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Macroeconomic Volatility in Latin America: A Conceptual  
Framework and Three Case Studies

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# Macroeconomic Volatility in Latin America: A Conceptual Framework and Three Case Studies

**A**fter decades of trial, error, and occasional regress, the pieces of a successful Latin American economic model can be seen scattered among the leading economies of the region. The most traditional macroeconomic maladies of the emerging world—such as chronic fiscal imbalances and monetary gimmicks—are gradually being left behind. Many of these economies have made significant progress in their regulatory and supervisory frameworks and, at times, have been leaders beyond Latin American boundaries in allowing private sector coparticipation in a wide array of formerly public sector activities. Despite these significant efforts, several structural sources of volatility remain, and new ones have emerged as a result of the new and otherwise better economic environment.

Chile offers a concrete example, having experienced a sudden and sharp recession during the recent global turmoil after a decade of solid performance. This setback raised concerns not only for Chileans but also for regional policymakers accustomed to seeing in Chile's stability the eventual reward of their reformist efforts. However, the reward for successful reforms may not come in the form of a dramatic decline in economic fluctuations, at least not in the short to medium run.<sup>1</sup> As Asia has recently

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1. See Caballero and Krishnamurthy (1999) and Aghion, Benerjee, and Piketty (1999) for models in which the correlation between financial development and economic stability is nonmonotonic. However, welfare is monotonically increasing with respect to institutional and financial development.

shown, an advanced developing economy is still fragile. The fast pace required by dynamic growth and restructuring, unbalanced development across different institutions and markets, and a still-limited range of precautionary options make for a delicate, potentially volatile scenario.<sup>2</sup>

This paper identifies some of these imbalances and hints at the policy considerations they raise. Although emerging economies suffer from multiple problems, I pursue a minimalist and parsimonious account of volatility, highlighting that which is relatively new and focusing on countries that have already attenuated most of the traditional sources of macroeconomic instability in Latin America. The paper is based on three case studies—Argentina, Chile, and Mexico—whose combined experiences illustrate the central dilemmas faced by emerging economies. While embodied differently in each country, two common factors clearly lie behind structural volatility: weak international financial links and a still-limited development of domestic financial markets, particularly for small and medium-size firms.<sup>3</sup> Once they start interacting, these two ingredients not only create volatility, but also generate externalities that require policy intervention. Most other shocks and deficiencies are leveraged—or even made possible—by these two factors, and to the frustration of highly competent policymakers, the environment becomes intolerant of policy mistakes. The experience of each of these countries is sufficiently different to identify the interactions between the core ingredients and more traditional factors. Some of these interactions include the exchange rate system and monetary credibility; fiscal imbalances; a fragile banking system; labor market rigidities; and an inadequate central bank mandate, in the sense of lack of contingency.

The paper is organized in three parts. First, the main argument is outlined, together with a simple model. The following section then summa-

2. The rewards of successful reforms apparently come in the form of high average growth, a decline in the frequency of crises (although these can be deep), and an increase in the speed at which the economy recovers from such crises. However, the lack of precautionary options is clearly demonstrated by the serious decline in electricity provision in Chile during 1998, which resulted primarily from a severe drought. Shocks that involve the only existing pipeline, be it electricity distribution, financial services, or a road, have a deep impact. While precautionary options and the ability to handle complex scenarios are luxury goods, their rewards come precisely in the form of tamed volatility.

3. The essence of the conceptual framework is an adaptation of that presented in Caballero and Krishnamurthy (1999, 2000). The examples and applications are mostly from Caballero (1999a, 1999b, 1999c), a series of reports prepared for the IDB's Research Department. All of these papers can be downloaded from [web.mit.edu/caball/www](http://web.mit.edu/caball/www).

rizes each country's recent experience with real volatility while establishing connections to the core ingredients discussed above. The main policy lessons are extracted in the final section.

## The Conceptual Framework

The simple organizing framework described in this section builds on the observation that emerging economies are distinctly characterized by two fundamental weaknesses: a weak link to international financial markets and underdeveloped domestic financial markets. These two ingredients represent the core, in the sense that even after addressing the traditional imbalances, they remain present and ready to cause and leverage crises.

Weak international financial links are simply financial constraints, which are possibly time varying, that restrict the public and private international borrowing (broadly understood) of emerging countries. These constraints limit the smoothing of shocks over time and are themselves a source of shocks, creating excessive volatility in the real side of the economy. Underdeveloped financial markets limit the prompt reallocation and proper aggregation of resources, creating wasteful contractions in those markets most affected by shocks or less plugged into the financial pipelines.<sup>4</sup> Most significantly, this domestic underdevelopment naturally creates externalities that justify macroeconomic policies aimed at improving the country's international liquidity management. With the help of a few diagrams, this section outlines a structure for thinking through the macroeconomic consequences and policy implications of the two core ingredients highlighted above.<sup>5</sup>

### *Environment*

It is not too farfetched to think about an emerging economy's timeline in the following terms. Date 0 corresponds to normal times, when investment, planning, and prevention are all very relevant. A significant element of planning has to do with anticipating and preventing a crisis in the perhaps

4. On the other hand, as financial development rises so does leverage, and as a result, the vulnerability of the financial system to shocks also increases. Many Latin American economies have suffered at both ends: chronic financial repression and underdevelopment and, when moving away from that, large collapse of the banking system. I return to this issue in the next section.

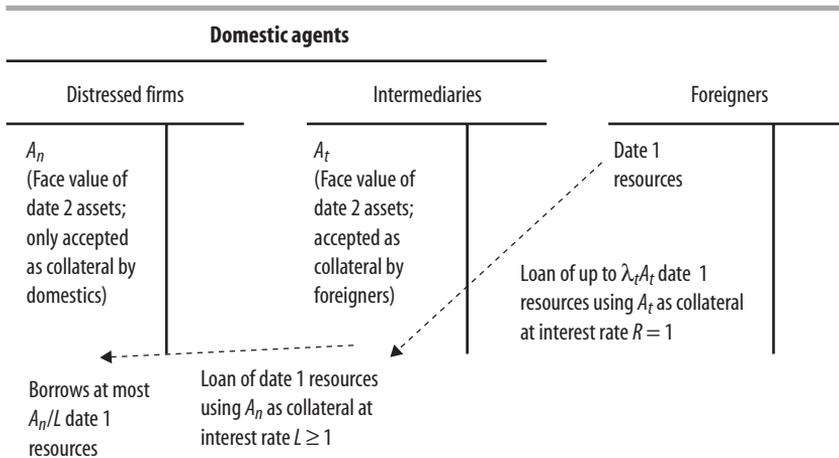
5. See Caballero and Krishnamurthy (1999) for a fully fleshed model along these lines.

not-too-distant future at date 1. For example, policymakers may slow the economy down at date 0 in an attempt to prevent a deep crisis at date 1. Date 2 represents the future, always brighter than the present, but a significant obstacle is that the country—both its sovereign as well as its corporations—often fails to fully persuade foreign financiers that they will share in that bright future if they help to avert the crisis. The country is thus said to have weak international financial links.

*External Crisis*

Figure 1 describes the elements creating a crisis driven entirely by insufficient external resources, but with a perfectly functioning domestic financial system, that is, when only the first ingredient is present. We can think of a crisis as a time when, first, a significant fraction of firms or economic agents are in need of financing to either repay debt or implement new investments needed to save high return projects (I refer to these agents as distressed firms) and, second, on net the economy as a whole needs substantial external resources but does not have enough assets and commitment to obtain them. Loosely, I refer to these assets and commitment as collateral, which need not be interpreted literally as pledged assets but

**FIGURE 1 . Equilibrium in Domestic Financial Markets<sup>a</sup>**



a. Main points: Distressed firms have profitable projects but need date 1 resources; foreigners require collateral when lending date 1 resources at the international interest rate; only domestic intermediaries own internationally accepted collateral.

rather as the resources that are likely to be recouped by a lender. To make things as stark as possible, imagine that distressed firms have no assets of value to foreigners, but that the high date 2 return on their investment projects ( $A_n$ ), if successfully maintained, can be fully pledged to other domestic agents. To be concrete, think of  $A_n$  as the date 2 value of a building (nontradable), and assume that absent a crisis the discount of future flows is simply zero, the international discount rate. For convenience, the mass of these projects is normalized to one.

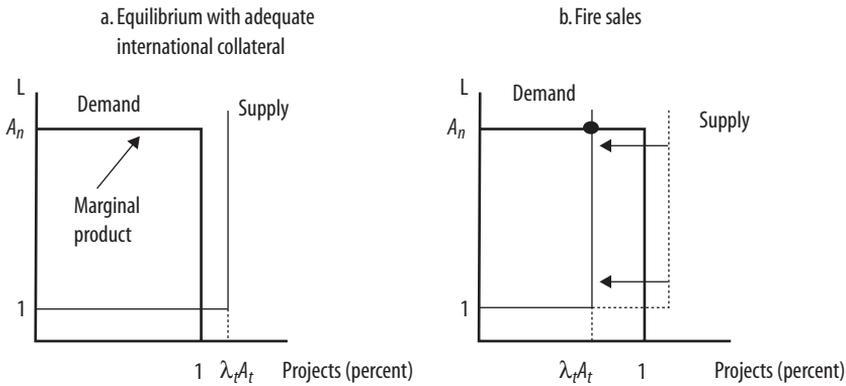
Other domestic firms and investors (or foreign specialists) have assets,  $A_r$ , that are considered good collateral by foreigners, such as U.S. T-bills, the present value of exports, or other domestic assets, like telecommunications companies, that may be deemed more transparent and trustable by foreign investors. As it is highly unlikely that foreigners would be willing to provide financing equivalent to the full value of these assets (due to a sovereign problem, for example), assume that one unit of  $A_r$  only secures a loan of  $\lambda_r < 1$  date 1 resources.<sup>6</sup> Much of the policy discussion in the final section has to do with increasing the value of this parameter.

Domestic financial markets are essentially the place where up to  $\lambda_r A_r$  date 1 resources are lent to the distressed firms, which have date 2 assets  $A_n$  to pledge as collateral. When the economy's pledgeable resources are greater than the needs of distressed firms, arbitrage keeps the internal cost of funds  $L$  equal to the gross international interest rate (of one by assumption). All distressed firms are able to borrow funds, and only a fraction of domestic collateral  $A_n$  needs to be pledged. This is the case in panel A of figure 2. In this simple example in which all projects have the same high return, the domestic demand for international liquidity by distressed firms is flat up to the point at which all projects are fully refinanced. The supply, on the other hand, is flat at the international interest rate until international collateral  $\lambda_r A_r$  runs out, at which point it becomes vertical.<sup>7</sup> When the aggregate needs of distressed firms are greater than pledgeable resources, competition among distressed firms transfers all of their private surplus (that

6. In addition to binding microeconomic incentive problems, sovereign risk may be associated with many of these assets, especially in the event of crises. The latter affects foreigners' valuation of these assets even when they acquire the private control rights.

7. These abrupt changes in slopes are only meant to capture as clearly as possible the fact that there are regions where most firms can satisfy their financial needs and the cost of credit is determined by international conditions, and others where it is the domestic availability of international assets that determines such cost.

FIGURE 2. Fire Sales<sup>a</sup>



a. Main points: Limited number of profitable projects; scarcity of international collateral limits the transfer of funds to distressed firms; a decline in the quality of a country's international collateral can cause a fire sale.

is, the return above the international interest rate) to the domestic suppliers of international liquidity. Panel B illustrates this fire sale of domestic assets. The fraction of projects financed is  $\lambda_t A_t < 1$ , and the domestic discount rate jumps from one, the international level, to  $L = A_n > 1$ .

Once in the environment described above, the bulk of modern Latin America's volatility can be sufficiently described using only two canonical external shocks. While sometimes it is the direct effect of these shocks that creates volatility, in many cases it is simply the fear of them that leads the authorities to create precautionary recessions or the private sector to speculate on their potential arrival.

The most direct shock conducive to a fire sale and crisis is indeed a sudden loss in the international appeal of a country's assets. This can arise from country-specific factors as well as from changes and shocks in the segments of international financial markets relevant for the country. The turmoil after the Russian crisis in October 1998 and the debt crises that followed U.S. interest tightening in the early 1980s are two prototypical examples of the latter. This type of shock is captured in the model simply as a deterioration in the quality of an emerging economy's international collateral,  $\lambda_t$ , which shifts the supply curve to the left as the country's capacity to borrow abroad is reduced. As the spread between the domestic and international interest rates increases, a fire sale of domestic assets occurs because the domestic opportunity cost of holding these assets is high when

credit is scarce.<sup>8</sup> The counterpart of the fire sale is the limited reinvestment and costly termination of distressed projects with a high net present value.

Shocks need not come directly from external financial factors to reflect the weakness of financial links. For simplicity assume that international collateral encompasses only tradable goods, while domestic collateral represents nontradable goods.<sup>9</sup> An adverse terms-of-trade shock is simply a decline in the value of traded goods,  $A_r$ , which reduces the country's borrowing capacity and shifts the supply curve to the left in a manner similar to the financial shocks above. A sufficiently large or sufficiently long sequence of terms-of-trade shocks can significantly reduce a country's international liquidity, causing a fire sale and corresponding real decline. Needless to say, the extent to which this is likely to happen depends critically on the tightness of external financial markets.

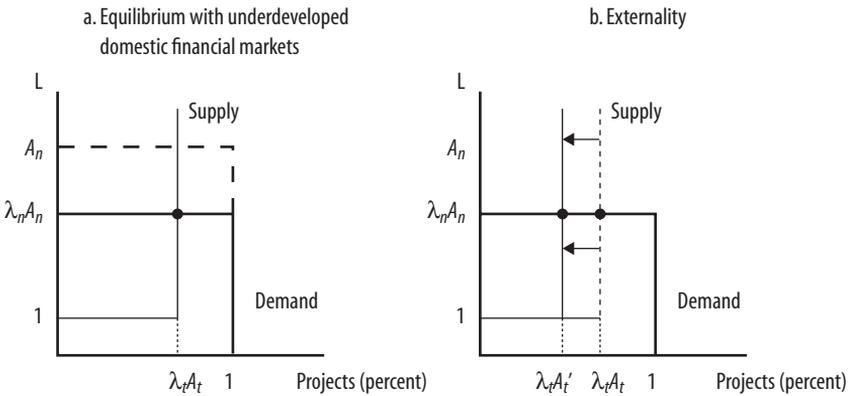
### *Externality and Policy Problems*

While the scenario described above can indeed represent a great source of uncertainty and volatility for a country, the role for policy, aside from a structural one, is limited. Since domestic providers of international liquidity are transferred all of the surplus during crises, they are given the right incentives to supply this liquidity. It is here that the second ingredient highlighted above plays a central role. When domestic financial markets are imperfect in the sense that distressed firms without direct access to international financial markets do not have the means to fully pledge their returns to other domestics or informed investors, the *ex ante* incentive to hoard and supply international liquidity is weakened. Market making is not a great business in a market with constrained demands. Imperfect

8. Foreigners or nonspecialists are unable to capture these high returns because at times of crises they only hold and arbitrage claims backed by international collateral. While their arbitrage during normal times keeps the international spread at zero, it is immaterial when the international collateral constraint binds. That is, the interest parity condition shifts until domestic equilibrium, rather than international arbitrage, holds.

9. The international economics literature has long recognized the importance of international collateral and its relation with a country's tradable sector (see Simonson, 1985). Formal models of sovereign debt renegotiation are built around the question of what international lenders can threaten sovereign countries with in the event of default. In this literature, international collateral is typically taken to be some fraction of exports (see Bulow and Rogoff, 1989). Cash revenues from exports can be seized before they make it back into the country. This feature was used by Mexico during the 1994–95 crisis, when its oil revenues were made part of the collateral backing the liquidity package it received.

**FIGURE 3 . Excess Vulnerability<sup>a</sup>**



a. Main points: Imperfect domestic collateral reduces the effective demand for funds; lower demand reduces intermediaries' expected returns for lending; these lower returns reduce date 0 investment in international collateral; less international collateral increases the vulnerability of the economy to bad shocks.

domestic financial markets are captured here by the assumption that only a fraction  $\lambda_n < 1$  of a distressed firm's value can be pledged to other domestics. As the capacity to compensate domestically available international liquidity is reduced for any given level of investment, the price of this liquidity  $L$  also falls.

Panel A in figure 3 illustrates this scenario. Given the date 0 allocations, a decline in  $\lambda_n$  reduces the effective demand for international liquidity as the maximum payment per unit of investment is now only  $\lambda_n A_n < A_n$ , leaving the marginal product curve (the dashed line) unchanged. While the returns to supplying liquidity fall, liquidity providers will continue their lending, given the fixed supply of international collateral, as long as pledgeable assets are greater than the opportunity cost of funds (namely, the international interest rate).<sup>10</sup>

Of course the problem here is that the domestic availability of international collateral will not remain unchanged. In this environment, frictions in the market for domestic assets distort the private returns of holding

10. Note that a lower  $L$  does not necessarily mean that the explicit domestic rate is lower than in the case with well developed financial markets (for a given supply of international collateral). It essentially means that a lower fraction of investments and loans can be collateralized and is likely to be recouped by the lender.

domestic and international collateral. The ex ante equilibrium response to such distortion at date 0 is captured in panel B, with an inward shift in the ex ante supply of international liquidity (or collateral). Since domestic financial constraints limit the returns received by international liquidity providers below the full return of distressed projects, the incentive to provide such liquidity declines. With this, the economy experiences more frequent fire sales and more severe distress in the event of an international squeeze on the country. The economy is in the end made too vulnerable to external shocks as domestic investors do not sufficiently value international liquidity, creating less international collateral than is socially optimal.<sup>11</sup>

A similar situation arises with respect to short- versus long-term debt. Long-term debt is like short-term debt plus rollover insurance. When domestic financial markets are underdeveloped, there is less incentive to buy the insurance than is socially optimal, since any insurance holders that do not experience distress and financial needs at date 1 do not receive the full social return of their guaranteed debt rollover.<sup>12</sup> The same holds true for debt denominated in external currency, which does not include insurance against events that put pressure on the exchange rate.

