4,0.9]	0.57	persistence of ε_{RP}
Resulting steady state ratios				
Y_T/Y	0.37	L_T/L	0.24	
C_N/Y	0.93	C_T/Y	0.68	
C^*/Y	0.08	BL/M	0.21	

Figure 4.1: EMBI spreads and investments for the LA-5 countries



(a) Country spreads in percent p.a.



(b) Investments in percent deviations from trend

Figure 4.2: Empirical impulse responses to the country spread shock

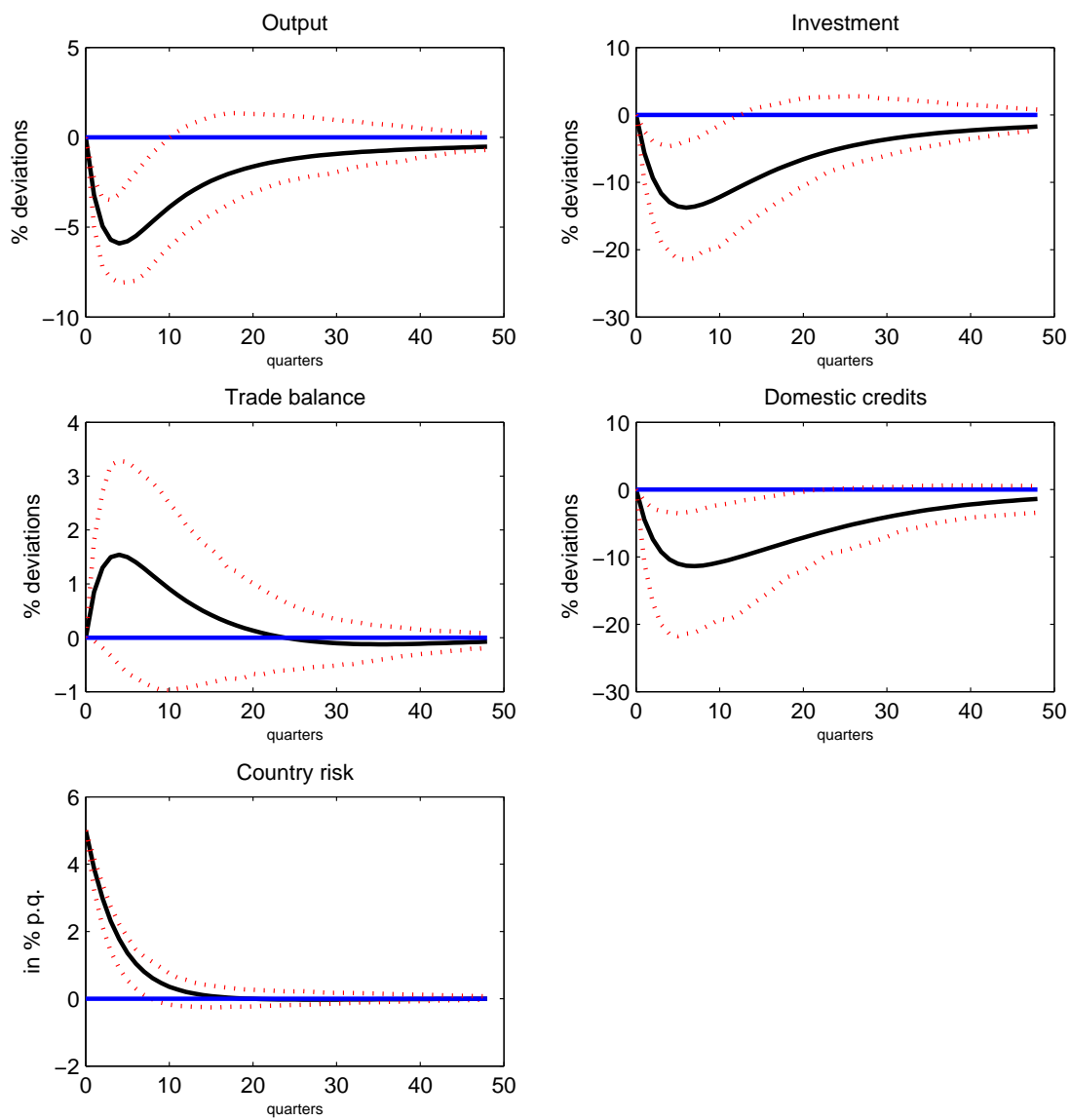


Figure 4.3: Empirical and theoretical impulse responses

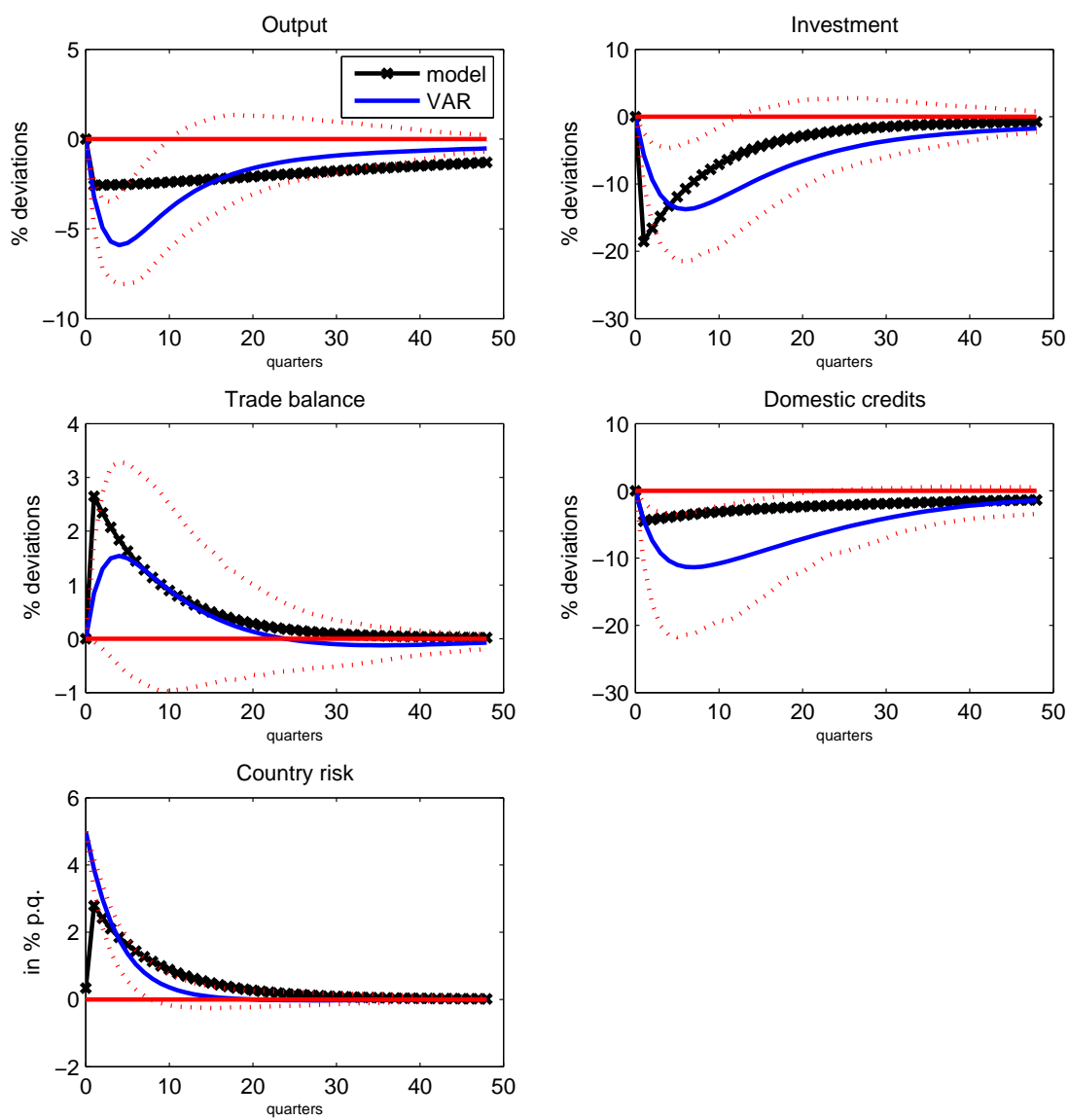
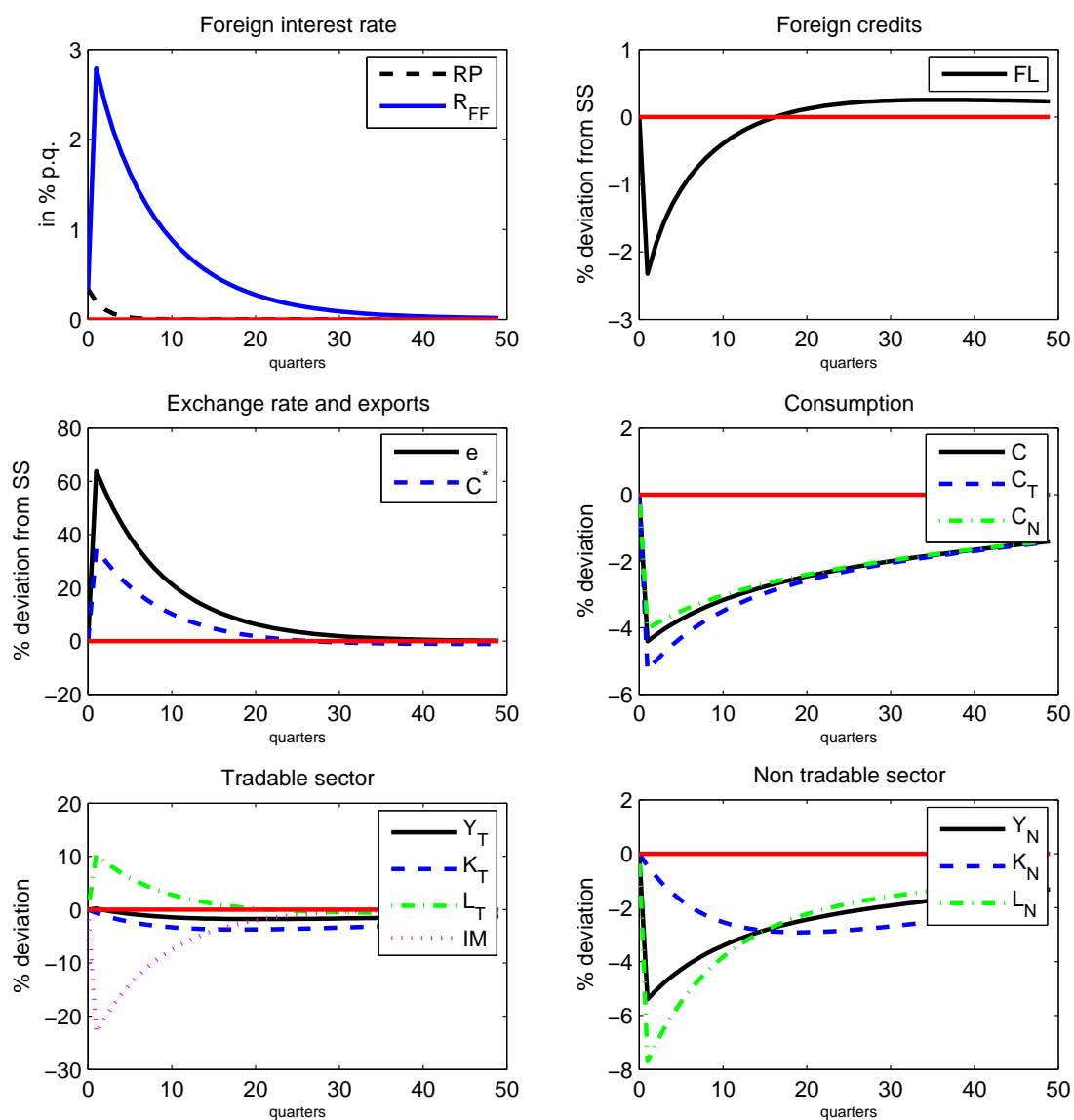