To summarize, the core of an advanced emerging economy comprises two basic features. First, the economy frequently finds itself near the limit of its capacity for international financing (stocks or flows). In such a position, intertemporal smoothing is limited, and changes in external or domestic conditions can have potentially large effects on domestic activity. Second, domestic transfers of value are limited by underdeveloped financial markets and the institutions that support them. As a result, the private sector undervalues the incentive to reduce the vulnerability brought about by the first feature, and the decentralized equilibrium is excessively volatile.

## Case Studies

While each of the countries discussed in this section has distinguishing characteristics, the framework sketched above highlights the unifying theme behind their volatility: the underdevelopment of their financial markets, both domestically and in their integration to international financial markets. After

11. This does not mean that international liquidity is valued less than in the first best. The claim is that it is valued less than the second best indicates.

12. See Caballero and Krishnamurthy (2000).

this documentation of unabated volatility, each of the cases illustrates the presence of these core volatility factors in practice and describes the different forms they take in different scenarios. A discussion of other, more idiosyncratic factors follows, stressing the interactions with core ingredients.

I have chosen to discuss Chile last because it is arguably the most advanced country in the region in terms of its financial and institutional development. Its weaknesses, therefore, offer lessons for the next stage in Argentina and Mexico, as well as for the rest of the region.

### *Argentina*

The Argentine economy underwent a dramatic transformation in the last decade. Inflation is a matter of the past due to a strong convertibility law; the government is no longer an important player in the production of goods and services; trade and capital accounts were largely liberalized; the pension system is being modernized and privatized; and the solvency, transparency, and liquidity of the banking sector were solidly raised. Symptoms of success abound. An important exception to this scenario, however, is the untamed, or even increased, volatility of output and employment.

While panel A of figure 4 highlights the clear success in terms of higher average output growth during the 1990s, panel B illustrates that aggregate volatility remained vividly present. During the 1980s, aggregate volatility was mainly driven by stabilization attempts and their failure. In contrast, steady output growth in the post-convertibility period was interrupted mainly by external factors, although these were amplified by domestic ones.

A parsimonious account of Argentina's volatility can be built around the two core ingredients, together with three idiosyncratic factors that are troublesome mostly because of the presence of the core factors:

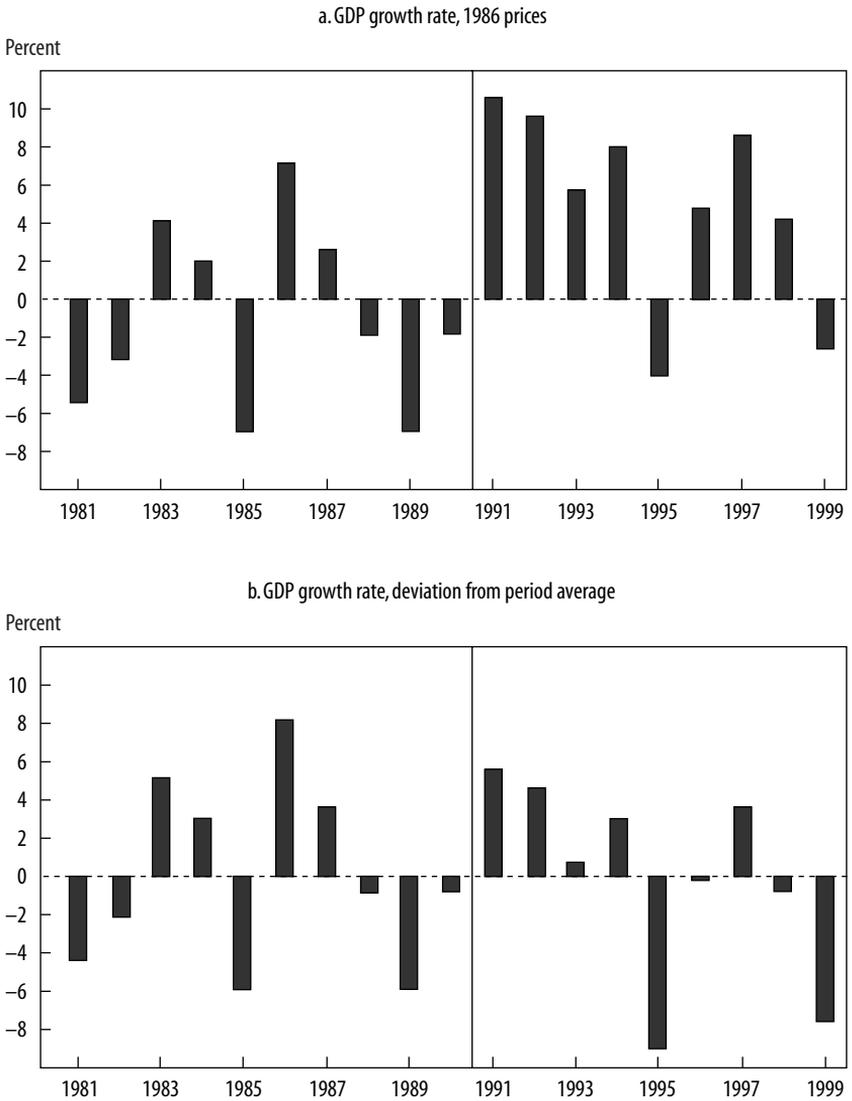
—Systematic crowding out, which results from the lack of fiscal adjustment and the absence of incentives and markets for prime firms to internalize their relative access to international financial markets, worsens the credit crunch on small and medium-size enterprises (SMEs) during crises.

—Labor market rigidities, both nominal and real, amplify external financial shocks.

—Real exchange rate inflexibility created by the convertibility system, when combined with labor market rigidities and limited access to external financial markets, delays expected recovery.

Evidence is first presented on the core ingredients, followed by a discussion of each of these three elements.

**FIGURE 4 . Argentine Growth and Volatility<sup>a</sup>**



Source: *International Financial Statistics* (IFS).

a. Pre-convertibility period: 1981–90; post-convertibility period: 1991–99. Preliminary data for 1998 and predicted data for 1999.

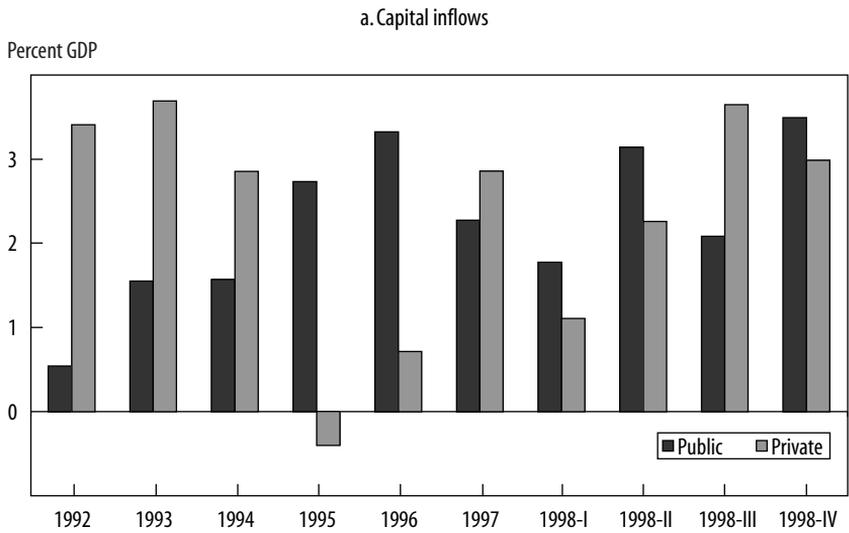
**WEAK LINKS TO INTERNATIONAL FINANCIAL MARKETS.** The relatively small size of an emerging economy's current account deficit is a perennial indication of its limited access to international capital markets. Argentina is no exception, as its current account deficit never exceeded 4 percent of gross domestic product (GDP) in the 1990s, despite the fact that its average growth rate exceeded 5 percent, more than double that of the member nations of the Organization for Economic Cooperation and Development (OECD) during the same period. With respect to aggregate volatility, however, it is not only the level but also the fragility of this limited access that is important. Panel A in figure 5 describes the path of capital flows to Argentina and their close connection with the two crises of the 1990s, especially the so-called tequila episode. Stark as it is, this figure underestimates the severity of the external constraint during crises since it ignores strained renegotiations and other mechanisms that smooth capital flows movements.<sup>13</sup> Some of this underestimate can be determined from price data, which are illustrated by the dark line in panel B through the dramatic rise in its sovereign spread around crisis dates.

The high correlation between Latin American sovereign spreads, which are also illustrated in the panel, certainly does not free Argentina from its share of responsibility for the weak nature of its international financial links, but it does hint that the shocks are not solely driven by domestic conditions.

Figure 6 illustrates yet another dimension of the weak and volatile international financial links. Panel A uses data on U.S. stock returns to illustrate the variance of returns over a twelve-month period centered on the indicated date. The thick line corresponds to a prime firm index (Standard and Poor's 100 Index), while the other two represent more inclusive indexes (S&P 400 and S&P 600). As one would expect, the more inclusive indexes are more volatile, especially at times of aggregate turbulence and distress, reflecting the greater vulnerability of smaller firms. This sensible volatility ranking is in sharp contrast with that found in Argentina. While the relative vulnerability of small firms is at least as large as in the United States, the pattern of relative volatility portrayed in panel B is reversed for

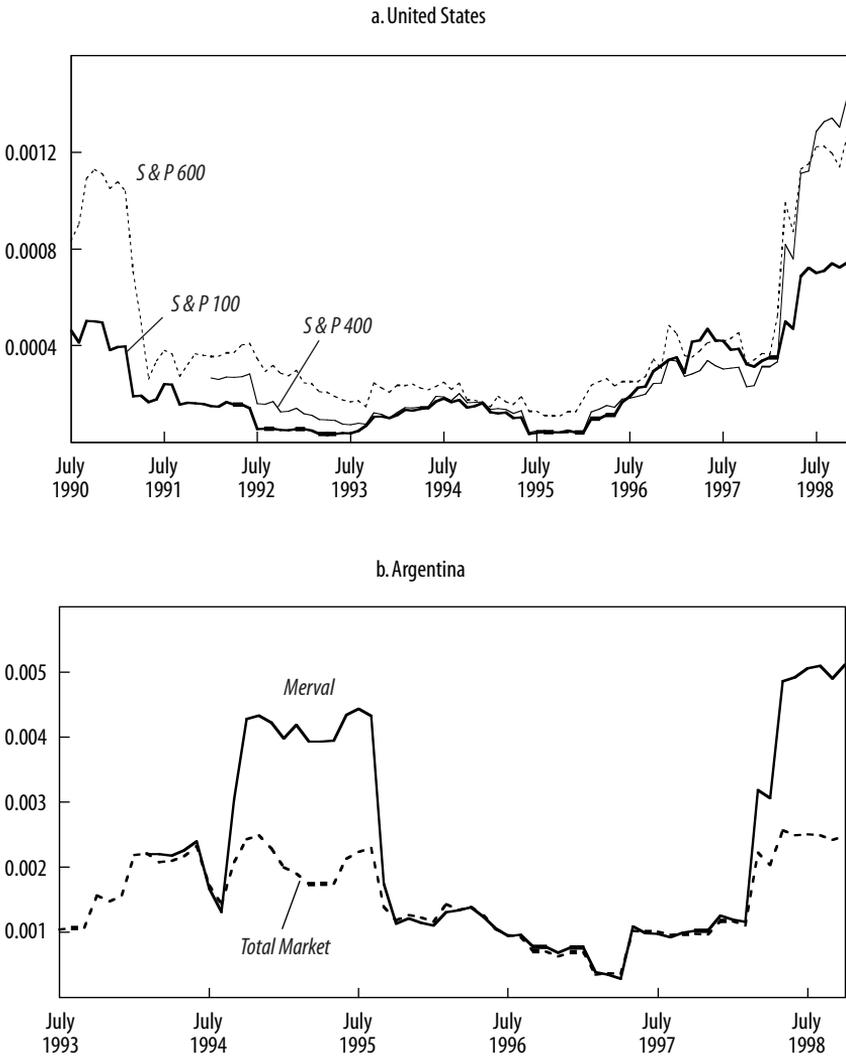
13. The capital flows reversal during the last crisis can be seen more clearly in the non-financial private sector, where they came down to \$2.7 billion in 1998, from \$8.2 billion the previous year. Official flows, on the other hand, rose supported by loans from the World Bank and Inter-American Development Bank (IDB).

**FIGURE 5 . Argentine External Conditions in the 1990s**



Sources: Datastream; capital inflows from IFS (columns 78bcd and 78bjd); international prices from Instituto Nacional de Estadística y Censo (INDEC).  
 a. Spread of Brady bonds yield vs. U. S. benchmark (30 years). Latin America is the average of Argentina, Mexico, Brazil, and Venezuela.

**FIGURE 6. Variance of Stock Returns: United States versus Argentina<sup>a</sup>**



Sources: Stock market data from Datastream.  
a. Twelve-month moving averages.

Argentina, which plots the variance series for the Merval index (prime companies) and for the more comprehensive IGPSA index. One interpretation of this finding is that foreign investors focus mainly on the Merval, and hence it is mostly these stocks that reflect large capital flow swings.<sup>14</sup>

Finally, there is evidence of a premium on Argentine sovereign bonds ascribed to persistent aggregate volatility. Consider the historical spread of Argentine sovereign bonds over U.S. Treasury bonds relative to similarly rated U.S. corporate bonds. In the last decade, a sample of Argentine sovereign bonds paid a premium of more than 100 basis points on average, and the time-series variance of Argentine spreads was more than double that of equivalently rated U.S. corporate bonds.<sup>15</sup> This spread premium is probably a result of the excess volatility created by weak links and underdeveloped financial markets, as the bulk of this volatility comes from episodes when financial markets tighten for emerging markets. The bottom line is that Argentine bonds look illiquid from the point of view of spreads and volatility, despite the fact that their volume is often much larger than that of the specific U.S. corporate bonds used in the above contrast.

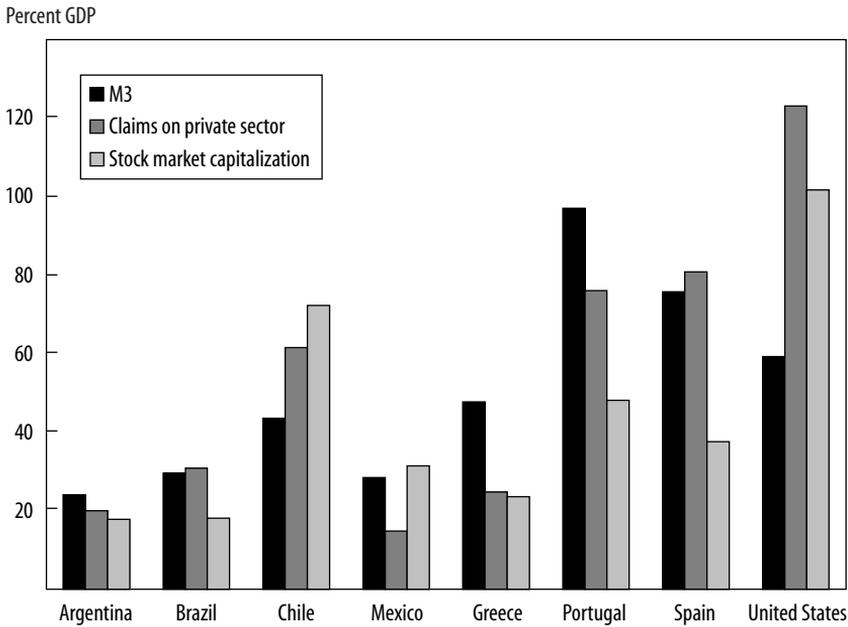
**UNDERDEVELOPED DOMESTIC FINANCIAL MARKETS.** The development of domestic financial markets is generally instrumental not only in fostering investment and growth, but also in aggregating resources during distress. Underdeveloped financial markets limit the prompt reallocation of resources and, as a result, cause wasteful contractions in those markets most affected by shocks or less integrated with the financial pipelines.

Figure 7 highlights Argentina's "level problem." Regardless of how they are measured, and despite significant improvements over the last decade, Argentina's financial markets and level of financial intermediation are substandard. M3, loans, and stock market capitalization all fare poorly, both within the region and certainly with respect to OECD economies.

14. Another interpretation is that the finding is spurious, as the more comprehensive series is polluted by too many no-trades. Although this remains a possibility, aggregate volume data for both indexes do not reveal a pronounced relative decline of transactions in the IGPSA. It is also important to realize what the relative-volatility claim in the text is not about: it does not say that large firms' financing is more distressed than that of smaller firms during crises. Indeed, the reality is quite the opposite, as concerned local banks reallocate their loans toward larger companies. It just says that an important segment of the demand for the shares of prime companies fluctuates with international sentiment about emerging markets.

15. See Caballero (1999a) for details on the bonds included in each sample.

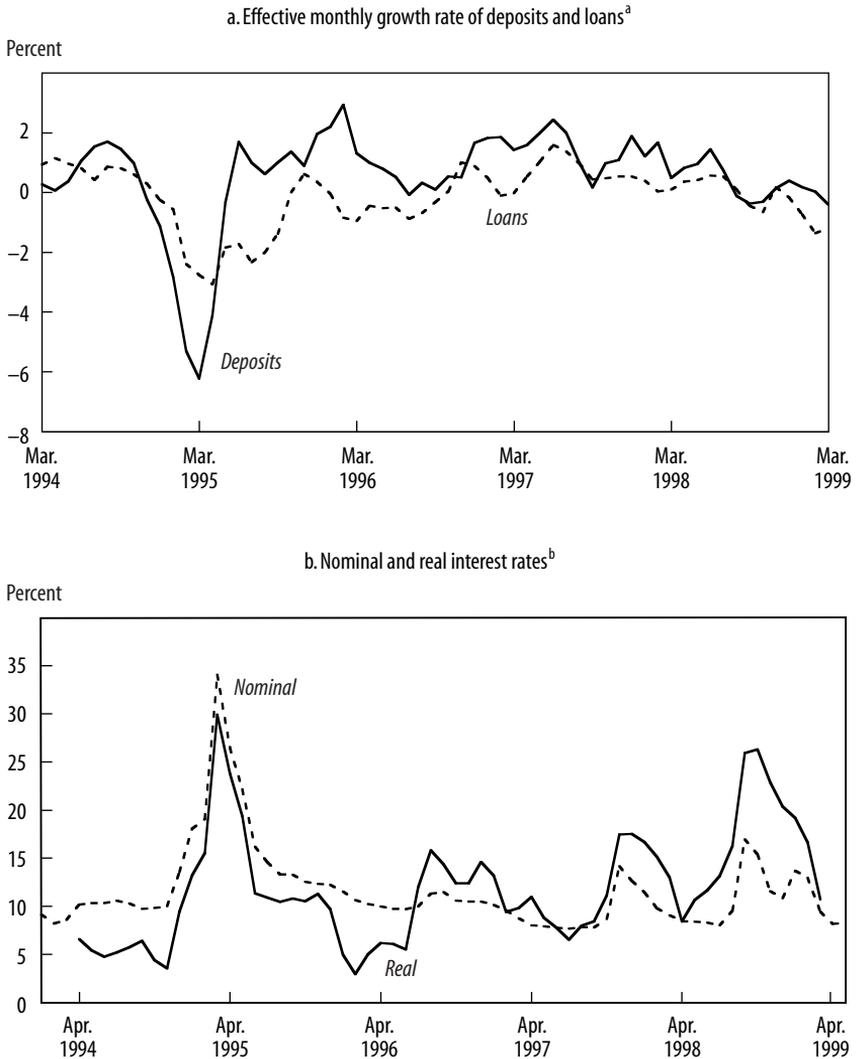
**FIGURE 7. Financial Market Development<sup>a</sup>**



Sources: M3 and loans to private sector from *IFS*; stock market capitalization from Datastream (broad but not complete coverage).  
 a. Data as of end of 1997.

Domestic financial markets played an important role during the two crises of the 1990s. Panel A of figure 8 depicts time series of deposit and loan growth rates, each less their respective interest rate. Albeit imperfect, these measures capture banks' and firms' flow availability and needs. Fears that the convertibility system would not survive the tequila crisis led to a run on banks and on the monetary base. As a result, a massive credit crunch took place despite the astute use of the few degrees of freedom with monetary policy allowed by the convertibility law.<sup>16</sup>

16. The Banco Central de la República Argentina (BCRA) can buy Argentine treasury bonds denominated in dollars (which are counted as reserves) as long as this does not lead to a decline in the ratio of international reserves (net of these bonds) to a base below two-thirds. Government notes in the BCRA rose by about 25 percent from 1994 to 1995 and then declined sharply.

**FIGURE 8 . Argentina's Credit Crunch**

Sources: Banco Central de la República Argentina (BCRA); INDEC.

a. Three-month moving average. The term *effective* refers to the fact that corresponding interest rates were subtracted from the growth rates. CD rates (30–59 days) were used as deposit rates. Credit-line rates were used as loan rates.

b. Annualized thirty-day peso loans to prime firms. Real interest rate calculated by subtracting annualized, centered, six-month PPI inflation from nominal rate.

There are several reasons why the aggregate figure on loans is somewhat misleading in measuring the contribution that reduced domestic intermediation and financial distress may have had on the sharp decline in real activity during the recent crisis. First, the increase in financial depth during the last five years has in all likelihood made the economy more credit dependent. Second, panel B illustrates that real interest rates increased even more as a result of the expected deflation required to adjust the real exchange rate within the context of the convertibility law. Finally, the cross sectional dispersion on prime loan rates also increased, which suggests that the composition of borrowers and lenders may have changed significantly during the crisis.<sup>17</sup>

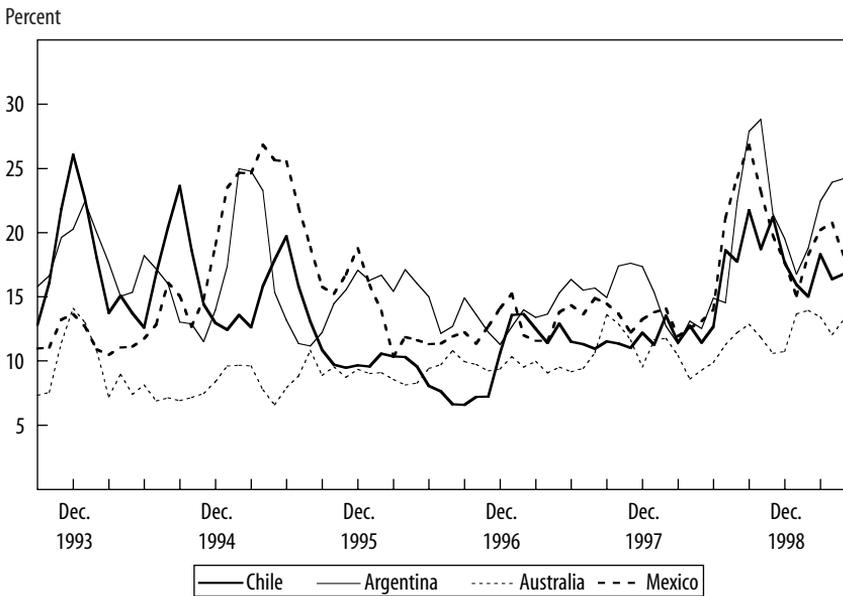
Prompted by the deep economic distress experienced during the tequila crisis, Argentina mounted a massive effort to improve the liquidity position of banks and the financial system as a whole. In addition to raising banks' liquidity requirements (a form of self-insurance), insurance features were introduced through a series of domestic and international "repo" facilities. The effort paid off: there were no traces of systemic bank runs during the recent crisis, and lending slowed down but not nearly as sharply as during the previous crisis.<sup>18</sup>

The consequences of underdeveloped and unstable domestic financial markets are ultimately reflected in the economy's failure to reallocate resources in an expedient manner, especially in times of crises. Figure 9 reports the path of a measure of the cross-sectional dispersion of the Argentine stock market returns for a group of approximately twenty-five industries. This cross-sectional dispersion surged dramatically during the 1994–95 crisis and the recent global turmoil.<sup>19</sup> For comparison,

17. The interquartile range (between 25 and 75 percent) of a cross section of nominal interest rates on 30-day peso loans averaged less than 2 percent in the months before the tequila crisis, but it then jumped to more than 16 percent in March 1995. Similarly, the same measure jumped from less than 2 percent to more than 6 percent during the Russian financial crisis.

18. See figure 3 in Powell (1999) for clear evidence on the improved systemic liquidity of the Argentine financial system. As described in that figure, starting in January 1996, liquidity requirements increased steadily from 10 percent of deposits to over 15 percent by March 1999. Excess reserves added a fairly constant 10 percent, and the repo program added yet another 10 percent starting in January 1997.

19. The industries correspond to the stock market subsectors at level of disaggregation 5 of the Datastream classification, which includes 116 potential entries. For Argentina, Chile, Australia, and Mexico, 26, 20, 25, and 24 sectors respectively were represented during the period considered. Similar results were obtained when different measures of dispersion were used.

**FIGURE 9 . Cross-Sectional Variability of Industry Stock Returns<sup>a</sup>**

Source: Datastream.

a. For the 15 to 85 percent range (three-month moving averages).

the figure also illustrates the paths of the same cross-sectional dispersion measure for Australia, Chile, and Mexico. Chile and Australia, both of which feature deeper financial markets, exhibited a milder increase in dispersion, suggesting that resource aggregation does play an important role in limiting the damage caused by crises. Argentina, on the other hand, had responses closer to those of Mexico, which is consistent with the fact that its financial markets are also very underdeveloped.<sup>20</sup>

**CROWDING OUT.** One of the main features of financial crises is that funds cease to be interchangeable, and where the government gets its funding becomes relevant. Except for extreme cases of lack of fiscal discipline, which is not the case of Argentina today, the government normally has the most opportunity to access international financial markets. The gov-

20. Ideally, these comparisons should be made with ex ante rather than ex post returns.

ernment should therefore shift its financing away from domestic markets. International crowding out is unlikely because a large share of government's borrowing abroad during crises comes from international organizations, which are probably more difficult to access directly by the private sector.<sup>21</sup> Conversely, domestic crowding out can be significant. Who buys the domestic debt, and whether these sources are available to the private sector as well, are important questions. In particular, does the government facilitate a flight-to-quality process by domestic lenders?

Panel A of figure 10 shows net public borrowing from banks, as a percentage of bank credit to the private sector. During the tequila crisis the government turned to the domestic banks for financing. Moreover, much of the slow recovery of private loans was caused by the government's crowding out, as it borrowed to pay back for its monetary intervention, and by the sharp consolidation process experienced by the Argentine banking sector following the crisis. During the recent episode, on the other hand, the government redirected its financing efforts toward the retirement and pension fund administrators (*Administradoras de Fondos de Jubilaciones y Pensiones*, or AFJPs), which could absorb larger volumes of bonds than they did in 1995.

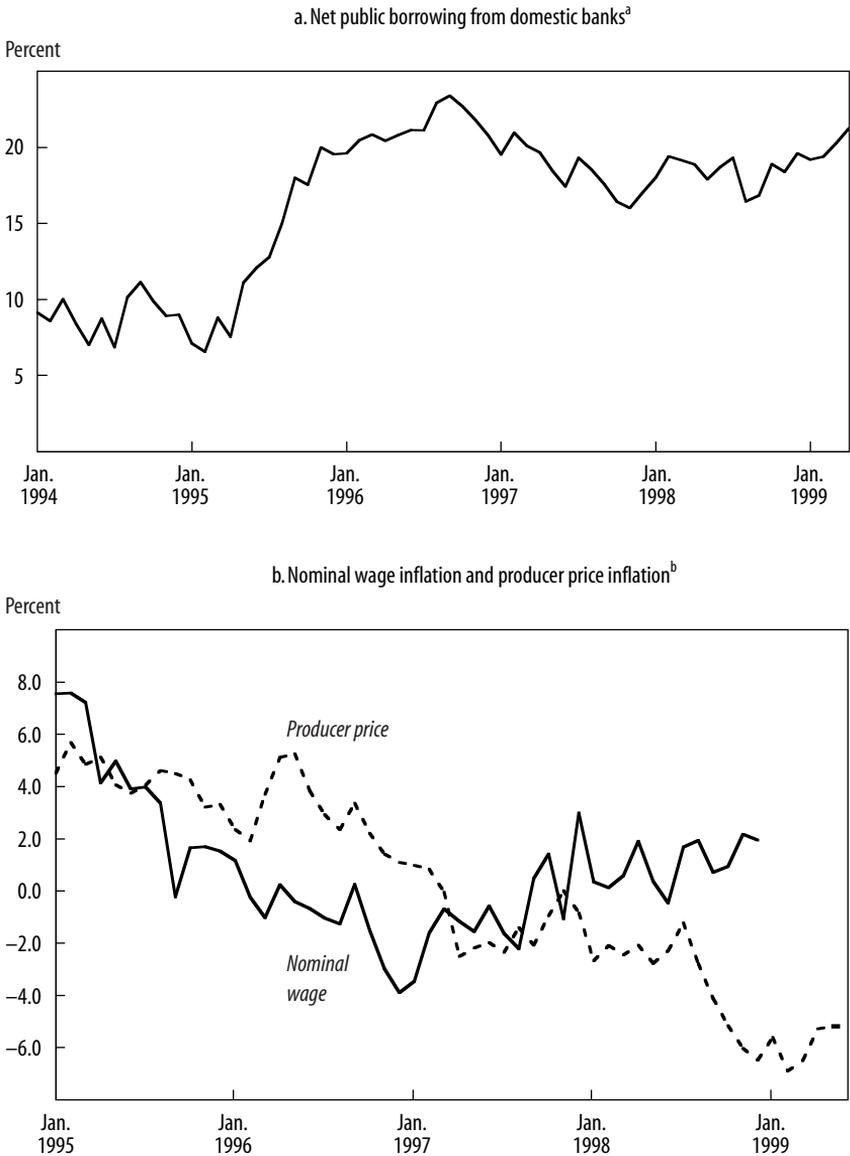
As external financing tightened for large firms, they too probably turned to domestic markets as preferred customers, exacerbating the ongoing flight to quality. The social cost of this strategy, nonetheless, is that SMEs generally do not have access to international financial markets, regardless of price. Along the same lines, deposits and loans within the banking sector were reallocated toward the larger banks. This probably resulted in a credit crunch on the clients of smaller banks, which are likely to be biased toward the SMEs. These two facts combined probably explain why the share of loans made by large banks continued to rise over the period.<sup>22</sup>

**LABOR MARKET RIGIDITY.** While the credit crunch experienced by the Argentine economy in 1995 probably could not have been averted by a more flexible real wage, in the recent episode such rigidity may have enhanced the crisis by generating a collateral squeeze, reducing the appeal of the firm's outlook from the point of view of the banks.

21. Of course, it would have been better had the government borrowed those resources not to solve its own fiscal imbalances, but to support a financially distressed private sector.

22. The share of loans made by large banks increased from 36 percent in late 1996 to 42 percent at the end of 1997 and 48 percent a year later.

**FIGURE 10 . Argentine Amplification Mechanisms**



Sources: BCRA; Ministerio de Economía; INDEC.

a. Percent of loans to private sector.

b. Inflation over previous twelve months.

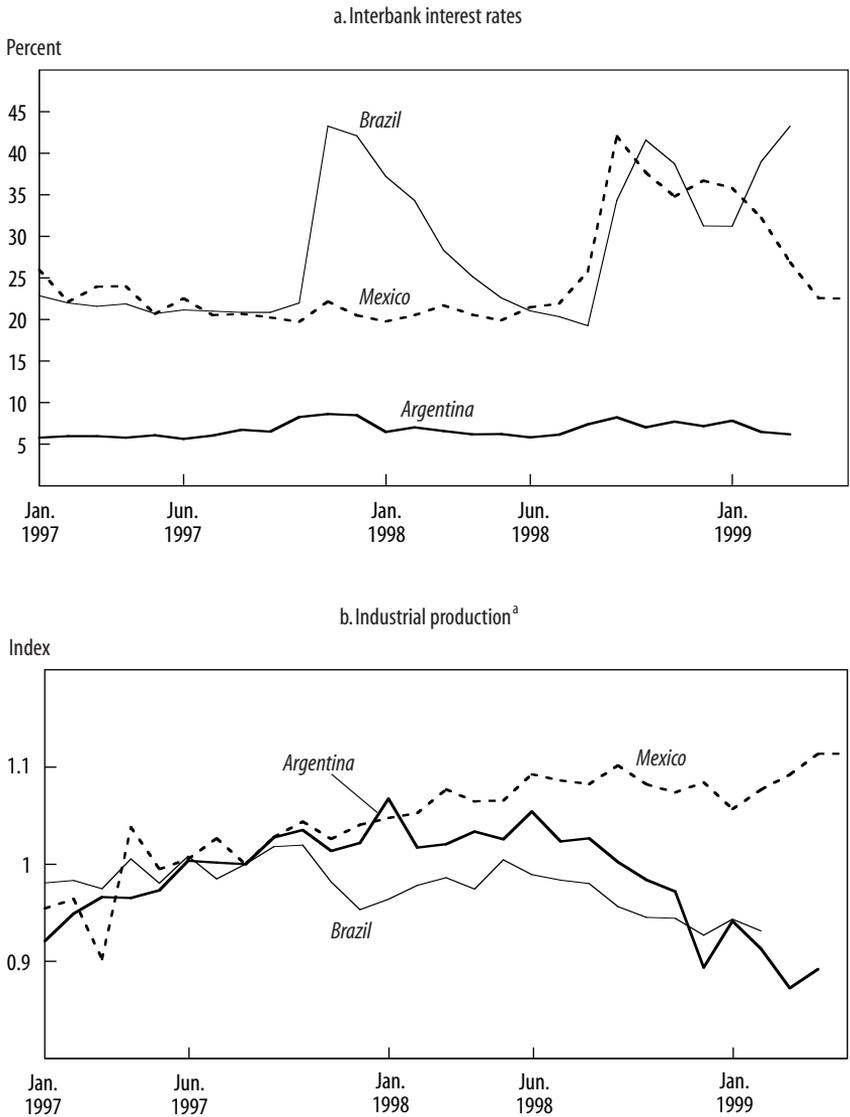
Although significant reforms are underway, Argentina has European-style labor market institutions and traditions. Ultimately an inflexible labor market generates labor costs—not all of which come in the form of wages—that are too slow to adapt to sharp downturns. While in theory these frictions are mostly real, in practice nominal and real factors are easily confounded, particularly in the face of rapidly changing nominal events. Panel B of figure 10 seems to support this nominal rigidity conclusion by comparing the time series of producer price and wage inflation. With a little imagination, one can see the price-inflation series as a straight downward-sloping line, crossing zero with no difficulty. The wage-inflation series comes down early on, but then flattens at zero.<sup>23</sup> Indeed, this description is remarkably close, except for the wage deflation of 1996. However, most of this wage deflation can be explained in terms of a compositional effect and a few outliers.<sup>24</sup> The costs of such rigidities are well-known, amplifying external shocks by forcing a larger share of adjustment onto real output and employment.