Figure 4.4: Selected theoretical impulses responses



Bibliography

- AGHION, P., P. BACCHETTA, AND A. V. BANERJEE (2004): "A Corporate Balance Sheet Approach to Currency Crises," *Journal of Economic Theory*, 119, 6–30.
- AGUIAR, M. (2005): "Investment, Devaluation, and Foreign Currency Exposure: The Case of Mexico," *Journal of Development Economics*, 78, 95–113.
- ALLEN, F., A. BERNARDO, AND I. WELCH (2000): "A Theory of Dividends based on Tax Clienteles," *The Journal of Finance*, 55, 2499–2536.
- ARELLANO, C., AND E. MENDOZA (2003): - *Credit Frictions and 'Sudden Stops' in Small Open Economies: An Equilibrium Business Cycle Framework for Emerging Market Crises* -chap. in: *Dynamic Macroeconomic Analysis: Theory and Policy in General Equilibrium*. Cambridge University Press.
- ARELLANO, M., AND S. BOND (1991): "Some Tests of Specification for Panel Data: Monte Carlo Evidence and an Application to Employment Equations," *The Review of Economic Studies*, 58, 277–297.
- ARELLANO, M., AND O. BOVER (1995): "Another Look at the Instrumental Variable Estimation of Error Components Models," *Journal of Econometrics*, 68, 29–51.
- ARENA, M., C. REINHART, AND F. VAZQUEZ (2006): "The Lending Channel in Emerging Economies: Are Foreign Banks different?," *IMF Working Paper*, (07/48), 1–54.
- BAGEHOT, W. (1873): - *Lombard Street: A Description of the Money Market* -London, H.S. King.
- BAIG, T., AND I. GOLDFAJN (1999): "Financial Market Contagion in the Asian Crisis," *IMF Staff Papers*, 46(2).
- (2000): "The Russian Default and the Contagion to Brazil," *IMF Working Paper*, 00/160.

- BARAJAS, A., E. BASCO, H. JUAN-RAMON, AND C. QUARRACINO (2007): “Banks During the Argentine Crisis: Were They All Hurt Equally? Did They All Behave Equally?,” *IMF Staff Papers*, 54(4).
- BARAJAS, A., R. CHAMI, AND T. COSIMANO (2005): “Did the Basel Accord Cause a Credit Slowdown in Latin America?,” *IMF Working Paper*, (05/38), 1–42.
- BERNANKE, B., M. GERTLER, AND S. GILCHRIST (1996): “The Financial Accelerator in a Quantitative Business Cycle Framework,” *Review of Economics and Statistics*, 78(1), 1–15.
- BERNANKE, B. S., C. S. LOWN, AND B. M. FRIEDMAN (1991): “The Credit Crunch,” *Brookings Papers on Economic Activity*, 1991(2), 205–48.
- BLEAKLEY, H., AND K. COWAN (2002): “Corporate Dollar Debt and Depreciations: Much Ado About Nothing?,” *mimeo*.
- BORDO, M. D. (2006): “Sudden Stops, Financial Crises and Original Sin in Emerging Countries: Deja vu?,” *NBER Working Paper Series*, No. 12393.
- CABALLERO, R., K. COWAN, AND J. KEARNS (2004): “Fear of Sudden Stops: Lessons from Australia and Chile,” *MIT Working Paper*, No. 04-23.
- CALVO, G. (1998a): - *Varieties of Capital-Market Crises* -chap. in: *The Debt Burden and its Consequences for Monetary Policy*. International Economic Association.
- (1998b): “Capital Flows and Capital-Market Crises: The Simple Economics of Sudden Stops,” *Journal of Applied Economics*, 1, 35–54.
- (1998c): “Understanding the Russian Virus with Special Reference to Latin America,” *Manuscript*.
- (1999): “Contagion in Emerging Markets: When Wall Street is a Carrier,” *Manuscript*.
- (2001): “Capital Markets and the Exchange Rate with Special Reference to the Dollarization Debate in Latin America,” *Journal of Money, Credit, and Banking*, 33(2), 312–334.
- (2002): “Globalization Hazard and Delayed Reform in Emerging Markets,” *Economia*, 2(2), 1–29.
- (2006a): “Crises in Emerging Market Economies: A Global Perspective,” *NBER Working Paper Series*, No. 11305.