**REAL EXCHANGE RATE INFLEXIBILITY.** The relative rigidity of wages in Argentina during crises underestimates the extent of the relative rigidity of the Argentine system, especially when one considers that the equilibrium real exchange rate fluctuates more in the presence of international financial constraints than otherwise. Much has been said about the advantage of a fully credible exchange rate for the peso-dollar spread. This is certainly supported by panel A of figure 11, which compares the path of nominal interest rates in Argentina to those in Brazil and Mexico, where most of the volatility is indeed tied to the uncertainty surrounding the respective currencies. But there is another side to this: the credibility of the exchange rate also means that the exchange rate is not expected to adjust in the near future even if doing so would help during the recovery. A crisis that brings about a perceived overvaluation—for example as a result of devaluation by neighbors or a large terms-of-trade shock—has no hope of a quick remedy. This depresses effective loan demand, for purely neoclassical as well as financial-constraint reasons, which may explain why it is not only the peso-dollar spread that does not rise as much in Argentina, but also the real interest rate level.

23. Despite the conventional wisdom on the matter, this decline is not purely due to the sharp decline in the prices of primary goods.

24. Outliers not in the sense of measurement error, but in that nominal rigidities are not very relevant for sectors in deep distress and with high turnover rates, such as construction.

**FIGURE 11 . Relative Performance: Argentina, Brazil, and Mexico**



Sources: Interbank interest rates from BCRA; federal funds rate from Banco Central do Brasil; interbank interest rates from Banco de México; industrial production from INDEC, Banco Central do Brasil, Banco de México.

a. Seasonally adjusted, August 1997 = 1.

A simple comparison of interest rates is thus not the proper measure of the relative distress across economies with different exchange rate systems and degrees of labor market rigidities, because the relation between these rates and the real side of the economy changes across these systems. Panel B shows that despite its better performance in terms of interest rates, industrial production did not fare well in Argentina, even when compared to Brazil, which was the regional epicenter of the recent crisis. Perhaps most significantly, while Brazil and Mexico recovered rapidly, Argentina remained trapped in a highly uncertain scenario. The question arises whether the relative calm during the crisis comes at the cost of a slower recovery, and whether that was indeed anticipated by economic agents.

The connection between the basic framework and the Argentine experience is not only apparent for its ingredients and basic outcomes, but also because Argentina's idiosyncrasies exacerbate the outcomes and matter mostly because of the presence of the ingredients. In the final section, I return to the policy recommendations that follow from Argentina's scenario, once interpreted under the perspective of the conceptual framework.

### *Mexico*

After following a rudderless path throughout much of the 1980s, Mexico embraced dramatic reforms in 1989. In the 1990s, inflation was dramatically reduced, banks and a wide range of public corporations were privatized, the land tenure system was modernized, and the private sector was authorized to participate in infrastructure projects. In addition, the public deficit vanished, public debt markets were developed, exchange rate controls were abolished, foreign investment and imports were liberalized, the North American Free Trade Agreement (NAFTA) was implemented, and the list goes on. Prompted by the implementation of the Brady plan, the international financial community welcomed these reforms and supported them with substantial capital flows. This cooperation came to an abrupt end in late 1994, when Mexico was again at the epicenter of an emerging markets crisis. Mexico's relative success in the recent emerging markets crisis surprised most, demonstrating that the fear of yet another crisis is still present.

While the post-reform period represents an improvement over the 1980s in terms of GDP growth and inflation, it is still far from the stability and overall performance of the economy in the 1970s and earlier (see figure 12).

As in the case of Argentina, the sources of Mexico's volatility rest on the two core factors, although with somewhat different weights and manifestations. Two idiosyncratic factors complicate—and are complicated by—the core factors:

—Even though the government's finances are in order, the systematic bailout of private sector excesses and dependence on oil revenues has created fiscal fragility.

—The lack of credibility in monetary policy has reduced the benefits of nominal exchange rate fluctuations.

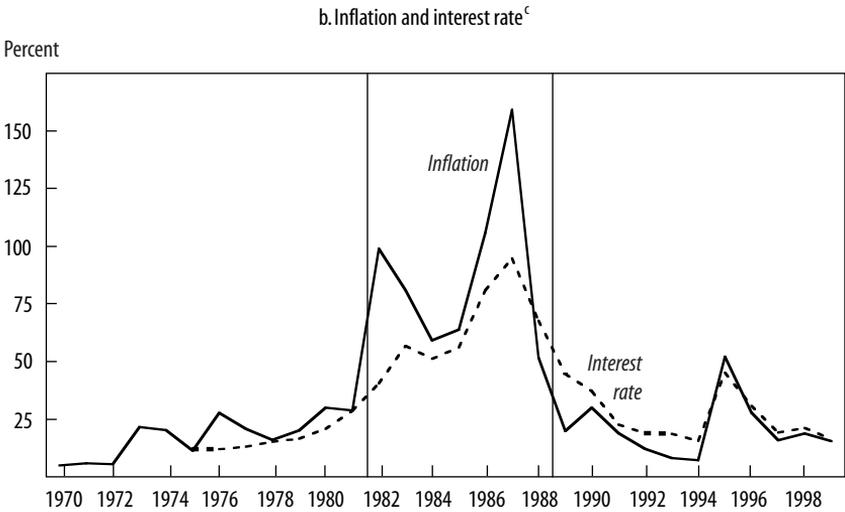
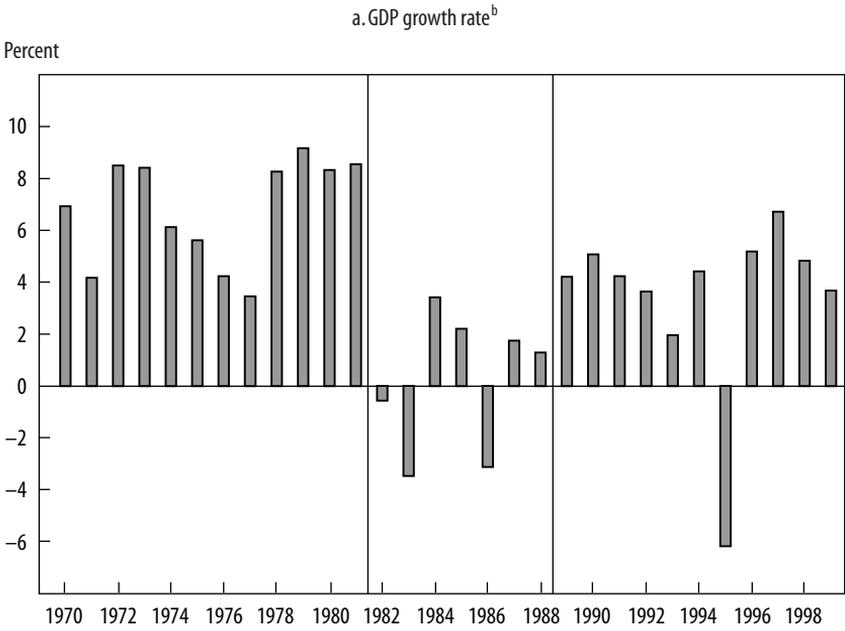
**WEAK INTERNATIONAL FINANCIAL LINKS.** Panel A in figure 13 illustrates the path of Mexican capital inflows and their close connection to the business cycle during the 1990s, especially during the tequila crisis in 1994–95. As both residents and foreigners became aware of the dollar illiquidity of the government and country, confidence vanished and private capital inflows rapidly turned from an annual inflow well above 5 percent of GDP into a rapid outflow.<sup>25</sup> No country can withstand such a turnaround, and Mexico experienced a deep recession despite the rapid response of the United States and the International Monetary Fund (IMF), which is illustrated in the panel by the temporary rise in public capital inflows.

Panel B plots the impact of terms-of-trade changes as a fraction of total exports. Since volatile oil represents a large share of its exports, Mexico experiences large terms-of-trade shocks. It is apparent, nonetheless, that it is not a terms-of-trade shock that negatively affected Mexico at the end of 1994, and that Mexico's good relative performance during the recent global crises occurred despite the weak terms of trade it faced.<sup>26</sup> While terms-of-trade shocks are an ongoing source of concern, particularly because they may be leveraged and may trigger a tightening in international financial constraints, they do not seem to have been the main factor in the post-reform period volatility.

25. It is certainly inaccurate to blame foreigners exclusively for the outflows. See, for example, Garber (1998) for a discussion of the role of domestic banks' off-balance sheet activities before the 1994–95 crisis. These activities inflated capital inflows before the crisis and automatically reversed them after the crisis.

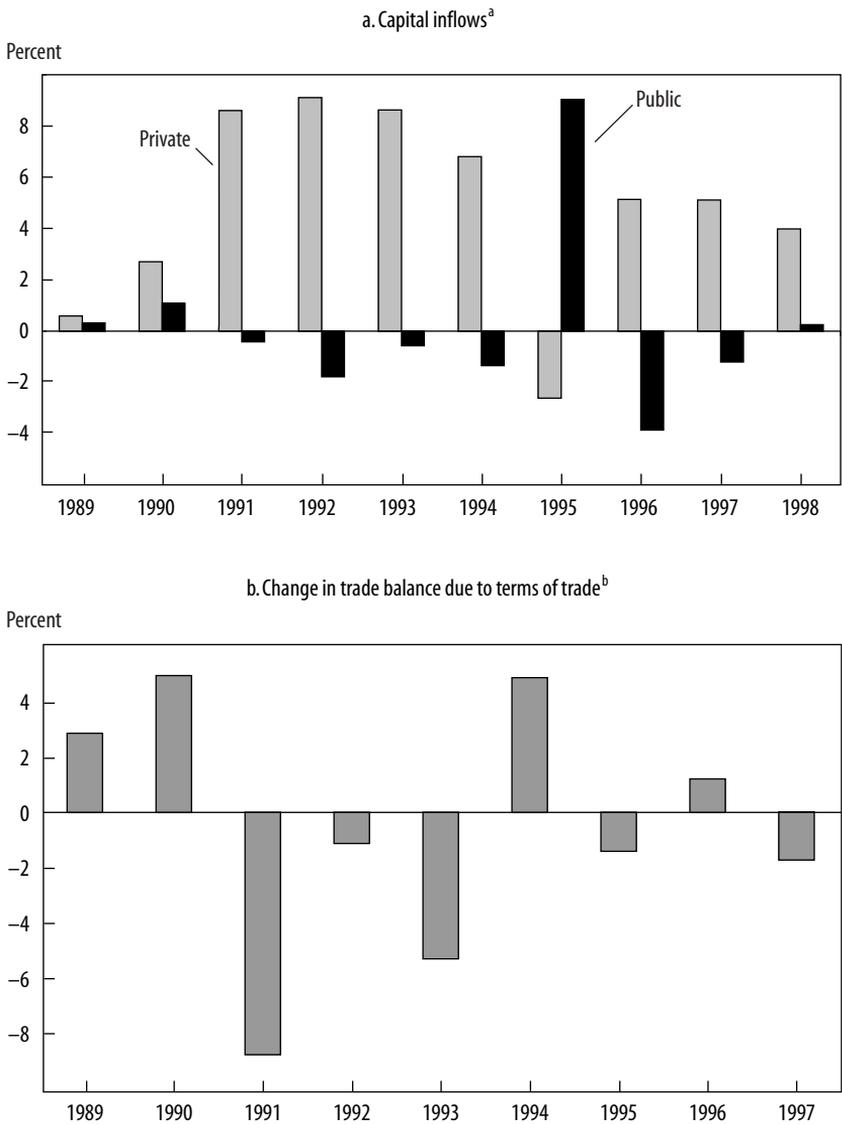
26. Much has been said about the positive role the U.S. expansion had in insulating Mexico from a large share of the recent global turmoil. By the same token, it seems unreasonable to solely blame Mexico for its poor growth performance—particularly of exports—in the early 1990s since the United States was not growing much either.

**FIGURE 12 . Growth and Volatility<sup>a</sup>**



Sources: IFS; INEGI; Banco de México.  
 a. Preliminary data for 1998 and predicted data for 1999.  
 b. 1980 prices.  
 c. Inflation is December to December. Interest rate is CPP.

**FIGURE 13 . Mexican External Conditions in the 1990s**



Source: IFS.

a. Public sector capital flows include general government and monetary authorities, excluding reserves and related items; private sector corresponds to total capital flows minus public sector.

b. Calculated using the following relation:  $dP_{x,t}/P_{x,t-1} - \alpha * dP_{m,t}/P_{m,t-1}$ , where  $\alpha = P_{m,t-1} M_{t-1} / P_{x,t-1} X_{t-1}$ .

Further evidence of weak Mexican links to international markets is found in an inverted volatility ranking of Mexican equity indexes and a volatility premium for its sovereign debt. As for Argentina, the variance of stock market returns for prime firms is much larger than the variance of the total market, especially during financial crises. Mexican sovereign bonds also paid a premium of more than 50 basis points on average and had more than twice the time-series return variance relative to U.S. corporate bonds of equivalent credit rating.<sup>27</sup> Each of these points is suggestive of international financial constraints.

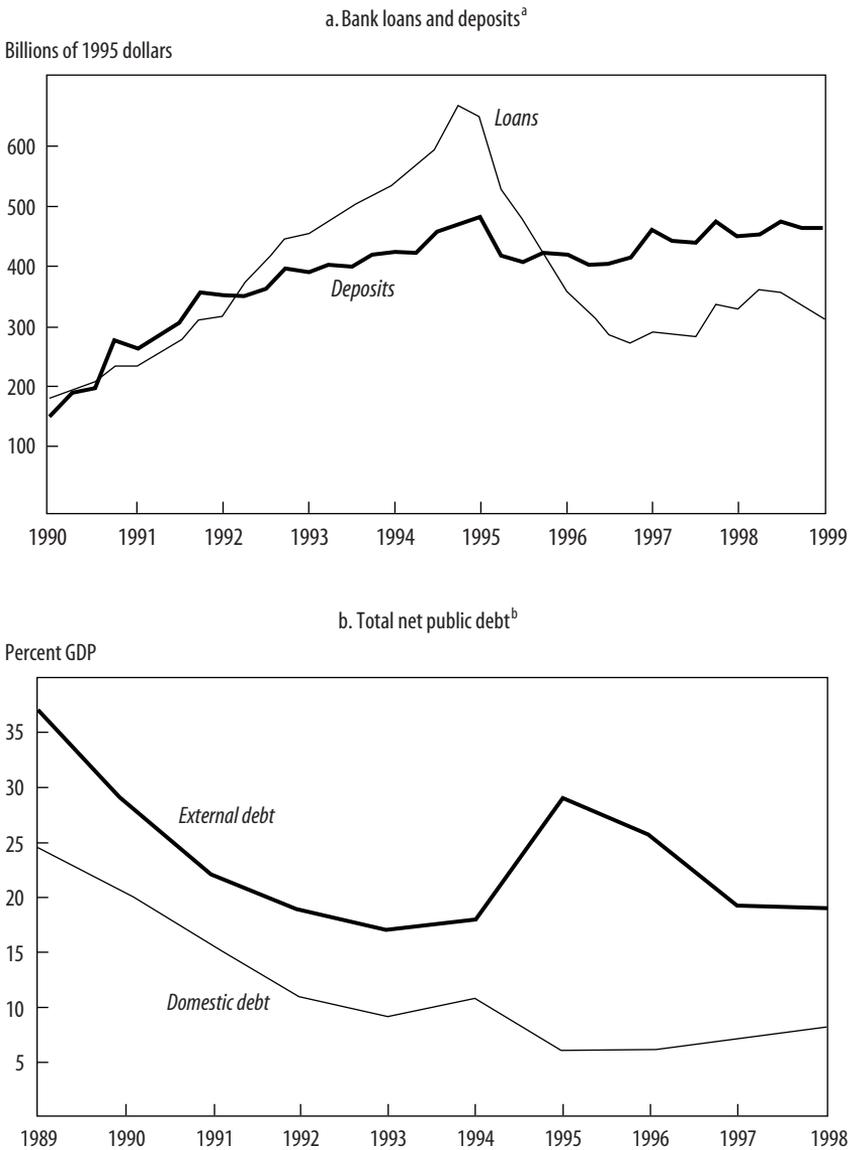
**UNDERDEVELOPED DOMESTIC FINANCIAL MARKETS.** Like Argentina, Mexico's financial markets and level of financial intermediation are substandard relative to OECD countries and leading countries within the region, regardless of how they are measured and despite significant improvements over the last decade (see figure 7 above). However, the figure hides important dynamic and cyclical aspects of Mexico's financial markets, and banks in particular. After a period of severe financial repression in the 1980s, banks were privatized and the government turned to a newly created domestic debt market for its financial needs, making way for a sharp credit boom in the early 1990s (see panel A of figure 14). The subsequent contraction in loans actually led the contraction in deposits, unlike in the case of Argentina. This decline was largely driven by a decline in new loans that imploded early in the crisis, especially as the currency depreciated sharply and pulled the already weak balance sheets of Mexican banks with it. The severe credit crunch significantly leveraged the tequila crisis, and the collapse of the banking system will impose costs on the economy and the public accounts for many years to come.

Was it the banks' reckless behavior that caused the crisis, or were the banks victims of the crisis itself? The majority of opinions support the former proposition, which probably means that there is plenty of truth behind it. On the other hand, the consensus view has been influenced by the outcome: *ex post* the loans did not perform; hence they must have been bad loans.<sup>28</sup> There is a point to be made in defense of the Mexican banks. At least from the perspective of a sample of large Mexican firms available

27. See Caballero (1999c) for the details of this analysis and further discussion.

28. Of course, this is not to deny that Mexican banks were vulnerable and had already shown an increasing trend of nonperforming loans before the crisis.

**FIGURE 14 . Mexican Amplification Mechanisms**



Sources: IFS; Banco de México; Secretaría de Hacienda y Crédito Público (Ministry of Finance).

a. Loans correspond to bank credit to the private sector, while deposits are the sum of demand, time, and savings deposits.

b. Average.

in Datastream, banks' lending seems to have been directed to firms that were perceived to be profitable by the stock market as measured by price-earnings ratios at the end of 1992. Firms with higher initial price-earnings ratios were clearly at the receiving end of the 1992–94 credit boom.<sup>29</sup>

If not only misbehavior and corruption, then what else? After a period of deep financial repression in the 1980s, banks were privatized at the same time that the economy was undergoing a deep structural reform. The first ingredient, namely, the history of financial repression, is bad because after years of lending to the public sector banks had little expertise in the analysis of credit risk. Banks substituted for this lack of knowledge by requiring collateral, mostly in the form of real estate, which works well in the case of idiosyncratic shocks but not when these are aggregate.<sup>30</sup> The second ingredient, namely, deep restructuring, is always bad for banks, especially for existing loans that cannot adjust their risk premium. The gains on such loans are limited on the winner's side, while they take a large share of the losses of those sectors and firms that are on the destruction end of the creative-destruction process.<sup>31</sup> Moreover, this process and the problems it generates may have been worsened by the difficulties faced by the expanding side of the economy, since growth in the United States was subdued at best through much of the late 1980s and early 1990s.<sup>32</sup>

As with Argentina above, the consequences of underdeveloped domestic financial markets are ultimately reflected in the economy's failure to reallocate resources in an expedient manner, especially in times of crises.

29. See Caballero (1999c) for further detail. Firms with price-earnings ratios greater than 11 at the end of 1992 more than doubled their debt over the next three years, while firms with price-earnings ratios less than 11 increased their debt by less than 50 percent.

30. The proportion of loans over 20 million pesos that were collateralized right after the crisis was around 70 percent of the total for most banks. Gelos and Werner (1999) document that banks' use of collateral increased after privatization.

31. This statement refers to a transitional surge in restructuring, not a steady-state relation between restructuring and banks' performance.

32. In the literature, the latter factor seems to have been underplayed relative to the exchange rate overvaluation as an explanation of depressed growth in Mexico. The overvaluation, the argument goes, was primarily due to the exchange rate-based stabilization program. An alternative—or at least complementary—interpretation, especially for those years well after the initial adjustment to the stabilization program, is that the “overvaluation” was an equilibrium consequence of the massive credit inflows largely made possible by the low U.S. interest rates. Of course, when these flows turned around abruptly, the exchange rate became overvalued.

Evidence on the time series of dispersion for industry cross-sectional stock market returns (presented above in figure 9) confirms this hypothesis. Mexico and Argentina had similar increases in cross-section dispersion of stock market returns relative to Australia and Chile, whose financial markets are more developed.

**FISCAL FRAGILITY.** Mexico's fiscal discipline is not at the heart of its volatility, at least not directly. More often than not, the public sector has been the residual claimant of the private sector's imbalances. Mexico exhibited a consistent primary surplus over the post-reform period, often to match the significant interest payments on the existing stock of public debt. Panel B of figure 14 hints at a fragility problem, describing a steady, fairly dramatic decline in both external and domestic debts throughout the period. This decline was abruptly interrupted during the 1994–95 crisis, when the government had to fetch new resources from abroad once again to bail out a distressed banking system.

While many argue that this systematic bailout practice is responsible for some of the private sector excesses, I believe that the importance of this form of moral hazard, while significant, is often vastly exaggerated. Either way, the bailout practice has another negative side: it raises the specter of fiscal fragility even when the official accounts look fine. A sudden burst in the government's financial needs and illiquidity is always around the corner, which means both real and nominal interest rates are ready to jump at any sign of distress anywhere in the economy, which in turn creates further distress. This feature was probably compounded by the large dollar amortizations coming due in early 1995, triggering the crisis.

Moreover, the sharp rise in interest rates that followed the devaluation and crisis was just the last chapter of the pressure building over the previous months. This increased pressure was reflected in the sharp reserve losses, as well as in the shift in public financing away from peso-denominated CETES and Ajustabonos and toward cheaper short-term, dollar-denominated Tesobonos. More to the point, domestic interest rates rose sharply during the recent emerging markets crises, despite the fact that the fiscal and external accounts looked healthy.

Regardless of whether a crisis materializes, these increases in interest rates put enormous pressure on fiscal targets, which often triggers offsetting contractionary forces on the primary surplus side. While the growth rate of interest payments was negative from 1989–94 as Mexico reduced its debt, the tequila crisis caused interest payments to grow by more than

80 percent in 1995. The low to negative growth in interest payments that followed was interrupted in 1999 by a 20 percent increase caused largely by the previous Russian financial crisis. Furthermore, these flows are probably an underestimate of the present-value consequences of a period of high rates, as not all debt is contracted at variable rates. Volatility in oil prices also has significant impact on the Mexican fiscal position. The growth rate of oil revenue turned from a 1990s peak of more than 15 percent in 1996 to contractions of 20 percent in 1998 and 10 percent in 1999.<sup>33</sup> The absence of a stabilization fund or significant insurance makes these shocks equally harmful.

The problem of fiscal fragility can be clarified by using a metric for public debt other than GDP. Figure 15 compares the situation of Mexico to that of Chile and the United States, two countries whose fiscal situation is not perceived as problematic.<sup>34</sup> The first bar shows that in terms of their respective GDPs, Mexico's public debt situation is far from critical. It looks substantially worse once normalized by fiscal revenue, but so does that of the United States. The real difference, however, becomes apparent when that debt is compared to the size of domestic financial markets, here indexed by claims on the nonfinancial private sector. The size of Mexico's public debt is large relative to its minute financial markets, and it looks even worse when multiplied by the volatility of fiscal revenue, which captures the speed at which fiscal conditions may deteriorate.<sup>35</sup>

**CREDIBILITY OF MONETARY POLICY.** The conduct of monetary policy in emerging economies is extremely difficult because it is subject to many political pressures and is also constrained by the fragility of the financial system and the large fluctuations in the demand for local assets. During the early stages of the "fixed" exchange rate system, Mexican monetary policy was continuously tight in a fruitless attempt to sterilize massive capital inflows in the face of rapidly accumulating foreign reserves and a steadily appreciating real exchange rate. By 1994 the authorities were engaged in the opposite, and much harder, fight. As the

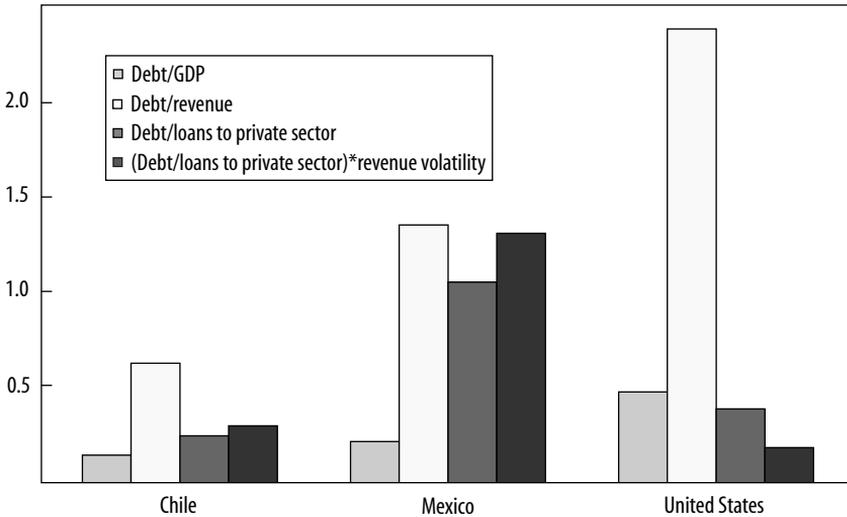
33. Statistics reported by the Secretaría de Hacienda y Crédito Público (Mexican Ministry of Finance), Instituto Nacional de Estadística, Geografía e Informática (Mexican Census and Statistics Bureau), and Banco de México.

34. Although in the case of Chile, one should add the outstanding debt of the Central Bank, which amounts to about 25 percent of the country's GDP.

35. This is an underestimate, since expenditures (when including those below the line) are also much more volatile in Mexico, as a result of the recurrent bailouts.

**FIGURE 15 . The Fragility of Mexico's Public Debt, 1997<sup>a</sup>**

Revenue volatility



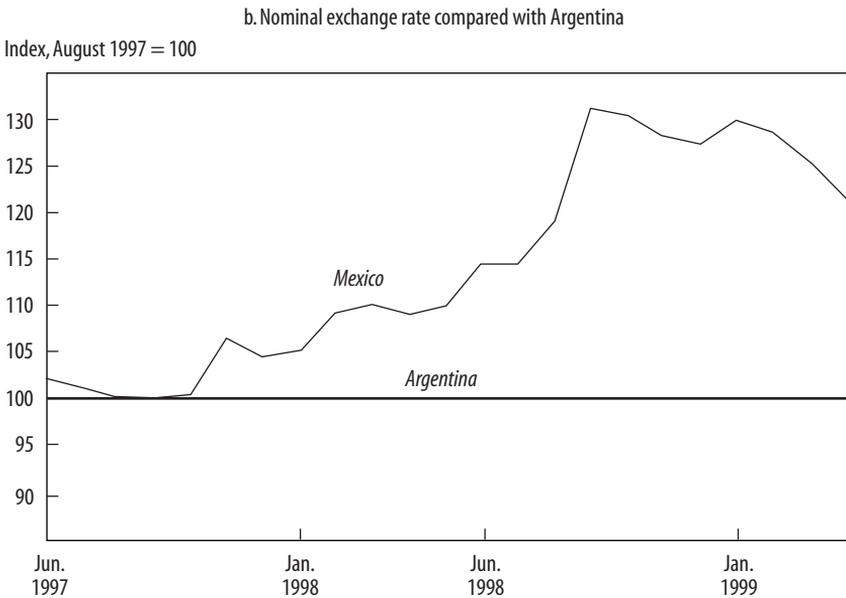
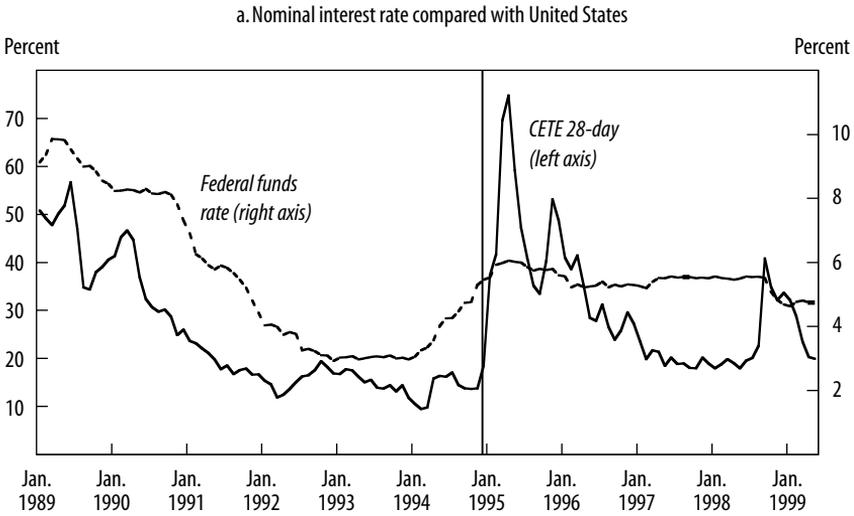
Source: IFS; Banco de México.

a. Revenue volatility is calculated using real growth rates and normalized to average volatility over countries.

international perception of the health of the Mexican economy began to change and the United States tightened credit, the Banco de México chose to keep interest rates low, since it was worried about the health of its banks (see panel A of figure 16). The result was a massive loss of both reserves and confidence, which was matched by further expansion in domestic credit to support the banking system; this eventually caused a collapse of the exchange rate system at the end of the year. Banks' balance sheets collapsed, leveraging the recession and depositing on the government a large amount of future commitments.

Without the fundamentals, and perhaps with no good reason to commit to an exchange rate, Mexico adopted an almost free float, and float it did as emerging markets felt the pressure from the recent crises. It is useful to compare the experience of Mexico to Argentina, a country with a much stronger exchange rate and monetary commitments. As shown in panel B, the exchange rate moved substantially during the recent emerging mar-

**FIGURE 16. Monetary Policy in Mexico**



Sources: INEGI; Banco de México.

kets crises, and a large component of it was reflected in inflation. Interest rates also rose sharply, mostly reflecting the rise in actual and expected inflation. Nothing similar was observed in Argentina, although the latter suffered much more dearly on the real side.

While the float and the good health of the U.S. economy served Mexico well during the recent round of international crises, lack of monetary credibility took its toll on both interest rates and inflation. Table 1 compares the experience of Mexico to that of two more advanced economies with flexible exchange rate systems: Australia and Canada. While all these countries experienced large and comparable nominal depreciations during this period, Mexico had much less to show for it in terms of a real devaluation. Rather mechanically, one can interpret this in terms of a very high pass-through. My view is that the problem results from a lack of a credible monetary anchor that drives both the exchange rate and domestic inflation up at the first sight of trouble. Thus Mexico gets some of the real exchange rate depreciation it needs, but it also gets a rise in expected inflation that limits the Central Bank's chances of supporting the market-desired real exchange rate adjustment.

Once again, the evidence on the presence of the core volatility factors is present in the case of Mexico. The fiscal and monetary instability are

**TABLE 1. Relative Performance: Australia, Canada, and Mexico<sup>a</sup>**

<i>Indicator</i>	<i>Asian crisis</i>	<i>Russian crisis</i>	<i>Both crises</i>
<i>Nominal depreciation</i>			
Australia	17.33	-0.07	17.25
Canada	4.47	6.60	11.36
Mexico	10.71	15.76	28.15
<i>Real depreciation</i>			
Australia	17.46	-0.07	17.38
Canada	4.94	7.09	12.38
Mexico	0.04	7.67	7.72
<i>Real/nominal depreciation</i>			
Australia	1.01	1.11	1.01
Canada	1.10	1.08	1.09
Mexico	0.00	0.49	0.27

Source: IFS.

a. Nominal exchange rates are relative to the United States, real exchange rates are constructed using the consumer price index and are relative to the United States. The base year in each panel is 1997; the Asian crisis includes depreciation from 97:3 to 98:2, while the Russian crisis includes depreciation from 98:2 to 98:4.

closely tied to these weaknesses as well. The final section addresses the policy implications of the Mexican scenario.

### *Chile*

In many respects, Chile is a prototype for Latin America's next economic stage. An early reformer, Chile has left behind the most traditional macroeconomic maladies of the emerging world. It has made significant progress in its regulatory and supervisory framework and has been a leader even beyond the boundaries of the region in allowing private sector coparticipation in a wide array of activities previously controlled by the public sector. Despite these important advances and a decade of stellar performance, the sharp recession of 1999 clearly indicated that the Chilean economy is still subject to significant volatility.

The success of the post-1986 period, which is occasionally referred to as the Chilean miracle, is apparent from the increase in average GDP growth illustrated in panel A of figure 17. Panel B describes a steady decline in inflation, which was never fully tamed before the debt crisis. Real volatility has not vanished, however; this phenomenon was expressed most dramatically during the 1999 recession and also in the occasional surge in real interest rates.