- (2006b): “Monetary policy challenges in Emerging Markets: Sudden stop, Liability dollarization, and Lender of Last Resort,” *Manuscript*.
- CALVO, G., A. IZQUIERDO, AND L.-F. MEJIA (2004): “On the Empirics of Sudden Stops: The Relevance of Balance Sheet Effects,” *NBER Working Paper Series, No. 10520*.
- CALVO, G., A. IZQUIERDO, AND E. TALVI (2006): “Phoenix Mirales in Emerging Markets: Recovering without Credit from Systemic Financial Crises,” *NBER Working Paper Series, No. 12101*.
- CALVO, G., AND E. MENDOZA (2000): “Capital-Market Crises and Economic Collapse in Emerging Markets: An Information Frictions Approach,” *American Economic Review: Papers & Proceedings*, 90, 59–64.
- CALVO, G., AND F. S. MISHKIN (2003): “The Mirage of Exchange Rate Regimes for Emerging Market Countries,” *Journal of Economic Perspectives*, 17(4), 99–114.
- CALVO, G., AND C. REINHART (1999): “Capital Flow Reversal, the Exchange Rate Debate, and Dollarization,” *Finance and Development*, Sep. 99, 13–15.
- (2000): - *When Capital Inflows Come to a Sudden Stop: Consequences and Policy Options* -chap. in: *Reforming the International Monetary and Financial System*, pp. 175–201. Washington DC: International Monetary Fund.
- CALVO, G., AND E. TALVI (2005): “Sudden stop, Financial Factors and Economic Collapse in Latin America: Learning from Argentina and Chile,” *NBER Working Paper Series, No. 11153*.
- CASTILLO, P., AND D. B. RONDAN (2008): “Facing up a Sudden Stop of Capital Flows: Policy Lessons from the 90’s Peruvian Experience,” *Central Reserve Bank of Peru, WP 2008-002*.
- CAVALLO, E., AND J. FRANKEL (2004): “Does Openness to Trade make Countries more vulnerable to Sudden Stops, or less? Using Gravity to establish Causality,” *Manuscript, Havard University*.
- CESPEDES, L. F., R. CHANG, AND A. VELASCO (2000): “Balance Sheets and Exchange Rate Policy,” *NBER Working Paper, (7840)*.
- CHRISTIANO, L., C. GUST, AND J. ROLDOS (2004): “Monetary Policy in a Financial Crisis,” *Journal of Economic Theory*, 119, 64–103.

- CHRISTIANO, L. J. (1991): "Modeling the Liquidity Effect of a Money Shock," *Federal Reserve Bank of Minneapolis - Quarterly Review*, pp. 3–34.
- CHRISTIANO, L. J., AND M. EICHENBAUM (1992): "Liquidity Effects and the Monetary Transmission Mechanism," *The American Economic Review*, 82(2), 346–353.
- CHRISTIANO, L. J., M. EICHENBAUM, AND C. L. EVANS (1997): "Sticky Price and Limited Participation Models of Money: A Comparison," *European Economic Review*, 41, 1201–1249.
- CLAESSENS, S., A. DEMIRGUC-KUNT, AND H. HUIZINGA (2001): "How does Foreign Bank Entry affect Domestic Banking Markets," *Journal of Banking and Finance*, 25(5), 891–911.
- CLARKE, G., M. MARTINEZ PERIA, AND S. SANCHEZ (2003): "Foreign Bank Entry: Experience, Implications for Developing Countries, and Agenda for Further Research," *World Bank Research Observer*, 18(1), 25–59.
- COOK, D., AND M. DEVEREUX (2005): "Accounting for the East Asian Crisis: A Quantitative Model of Capital Outflows in Small Open Economies," *Journal of Money, Credit and Banking*.
- COOPER, R., AND J. EJARQUE (2003): "Financial Frictions and Investment: Requiem in Q," *Review of Economic Dynamics*, 6, 710–728.
- DAGES, B., L. GOLDBERG, AND D. KINNEY (2000): "Foreign and Domestic Bank Participation in Emerging Markets: Lessons from Mexico and Argentina," *Federal Reserve Bank of New York Economic Policy Review*, 6(3), 17–36.
- DIAMOND, D. W., AND P. H. DYBVIK (1983): "Bank Runs, Deposits Insurance, and Liquidity," *Journal of Political Economy*.
- DIAMOND, D. W., AND R. G. RAJAN (2005): "Liquidity Shortages and Banking Crises," *The Journal of Finance*, 60(2), 615–47.
- DORNBUSCH, R. (2001): "A Primer on Emerging Market Crises," *Manuscript, MIT*.
- EDWARDS, S. (2005): "Capital Controls, Sudden Stops and Current Account Reversals," *NBER Working Paper Series, No. 11170*.
- EICHENGREEN, B., P. GUPTA, AND A. MODY (2006): "Sudden stops and IMF-supported programs," *NBER Working Paper Series, No. 12235*.
- EICHENGREEN, B., AND R. HAUSMANN (1999): "Exchange Rates and Financial Fragility," *NBER Working Paper Series, No. 7418*.