Despite Chile's greater financial development, the country's aggregate volatility is best explained by the core weaknesses. While Chile's greater development means that neither of these core ingredients is as binding as in Mexico and Argentina, the implementation of monetary policy is exceptionally difficult. Thus, two additional but very related volatility factors are the following:

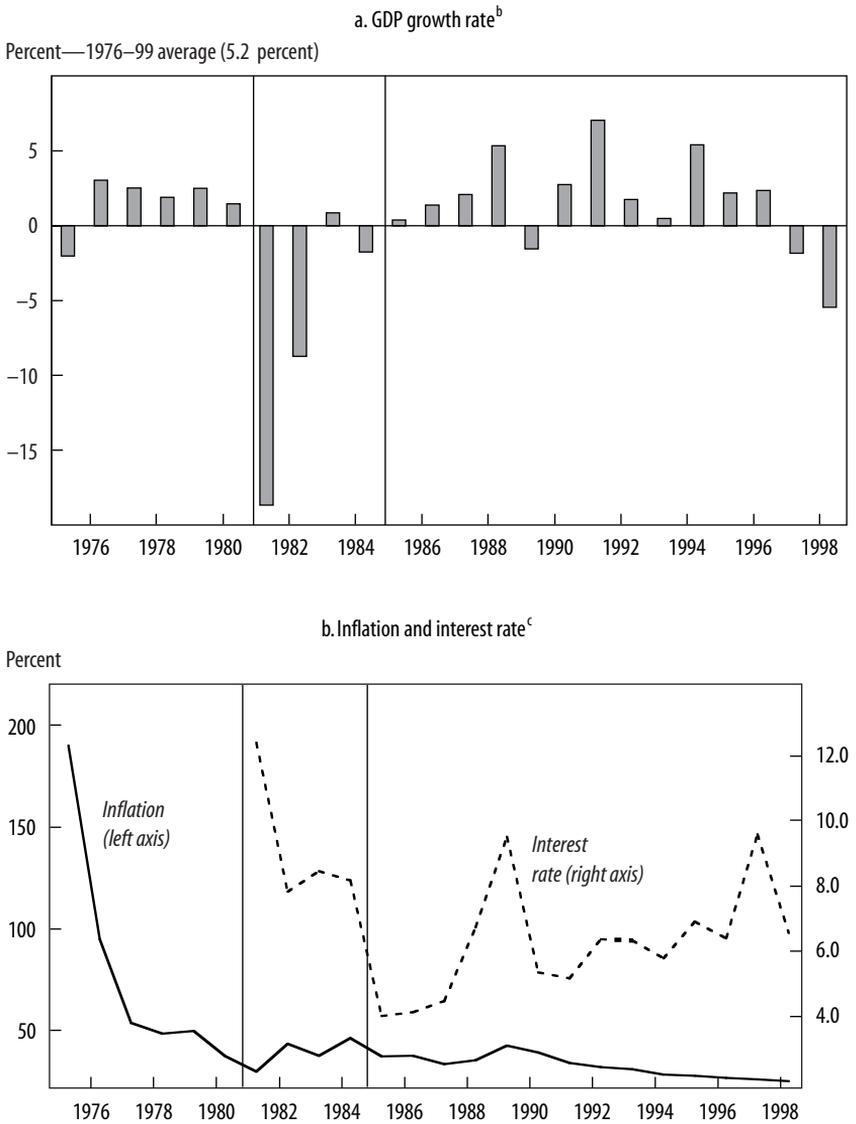
- The mandate of the Central Bank (or its interpretation) amplified recent external financial shocks, creating large volatility in real interest rates.

- Illiquid domestic financial markets have exacerbated the impact and standard roughness of monetary policy.

The following discussion elaborates on how these structural factors contribute to Chilean volatility.

**WEAK LINKS TO INTERNATIONAL FINANCIAL MARKETS.** The size of Chile's current account deficit is small relative to a neoclassical benchmark; this is a clear manifestation of weak international financial links,

**FIGURE 17. Chilean Growth and Volatility<sup>a</sup>**



Source: Instituto Nacional de Estadística (INE); Banco Central de Chile.

a. Preliminary data for 1998 and predicted data for 1999.

b. From 1982 to 1985 the average rate of growth was 2.1 percent, while from 1976 to 1981 and from 1986 to 1999 it was 6.8 percent.

c. Domestic interest rate is for 90- to 365-day loans, adjustable in *unidad de fomento* (UF).

whether actual or perceived. Furthermore, the relation between the Chilean business cycle and the price of its main export product is remarkably strong.<sup>36</sup> At the heart of the problem is a close time-series correlation between the spot price of copper and quarterly GDP growth, which violates the basic principles of smoothing through international financial markets. Panel A of figure 18 documents the excessive sensitivity of Chile's GDP to copper prices by plotting, together with the GDP growth rate, the annuity value of the expected present-value impact of the decline in copper prices, as a share of GDP. The different scales on the axes, in particular, demonstrate that fluctuations in GDP are an order of magnitude larger than a smoothing model would dictate.<sup>37</sup>

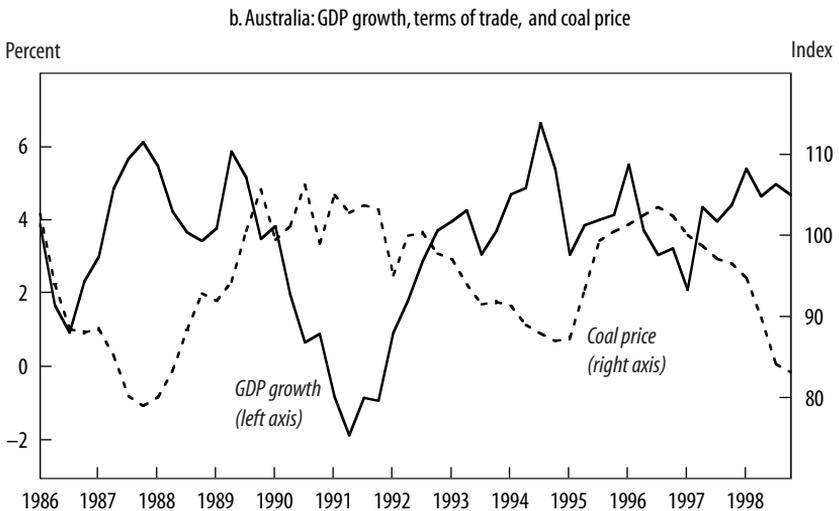
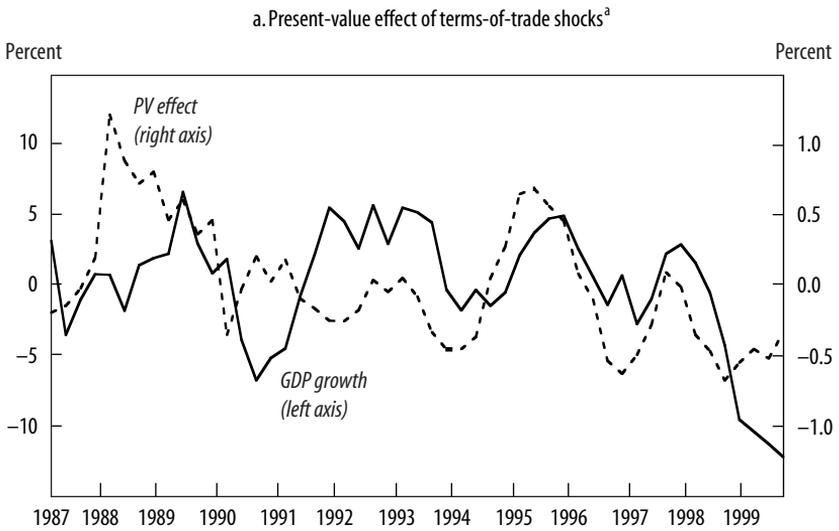
Panel B offers a cross-sectional dimension to the problem of excessive sensitivity, reporting the paths of Australia's GDP growth and the price of its primary export. While more advanced than Chile, Australia's exports are also concentrated in a few commodities.<sup>38</sup> Australia does not experience nearly as high a correlation between the price of its primary exports and its growth rates as does Chile, which further highlights the excessive nature of Chile's responsiveness to copper prices.<sup>39</sup>

36. In the late 1990s, copper exports accounted for about 40 percent of Chilean exports, which is equivalent to about 9 percent of its GDP. Chile has a copper stabilization fund (FEC) aimed primarily at stabilizing fiscal revenues: at the beginning of each year the Budget Office sets a reference price; withdrawals or deposits are made quarterly as a step function of the deviation between actual and reference prices. The largest yearly net deposit to the fund occurred in 1995 and amounted to 5 percent of fiscal revenues, when the price of copper exceeded its average of the 1985–99 period by 22 percent. The largest yearly net withdrawal occurred in 1998 and amounted to around 1.5 percent of revenue when the copper price was 36 percent below the average.

37. The price of copper has trends and cycles at different frequencies, some of which are persistent (see Marshall and Silva, 1998). However, the sharp decline in the price of copper during the current crisis was mostly the result of a transitory demand shock brought about by the Asian crisis. When the latter economies began to recover, so did the price of copper. I would argue that conditional on the information that the current shock was a transitory demand shock, the univariate process used to estimate the present-value impact of the decline in the price of copper in figure 3 overestimates the extent of this decline. The lower decline in futures prices is consistent with this view. The variance of the spot price is six times the variance of fifteen-months-ahead futures prices. Moreover, the expectations computed from the AR process track reasonably well the expectations implicit in futures markets but at the very end, when liquidity premiums may have been a consideration.

38. For Australia, coal represents a bit more than 10 percent of exports; together with wheat and wool, this share rises to around 20 percent. Australian terms of trade were severely hurt by the sequence of crises starting in mid-1997.

39. See Caballero (1999b) for more discussion. Norway also has a similar export concentration and also appeared to have output less sensitive to terms-of-trade shocks.

**FIGURE 18 . Chile's Excessive Sensitivity to Copper Prices**

Sources: Growth from IFS; copper prices (London Metal Exchange) and coal prices from Datastream.

a. The present value effect is computed assuming an AR(4) process for the spot price of copper, a constant growth rate for copper production (7 percent), and a fixed discount rate (7.5 percent). GDP growth is deviation from mean.

Why does Chilean economic activity respond so strongly to the price of copper? In my view, the fundamental problem is one of weak links to international financial markets. Panel A in figure 19 demonstrates that unlike what one would expect from standard smoothing arguments, the correlation between the current account deficit, capital flows, and the price of copper is clearly positive. The tequila crisis of 1995 is the exception that proves the rule: the high copper price gave the Chilean economy enough liquidity to ride the crisis and experience fast domestic growth despite the large international credit crunch that affected emerging economies.<sup>40</sup> Exactly the opposite occurred during the recent crisis as the price of copper plummeted, erasing Chile's liquidity at precisely the moment that international financial markets tightened.

Finally, an inverted volatility operates in Chile as in the other two countries above, again consistent with the hypothesis that foreign investors focus their trading on prime firm equities. The variance of returns for stocks listed in the IPSA index is greater than that of the total market, so it is these stocks that reflect large swings in capital flows. Most of the disparity in volatility arose during the recent recession, which figures 18 and 19 show is clearly related to external financial factors.

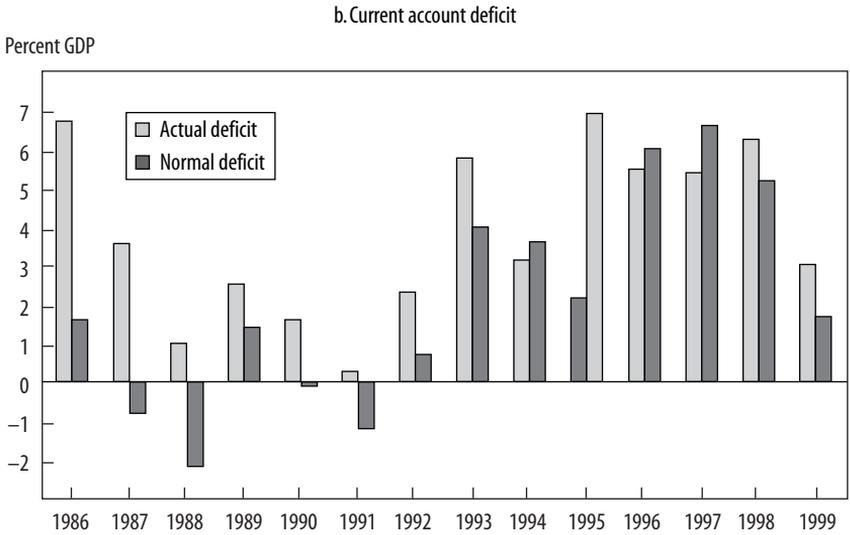
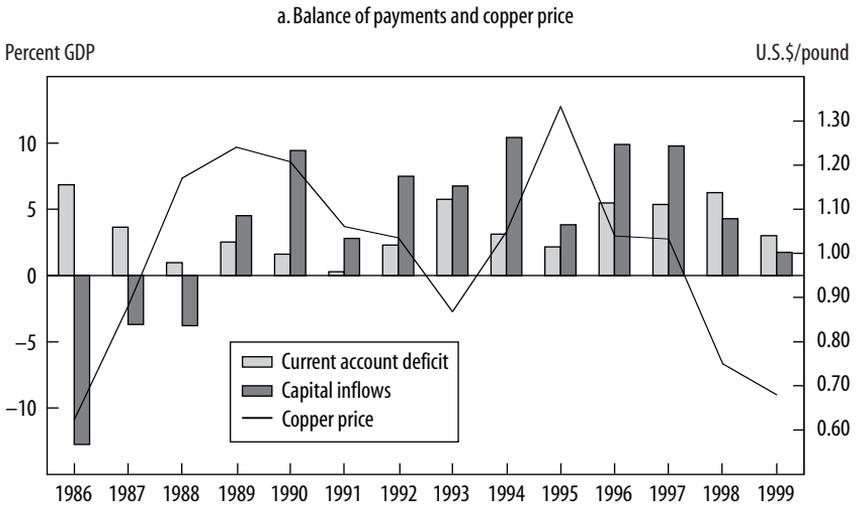
**UNDERDEVELOPED DOMESTIC FINANCIAL MARKETS.** Although a leader in the region, the development of Chile's financial markets is still only limited. The domestic corporate bonds market is negligible, and the equity market is both selective and fairly illiquid though large in terms of capitalization ratio. Bank dependence is large, especially for small firms, which amplifies other shocks.<sup>41</sup> When banks squeeze, firms have few other sources of funding.

Limited financial development is reflected even in places one would not expect to find it, such as the stock market. While the Chilean stock market has world-level capitalization values, its turnover ratio is very sub-

40. Capital flows were high, matching the high copper price, but the current account was not. The other exception reflects a domestically induced recession, as it resulted from the monetary tightening implemented at the beginning of the new government to offset the inflationary pressures of the preceding political cycle. Capital flows remained high but ultimately led to the accumulation of international reserves rather than financing a current account deficit.

41. These features need not be a problem. As many European economies have demonstrated, banks' credit can do most of the job, but this is less likely when banks are often subject to credit crunches.

**FIGURE 19. Chilean External Conditions**



Sources: INE; Banco Central de Chile.

standard (see figure 20, panel A).<sup>42</sup> Panel B of figure 20 reinforces the concern about the ability of the Chilean financial system to handle abrupt changes in the demand for its services. The figure reports the results of a simple regression of the absolute value of daily price changes (a measure of volatility) on the change in the fraction of total capitalization traded. Literally interpreted, an increase in the volume traded, in terms of total capitalization value, is associated with an increase in price volatility that is on average about ten times larger in Chile than in more developed economies.

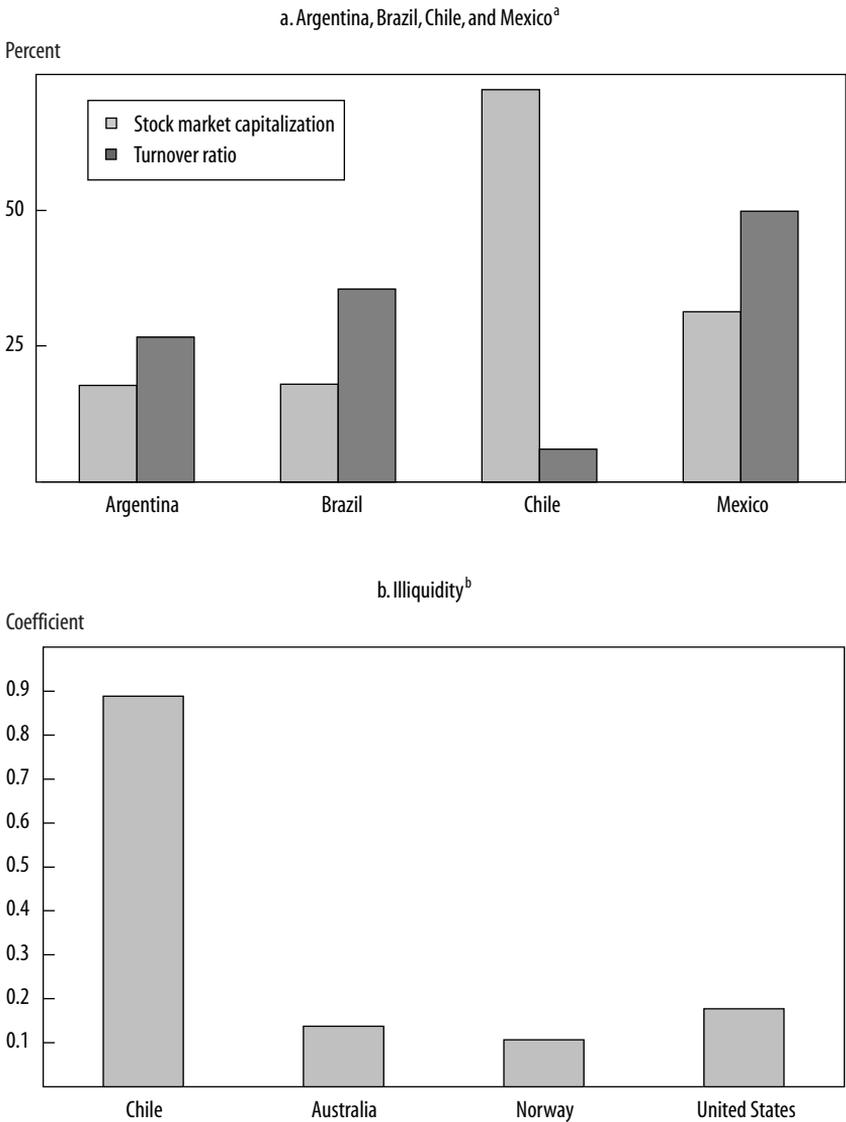
One reason that Chilean equity markets are so illiquid is the high concentration of ownership. In an average top-ten traded company in Chile, over 45 percent of the shares are held by the top three shareholders (excluding the government), as compared with a much lower percentage for economies like Australia (28 percent), the United States (20 percent), the United Kingdom (19 percent), or Japan (18 percent).<sup>43</sup> As for the rest, a large share is held by the pension funds (AFPs), with a limited role for other institutional investors. The assets of Chilean pension funds account for more than 25 percent of Chile's capitalization, more than twice the assets of all other institutional investors combined. While the sound practices of AFPs provide many benefits for the development of good corporate governance and for the stock market itself, they do not help with turnover or with attracting liquidity providers, since they tend to buy and hold rather than churn assets.