- EICHENGREEN, B., R. HAUSMANN, AND U. PANIZZA (2002): "Original Sin: The Pain, the Mystery and the Road to Redemption," *University of California, Berkley*.
- FISCHER, S. (2001): "The International Financial System: Crises and Reform," *The Robbins Lectures, LSE*.
- FISHER, I. (1933): "The Debt-Deflation Theory of Great Depressions," *Econometrica*, 1(4), 337–347.
- GALINDO, A., U. PANIZZA, AND F. SCHIANTARELLI (2003): "Debt Composition and Balance Sheet Effects of Currency Depreciation: A Summary of the Micro Evidence," *Emerging Market Review*, 4, 330–339.
- GAMBACORTA, L., AND P. E. MISTRULLI (2004): "Does Bank Capital Affect Lending Behavior?," *Journal of Financial Intermediation*, 13, 436–457.
- GARCIA, M. (2007): "Policy Responses to Sudden Stops in Brazil," *PUC Rio*.
- GILCHRIST, S., AND J. SIM (2007): "Investment During the Korean Financial Crisis: A Structural Econometric Analysis," *NBER Working Paper*, (13315).
- GOLDFAJN, I. (2001): "Roundtable Comments on Monetary and Regulatory Polic," *Domestic Finance and Global Capital in Latin America Conference, Federal Reserve Bank of Atlanta*, pp. 1–4.
- GREENWOOD, J., Z. HERCOWITZ, AND G. W. HUFFMAN (1988): "Investment, Capacity Utilization, and the Real Business Cycle," *The American Economic Review*, 78(3), 402–417.
- GUIDOTTI, P., F. STURZENEGGER, AND A. VILLAR (2004): "On the Consequences of Sudden Stops," *Economia*, 4.
- HALAC, M., AND S. L. SCHMUKLER (2003): "Distributional Effects of Crises: The Role of Financial Transfers," *World Bank Research Paper, No. 3173*.
- HONIG, A. (2005): "Fear of Floating and Domestic Liability Dollarization," *Emerging Markets Review*, 6, 289–307.
- IMF (1998): "Indonesia Memorandum on Economic and Financial Policies," *Washington (January 15)*, pp. 1–15.
- JEANNE, O., AND R. RANCIERE (2006): "The optimal Level of International Reserves for Emerging Market Countries: Formulas and Applications," *IMF Working Paper*, 06/229.