This problem was further compounded when limits on the AFPs' foreign investments were relaxed in mid-1997, right before the onset of a sequence of crises. While such measures helped the AFPs and their members, at least in partial equilibrium, the change came at the worst of times in terms of domestic liquidity provision, since the pensions indeed used this new margin actively throughout the crisis. The timing of the introduction of the measure, which coincided precisely with the onset of crisis, thus resulted in a short-term liquidity problem, although in the long run the measure should prove adequate.

42. While excessive churn can be wasteful, it is highly unlikely that Chile's depressed levels are enough to support a solid infrastructure of market makers, able to provide optimal levels of immediacy and liquidity. Moreover, one could argue that the waste associated with normal churn is a cost worth paying to reduce the extent of systemic liquidity crises when these arise.

43. See La Porta and others (1997).

**FIGURE 20 . Chilean Stock Market Illiquidity, January 1990–September 1999**



Sources: Banco Central de Chile; Datastream global indexes.

a. Stock market capitalization is given as percent of GDP. Turnover ratio is turnover over market capitalization.

b. Illiquidity is measured by the coefficient of the regression of daily absolute value price changes on daily volume over market capitalization.

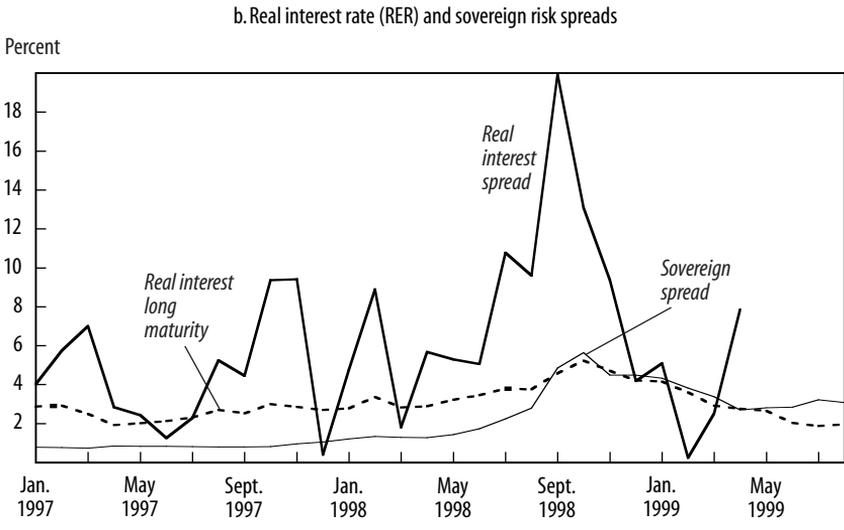
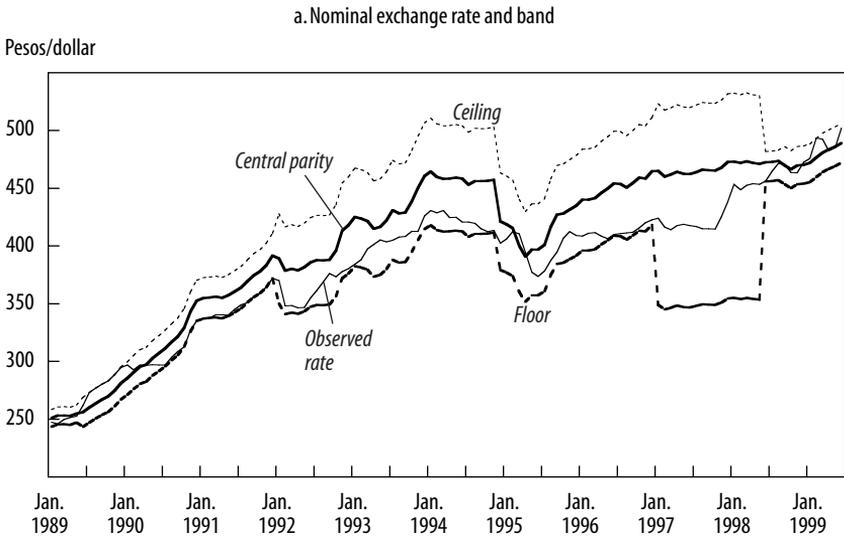
The consequences of underdeveloped domestic financial markets are ultimately reflected in the economy's failure to reallocate resources in an expedient manner, especially in times of crises. Figure 9 (above) plots a measure of the cross-sectional dispersion of the stock market returns for a group of approximately twenty-four Chilean industries. While Chile fares better than other regional economies, such as Argentina, it does not have the stability of more developed economies, such as Australia.

**MONETARY POLICY SHOCKS.** The mandate of the Central Bank of Chile, as interpreted by its authorities, had two basic components: to meet a declining inflation target and to prevent the current account deficit from growing much beyond 4 percent at the normal terms of trade. Under this mandate, the recession of 1998–99 represented the Central Bank's worst scenario. Inflation closely followed targets until the late 1990s (see figure 17, panel B, above). The failure to meet targets at the end of 1997 and through most of 1998 is largely explained by pressure on the exchange rate caused by tighter external conditions and a decline in the terms of trade (see figure 21, panel A). While low inflation on the tradable component of the consumer price index was essential in bringing down inflation through much of the 1990s, this contribution subsided following the Asian crisis. The sharp decline in the terms of trade put pressure on the peso, and hence on inflation, and directly worsened the current account via its income effect.

The Central Bank's situation was further complicated by a series of attacks on the peso, which reached its apex during the Russian crisis. Largely constrained by its mandate, the Central Bank responded to the attacks with a sharp hike in domestic short-term interest rates, well above the increase in the country's risk spread. The sharp use of interest rates made Chile an outlier compared to other, more advanced economies that were affected by the recent turmoil through similar mechanisms, although to a lesser extent (see figure 21, panel B).

**MONETARY POLICY WITHOUT MUFFLERS: ILLIQUID FINANCIAL MARKETS.** The large fluctuations in the Chilean nominal interest rates have significant consequences for its real side. Why might interest rate volatility affect Chile more than other Latin American countries? Financial development offers a plausible explanation. Chile's degree of financial development seems closer to that of more advanced economies than to that of the rest of Latin America. While financial development is

**FIGURE 21. Chilean Targets and Policies**



Sources: Banco Central de Chile; Ministerio de Hacienda.  
 a. Preliminary data for 1998 and predicted data for 1999.

undoubtedly a positive feature in that it facilitates an adequate reallocation of resources, it also builds the leverage for a larger impact from an interest rate hike. Panel A of figure 22 shows the paths of the relation between the output gap, measured as the deviation of output from a deterministic trend, and the ex post real interest rates multiplied by the average ratio of loans to GDP.<sup>44</sup> This is done for Chile, Australia, Mexico (representing a country with less developed financial markets), and Norway. Chile's interest rates are very volatile, and its output gap moves more for a given change in interest rates than in any of the other countries. When one looks at the real interest rate unscaled by financial depth, the basic message remains unchanged: both the interest rate and output are relatively volatile in Chile, and they are clearly negatively correlated.

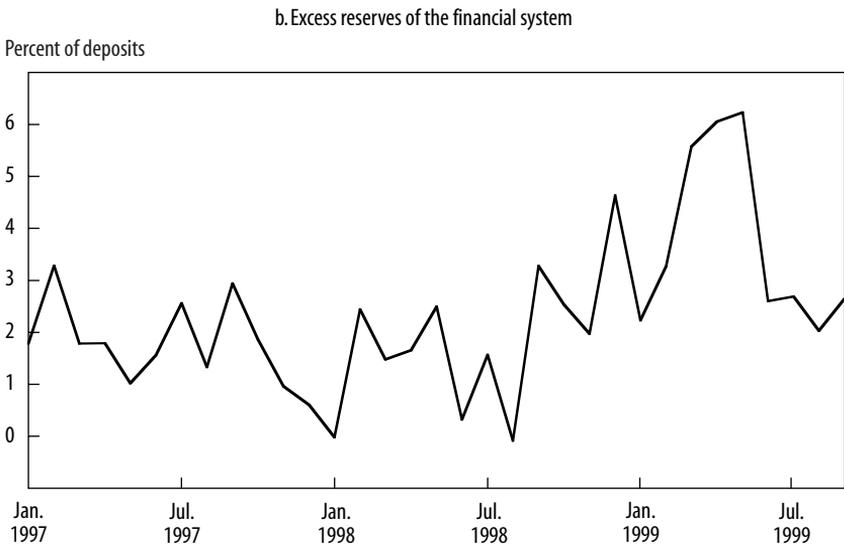
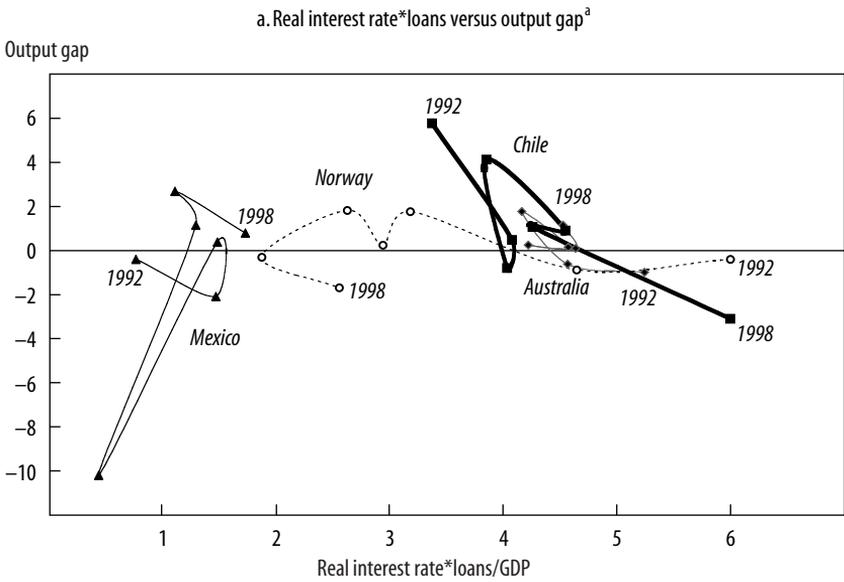
Thus while Chile has more financial depth than other countries in the region, this makes the system vulnerable to large interest rate hikes. The latter are particularly powerful because illiquid financial markets make the banks the almost exclusive source of funds, and because the banks are also affected by the thin financial markets. Chile apparently does not have many good mechanisms for muffling the direct and rough impact of monetary policy. Between 1992 and 1998, the daily volatility of the changes in the Chilean interbank market rate was relatively large—50 percent larger than Mexico, three times as large as Argentina, and more than ten times the size of Australia, Norway, and the United States. While several institutional factors complicate the cross-country comparison of data on very short-term interest rates, such volatility probably reflects the illiquidity of that market. Panel B highlights the sharp liquidity droughts (measured by average excess reserves) that took place when the Chilean peso was attacked, particularly during the first and third quarters of 1998, as well as the prudence exhibited by the banks after the episode.

In response, banks squeezed borrowers. Panel A in figure 23 portrays the path of net deposit and loan flows, measured as the rate of change in these variables minus their respective interest rates. As the figure shows, hikes in interest rates were soon followed by credit crunches.<sup>45</sup> The firms

44. While in principle only the real interest rate should matter, in practice several factors justify plotting the relation with respect to nominal interest rates as well. For example, a sudden rise in the flow payment associated with a sharp increase in the nominal rate may induce financial distress on a constrained firm.

45. Banks have also played a more indirect but significant role in the initial rise in interest rates, as they seem to have been one of the main forces behind the attack on the Chilean

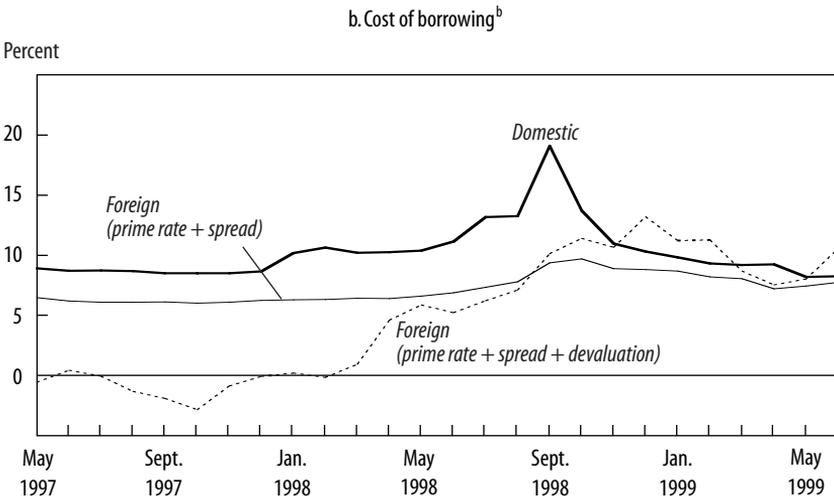
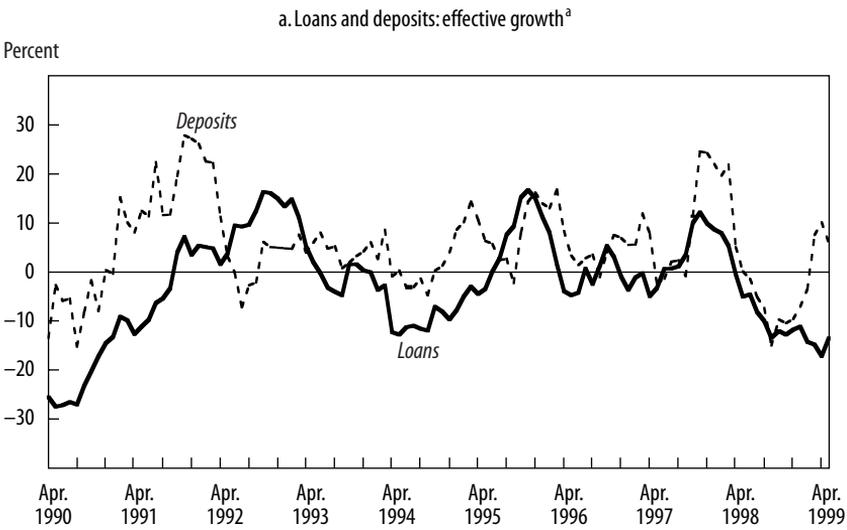
**FIGURE 22 . More Chilean Amplification Mechanisms**



Source: Banco Central de Chile.

a. The interest rate is the leading rate published by the *IF*S.

**FIGURE 23 . Chile's Credit Crunch and Crowding Out**



Sources: ABIF; SBIF; Banco Central; Ministerio de Hacienda; Federal Reserve.

a. Six-month moving average. The effective growth rate is a measure of net financial flows, computed as the rate of growth of the nominal stock minus the nominal interest rate.

b. The domestic interest rate corresponds to the financial system average rate for 90- to 365-day loans, adjustable in *unidad de fomento* (UF). The sovereign spread is the cost of borrowing abroad of a prime company (Enersis) minus the U.S. Treasury bill. The devaluation is annualized monthly real devaluation.

most directly affected by credit crunches are almost always the small and medium-size enterprises, and these may have suffered continued credit shortages even after the crisis passed as a result of crowding out by large firms. When it became apparent that the contraction was more severe than expected, the Central Bank lowered interest sharply, so much so that large firms may have found it advantageous to turn to domestic financial markets to obtain financing that was still difficult abroad. Panel B shows an approximate measure of a prime Chilean firm's cost of borrowing abroad (the U.S. prime rate, plus a measure of the international spread on Chilean corporate debt, plus two different measures of the peso's real devaluation) versus the cost of borrowing from domestic banks. Before the crisis, borrowing abroad was probably much cheaper for these firms, especially given the real appreciation of the peso; the opposite holds after the crisis.<sup>46</sup>

Chile's experience over the last decade illustrates that successfully tackling traditional macroeconomic maladies is certainly not sufficient for taming real volatility. Moreover, the increased leverage associated with financial development and the mandate of the central bank amplified the effects of external shocks, themselves important only because of the continued presence of core deficiencies. The policy lessons from Chile's experience, as well as those of Argentina and Mexico, are described below.

## Policy Lessons

Latin American economies are weak along two central dimensions: links with international financial markets and the development of domestic financial markets. As most primitive forms of macroeconomic volatility

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peso in 1998. Although no public information is available on the subject, the presumption is that they did it to bridge currency mismatches rather than for speculative reasons. If the former is indeed the case, the appropriate response by the Central Bank was not to hike interest rates but to "rent" the reserves to the banks (see the discussion on policy). Decentralizing reserve holdings seems to be a reasonable component of an efficient system for international liquidity management.

46. If the situation persists, local banks will probably borrow abroad to lend to the SMEs. In the short run, however, this mechanism is limited, given uncertainty and the banks' conservatism. In fact, the crowding-out mechanism can be phrased in reverse: the sharp increase in the banks' appetite for quality lowers the equilibrium rate and exacerbates the rationing mechanism.

lose their importance in response to reforms and regained fiscal and monetary discipline, these two ingredients probably account for much of the fluctuations and crises in modern Latin America, either directly or by leveraging a variety of standard shocks. While conventional advice for conventional maladies is still valid, focusing on these two features offers a clear and potentially rewarding policy target.