- JOYCE, J. P., AND M. NABAR (2007): “Sudden Stops, Banking Crises and Investment Collapses in Emerging Markets,” *Wellesley College Working Paper*.
- KALANTZIS, Y. (2007): “Financial Fragility in Emerging Markets: Firm Balance Sheets and the Sectoral Structure,” *Manuscript, PSE*.
- KAMIL, H. (2004): “A new Database on the Currency and Maturity Structure of Firms’ Balance Sheets in Latin America,” *Inter-American Development Bank*.
- KAMINSKI, G., C. REINHART, AND C. VEGH (2003): “The Unholy Trinity of Financial Contagion,” *Journal of Economic Perspectives*, 17, 51–74.
- LANE, P. R., AND G. M. MILESI-FERRETTI (2006): “The External Wealth of Nations Mark II: Revised and Extended Estimates of Foreign Assets and Liabilities, 1970–2004,” *IMF Working Papers*, No. 06/69.
- LEWIS, K. (1995): “Puzzles in International Financial Markets,” in *Handbook of International Economics*, ed. by G. Grossman, and K. Rogoff, vol. III, pp. 1913–1971. Elsevier, Amsterdam.
- LINTNER, J. (1956): “Distributions of Incomes of Corporations among Dividends, Retained Earnings, and Taxes,” *American Economic Review*, 46, 97–113.
- MARTINEZ PERIA, M., AND A. MODY (2004): “How foreign Participation and Market Concentration Impact Banking Spreads: Evidence from Latin America,” *Journal of Money, Credit and Banking*, 36(3), 511–37.
- MENDOZA, E. (1991): “Real Business Cycles in a Small Open Economy,” *The American Economic Review*, 81(4), 797–818.
- (2006a): “Endogenous Sudden Stops in a Business Cycle Model with Collateral Constraints: A Fisherian Deflation of Tobin’s Q,” *NBER Working Paper Series*, No. 12564.
- (2006b): “Lessons from the Debt-Deflation Theory of Sudden Stops,” *American Economic Review*, 96(2), 411–416.
- MILLER, H. M., AND K. ROCK (1985): “Dividend Policy under Asymmetric Information,” *The Journal of Finance*, 40, 1031–1051.
- MINSKY, H. (1964): “Longer Waves in Financial Relations: Financial Factors in the More Severe Depressions,” *American Economic Review*, 54(3), 325–335.

- MISHKIN, F. S. (2003): - *Financial Policies and the Prevention of Financial Crises in Emerging Market Countries* -chap. in: *Economic and Financial Crises in Emerging Markets*. University of Chicago Press.
- NEUMEYER, P. A., AND F. PERRI (2005): “Business Cycles in Emerging Economies: The Role of Interest Rates,” *Journal of Monetary Economics*, 52.
- PEEK, J., AND E. ROSENGREN (2000): “Implications of the Globalization of the Banking Sector: The Latin American Experience,” *New England Economic Review*, 2000(3), 45–63.
- ROUBINI, N., AND B. SETSER (2004): *Bailouts or Bail-ins? Responding to Financial Crises in Emerging Economies*. Institute For International Economics.
- RUHL, K., AND T. KEHOE (2007): “Sudden Stops, Sectoral Reallocations, and the Real Exchange Rate,” *University of Minnesota*.
- SACHS, J., A. TORNELL, AND A. VELASCO (1996): “Financial Crises in Emerging Markets: The Lessons from 1995,” *NBER Working Paper*, (5576).
- SCHMITT-GROHÉ, S., AND M. URIBE (2003): “Closing Small Open Economy Models,” *Journal of International Economics*, 61, 163–185.
- STIGLITZ, J. (2002): - *Globalization and its Discontents* -. Norton & Co, New York.
- TAUSSIG, F. (1928): *International Trade*New York: Macmillan.
- TORNELL, A., AND F. WESTERMANN (2003): “The Credit Channel in Middle Income Countries,” *NBER Working Paper No. 9737*.
- URIBE, M., AND V. YUE (2006): “Country spreads and Emerging Countries: Who drives whom?,” *Journal of International Economics*, 69.
- VALDES, R. (2007): “Policy Responses to Sudden Stops in Capital Flows: The Case of Chile in 1998,” *Banco Central de Chile Working Paper, No. 430*.

Eidesstattliche Erklärung

Hiermit versichere ich an Eides Statt, dass ich die vorliegende Dissertation ohne unerlaubte fremde Hilfe angefertigt und andere als die in der Dissertation angegebenen Hilfsmittel nicht benutzt habe. Alle Stellen, die wörtlich oder sinngemäss aus veröffentlichten und nicht veröffentlichten Schriften entnommen sind, habe ich als solche kenntlich gemacht.

Bonn, den 01.08.2008