As described above, weak links to international financial markets are simply financial constraints, possibly time varying, that limit the public and private international borrowing of emerging countries, as well as their ability to smooth shocks over time. In fact, they are themselves a source of shocks. Latin America's small current account deficits, relative to a neo-classical benchmark, and the procyclical behavior of the region's fiscal policy suggest the presence of an international borrowing constraint. Large swings in capital flows and sovereign spreads that bear little relation to economic fundamentals—at least in terms of magnitude—in Mexico and Argentina illustrate the fragility of this constraint. External financial shocks affect the private sector through a variety of mechanisms, including the crowding out of small firms by the government in Argentina and by large firms in Chile, together with the inverted volatility ranking of Latin America's prime firm equity markets. The Chilean economy's excessive sensitivity to the price of copper and the volatility premium on Mexican and Argentine corporate debt issues further support the fragility of these links.

Turning to the second ingredient, financial markets are key not only for fostering investment and growth, but also for allowing adequate aggregation of resources during distress. In the presence of weak international links, financial development affects an emerging economy's ability and incentive to aggregate its international collateral in order to intermediate funds to firms in need of international liquidity. The level problems in Argentina and Mexico and the illiquidity of Chilean stocks illustrate that Latin American financial markets still require further development. On the other hand, as financial development rises, leverage also increases, as does the vulnerability of the system to shocks. While the Mexican crisis of 1994–95 offered an extreme example of this, the excessive sensitivity of the Chilean economy to changes in interest rates also supports this hypothesis.

Underdeveloped financial markets ultimately limit the prompt reallocation of resources, creating wasteful contractions in those markets most affected by shocks or less integrated in the financial system. The negative

correlation between financial development and cross-sectional dispersion in industry stock returns, as discussed above in each of the three cases, provides evidence that the development of financial markets is an important factor in explaining aggregate volatility.

Dealing with these weaknesses requires two types of policy: structural policies aimed at deepening domestic financial markets and foreign participation in them and macroeconomic policies aimed at dealing with and preventing crises during the transition toward a sounder financial system. These two types of policies are discussed separately in the following sections.

### *Structural Solutions: The Long Run*

Structural policies should be based on three basic and general principles.

—Aim right. A widespread consensus is currently held on a series of general recommendations to improve external financial links, which can be found in most literature outlining international financial architecture. These recommendations include norms of transparency and accountability; sound practices for banking supervision, settlement, accounting, and disclosure; aggregate risk management; and a series of related measures and practices aimed at improving a country's contractual environment and corporate governance.

—Use the private sector. Fostering the development of well-supervised institutional investors is an efficient mechanism for delegating the enforcement of good corporate governance standards to the private sector, since these institutions often consider such factors in their investment decisions. For example, TIAA-CREF, one of the largest institutional investors in the United States, has publicly stated that it simply does not invest in claims issued by companies with poor corporate governance standards.<sup>47</sup> Its requirements include the following: a company's board must consist of a substantial majority of independent directors (that is, no significant personal ties, both current or past); a company's board must obtain shareholder approval for actions that could alter the fundamental relationship between shareholders and the board; and companies must base executive compensation on a "pay for performance" system, and they must provide

47. *Participant* (TIAA-CREF's quarterly news and performance magazine), May 1999, pp. 10–11.

full and clear disclosure of all significant compensation arrangements. It does not take an in-depth knowledge of Latin American corporations to realize that very few of them would make it onto TIAA-CREF's list for good corporate governance. Institutional investors can have a significant impact on market development. For example, the Chilean stock market owes much of its relatively large capitalization value to the investments and monitoring of the pension funds.

—Be wary of short-run measures. Capital controls or their removal should be considered, although this entails a tension between the short and long terms. Capital controls can supplement sterilization or, in principle, slow down capital inflows of a targeted maturity. On the other hand, while these controls may be justifiable in terms of static second-best arguments, they may hurt in the medium term once the endogenous arrival of international market makers and corporate governance improvements are taken into account. This hints at an important synergy in fostering a deeper integration with international financial markets: not only is good corporate governance necessary for successful integration, but integration may be an essential ingredient for achieving good corporate governance. If a country's institutions are so far off the ideal ones that the decentralized equilibrium is very unstable, taxing capital inflows contingently (that is, removing them during external distress) may be justified. If that is not the case, however, it may well pay to bear the additional risk in exchange for a faster development of financial links and markets.<sup>48</sup>

### *Macroeconomic Policy: The Short and Medium Terms*

Because structural change in emerging economies will certainly take several years, the role of macroeconomic policy in the short term is to take steps to prevent and manage crises. Since underdeveloped domestic financial markets typically lead to a situation in which international liquidity provision is undervalued *ex ante*, the goal of macroeconomic policy is to reallocate international liquidity use and availability from booms to crises. During the latter, the goal is to reallocate it to those economic agents that need it the most, but this must be done carefully to avoid cre-

48. In May 2000, Chile opted for the latter—permanently removing capital controls—together with a series of measures aimed at improving corporate governance, integrating with international financial markets, and developing domestic financial markets.

ating significant, perverse *ex ante* incentives to hoard and produce international liquidity. Below I highlight a few policy features that appear desirable from the perspective adopted here, as well as some caveats to standard advice.

**INTERNATIONAL LIQUIDITY MANAGEMENT.** Several mechanisms are available for managing international liquidity. In the area of monetary policy, the quintessential instrument for addressing this problem is a sterilized intervention during the capital flows boom—essentially, the central bank sells public bonds for international reserves. The counterpart ought to be the selling back of these reserves during external crises. Experience and theory suggest that the first half of this policy, the sterilized intervention, is hard and expensive to implement for prolonged periods, and it may even backfire as the private sector reacts perversely to the quasi-fiscal deficit, appreciation, and reserves accumulation at the central bank.<sup>49</sup> Thus this instrument is probably not feasible for medium-term prevention.

In the area of fiscal policy, the pattern of procyclical fiscal deficits in Latin America has traditionally been interpreted as seriously suboptimal, on the basis of Keynesian mechanisms that advocate countercyclical fiscal policy. Traditional analysis then attributes the procyclical pattern to the financial constraints faced by the governments themselves. However, when external financial shocks are an important source of fluctuations, the economy should optimally distribute the scarce available international resources across domestic economic agents so as to smooth differences in financial distress. It is highly unlikely that government expenditure, unless used very selectively to solve financial distress in the private sector, is the right mechanism for allocating the marginal dollar.<sup>50</sup> Optimal fiscal policy may need to be procyclical after all, in contrast to the more standard argument that explains the fiscal pattern in terms of governmental financial constraints. Which effect dominates depends on whether the private sector (perhaps a specific sector within it) or the government faces the tightest financial constraints during the crisis.

With regard to labor markets, most countries in the region are in need of a modern labor code. Because they are leveraged by financial problems,

49. See Calvo (1991); Caballero and Krishnamurthy (2000).

50. This also suggests that fiscal adjustments during crises ought to be done on the expenditure side rather than on the tax side. If the latter is unavoidable, the adjustments should be targeted away from the supply side of the economy.

Latin American economies are exposed to much larger short-term adjustment needs. These needs are highly unlikely to be fully accommodated—and to a different degree in each country—by exchange rate movements. A new labor code must allow for a more or less automatic recession (or crisis) package. Choosing to follow the advice, as did Argentina recently, of those who argue that temporary contracts have not been effective in Europe is misguided.<sup>51</sup> The European problem is primarily one of lowering structural unemployment, whereas Latin American economies also need to deal with sharp short-term crises. The Latin American solution should at the very least allow for a contingent relaxation of constraints on temporary contracts, to promote this form of hiring during crises.

In the area of debt management, it has become common practice to advocate a strategy that avoids lumps, since the government itself may trigger a crisis in the face of large debt renewal or payment. While it is sound advice for the government to reduce its own bottleneck, the private sector will probably undo part of the smoothing. The public debt schedule is not the only factor that matters, and the private sector may undervalue the benefits of smoothness in the repayment of aggregate debt.

The optimal exchange rate policy, in turn, is one of reallocation of international reserves from high to low capital flow states, which clearly implies an element of real exchange rate stabilization. Reserve management must be active and transparent. While Mundell-Fleming considerations give an edge to flexible exchange rate systems if sterilization is to be tried, such policies may have a large transfer component from domestic suppliers of international liquidity to potential borrowers during crises (for example, as would happen if sterilization acts through lending channels, whereby intermediaries are hampered in their ability to reallocate liquidity during booms).<sup>52</sup> This effect may eventually reduce the incentives to supply international liquidity.<sup>53</sup> In other words, if sterilization succeeds in choking intermediation during booms, it represents a tax on

51. The argument against temporary contracts is not that they don't create employment, but rather that they further separate insiders from outsiders by reducing the pressure on insiders and creating a class of temporary, unskilled workers.

52. See Caballero and Krishnamurthy (2000).

53. An additional point against a fully flexible exchange rate system is that it may not be possible for an individual country to allow the development of sufficiently deep currency-risk hedging instruments. Investors may use them to hedge the risk on neighbors'

savers and liquidity providers in general. On the other hand, a fixed exchange rate system probably requires that a very large share of the country's international liquidity be held by the central bank (or mandated on the private sector) if it is to succeed in improving the use of this liquidity.

Finally, active management of banks' reserves, capital-adequacy ratios, and possibly international liquidity ratios can also affect the aggregation of international collateral. The level of these ratios should be decreasing in the degree of financial development and should be procyclical. There are two practical problems with the latter recommendation, however. First, for those countries where the health of the banking system is suspect, weakening standards may increase the likelihood of a run. This was a concern in Argentina during the recent crisis. Second, the policy may be ineffective during crises, since the constraint may not be binding. This is true especially when foreign banks have large market shares. In Chile, for example, the capital-adequacy ratios of foreign banks rose significantly vis-à-vis those of domestic banks during the recent crisis.<sup>54</sup> Importing solid international banks is clearly a must, but it is important to understand their implications for aggregate liquidity management.

**INTERNATIONAL INSURANCE.** An emerging economy could easily smooth external shocks in the absence of the core weaknesses described above. As long as these structural problems are present, however, a significant component of the aggregate risk associated with external shocks should be eliminated through insurance whenever feasible. Aside from the controversial taxation of short-term capital inflows, governments often resort to stabilization funds and other self-insurance mechanisms, such as industrial policy aimed at export diversification.<sup>55</sup> The macroeconomic measures discussed above are also forms of aggregate self-insurance. All of these policies are generally expensive, inefficient insurance methods,

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currencies, if these do not have their own deep hedging markets. This was a problem for Mexico around the Brazilian turmoil during 1998–99, and it is a particularly serious concern if the country's financial markets are not deep enough.

54. See Caballero (1999b).

55. Yet another mechanism is to sell domestic assets to foreigners. The issues here are when to sell and, closely related, whether the perceived agency problems (such as the risk of expropriation) are low enough to prevent a steep price discount.

but unfortunately the incomplete nature of the corresponding insurance and hedging markets often makes them the most feasible option.<sup>56</sup>

Why these markets are so incomplete is a key research question that should probably be linked to the emerging literature on underdeveloped catastrophe risk markets in more developed economies. Aside from incentive problems affecting countries, the high correlation between commodity prices and global activity probably makes the capital required to insure that risk naturally very expensive and too large for insurance companies to immobilize. It is here that a market-making role on the part of the international financial institutions may represent a significant aid.

**STATE-CONTINGENT POLICIES.** Since much of Latin America's volatility problems can ultimately be linked to external financial factors and terms-of-trade shocks, which are themselves important only as a result of weak international financial links, the need for designing a solid contingent policy is clear. Most macroeconomists would agree in principle on the cyclical features of the policies described above, but much disagreement would arise in practice. Opposition often comes from those who give priority to credibility issues. With regard to the exchange rate, for example, the credibility of the system is the main argument in favor of dollarization and other strongly fixed systems.

To my mind, however, the most credible policy is that which is most suited to the scenario faced by the country. Speculative behavior that is created by discretion can largely be eliminated by making the contingent rule explicit. This rule must be simple, easily verifiable, and a function of variables not directly controlled by the authorities. Terms of trade (in most cases) and some index of the tightness in international financial markets (such as the Emerging Markets Bond Index, or EMBI, spread) would probably suffice.

Monetary policy and the exchange rate are crucial areas for the design of state-contingent policies. If the locally preferred exchange rate system is fixed, for example, this may be allowed to depart transitorily from its

56. The need for intervention here is motivated by another manifestation of the underprovision of international liquidity discussed above: international insurance is undervalued by the private sector. Since long-term external debt is simply short-term debt plus a rollover insurance contract, the private sector will borrow at maturities that are shorter, on average, than is socially optimal. From the point of view of the aggregate economy, the private sector will underinsure with respect to terms-of-trade and external financial shocks.

long-run parity as a function of the state of the economy, with care being taken to eliminate any arbitrage opportunities. If the choice is flexible, on the other hand, the rule must control the release of central bank reserves to the open market. Unconditionally, I advocate a flexible exchange rate system coupled with a very active—but explicit and contingent—reserve management strategy and a nontradables inflation target. Reserve management is aimed at reallocating international liquidity as discussed above, while the inflation target provides an anchor which is not directly affected by short-run fluctuations in the exchange rate, especially those that are needed in the face of an external shock. When credibility problems are severe, however, a fixed regime may be preferable while still preserving the reserve management strategy. Since this latter case requires potentially costly mandatory international liquidity requirements or taxes on capital flows, authorities must keep a close eye on the consequences of these policies for the private sector's incentive to hoard and produce international liquidity.

With regard to fiscal policy, a fiscal contraction is better designed to handle a terms-of-trade shock than a monetary tightening. A fiscal contraction reduces expenditure directly, frees up financing to the private sector, and facilitates expenditure switching. In addition, by allowing the real depreciation to take place, it improves the outlook for exports and hence for international collateral. Fiscal policy ought to have a component indexed to the terms of trade: when the terms of trade are low, expenses that do not suffer from non-smooth behavior should be reduced according to some preestablished rule.<sup>57</sup>

Finally, in the area of labor markets, firms should insure workers under normal circumstances, rather than the other way around, but when crises have severe financial implications for firms, the insurance may have to be turned around and quickly, at least from employed workers. Indexing labor costs—for example, contributions to unemployment insurance and (future) severance accounts—to terms of trade and external financial conditions may be sound as well.

The policy options discussed above focus on domestic—as opposed to international—reforms and policies that can help overcome chronic

57. It is important that this rule be predetermined. Part of the recent Chilean recession was arguably created by bickering between the Treasury and Central Bank about who should make the first adjustment.

volatility. This focus reflects my views on what is immediately feasible, as well as space limitations. It does not absolve the international financial system, which will also have to do its part to solidify its relation with advanced emerging economies. These economies have already undergone substantial changes, and in many ways their conduct is more prudent and responsible than that of many developed economies. It is not reasonable, for example, that these emerging economies have to do so much in term of expensive self-insurance and must forgo the advantages of short-term and own-currency borrowing. The international financial institutions can play a major role to help deepen financial markets and integration. On this account, the World Bank's recent issuance of Chilean peso-denominated bonds represents a significant step forward in the development of an important missing market.

## Comments

**Jeffrey A. Frankel:** I applaud the approach of this paper. When finance experts writing on the subject of volatility are unable to explain why market prices go up or down, they are sometimes content to identify time periods or places when volatility is high. Caballero, in contrast, first summarizes his earlier theoretical work and then tries to relate it to recent events in three case studies (namely, Argentina, Mexico, and Chile). This is a worthy challenge for any theorist.

I agree with the opening observation that desirable economic reforms do not necessarily lead to a decline in fluctuations. They may in fact lead to an increase in volatility, particularly in the case of financial liberalization. The United States, for example, suffered regular financial and economic collapses during its historical phase of high-growth industrialization, which involved much sharper falls in output than we would be prepared to tolerate today. (The paper skirts around the hypothesis that in the presence of an underdeveloped domestic financial system, international financial integration can be harmful on net.)

I also agree with the recurrent theme that international financial markets in practice fail one of their prime assignments, namely, smoothing fluctuations, and that this failure is acute in the case of emerging markets. But I have some quibbles. One of the pieces of evidence that Caballero offers is figure 18, which shows that Chile's GDP is sensitive to the world price of copper and that this sensitivity is greater than that of Australia's GDP to the price of coal. However, copper represents a substantially higher share of Chile's economy than does coal in the Australian economy. Furthermore, one should look for evidence of smoothing in countries' consumption, rather than in their GDP. But no matter. The point is correct: financial markets do not allow developing countries to smooth out fluctuations in their living standards as they should.

The situation is worse than this, however. Not only are net capital inflows inadequately countercyclical, they are actually procyclical.

Caballero refers to “Latin America’s small current account deficits, relative to a neoclassical benchmark,” but the problem is not just that the region’s current account deficits are small: they move in a direction that destabilizes consumption relative to output rather than the reverse. The money floods in to finance current account deficits in boom times, and rushes out during recessions. Worse still, the evidence is mounting that these variations in capital flows are actually the origins of the economic fluctuations, at least in a proximate sense. One could readily attribute the crises that surfaced in Mexico in 1982 and 1994 to bad macro policies (particularly in the first crisis), to bad luck in terms of local political instability (particularly in the second case), and to increases in U.S. interest rates (in both cases). The crises that surfaced in East Asia in 1997, however, had no such evident proximate causes, even if one holds that their deeper origins lay in structural flaws in their economies. Capital flows *were* the crisis.

My final point on this issue is that the small size and procyclical nature of net capital inflows is not just a problem of developing markets. It is also a phenomenon of industrialized countries with highly developed financial markets. The fact that trade balances go into deficit in expansions and surpluses in recessions is one of the most robust empirical regularities of open-economy macroeconomics. One must therefore assess the evident failure of the theoretical paradigm—namely, the so-called neoclassical benchmark—that models current accounts simply as the outcome of intertemporal optimization.

Who is to blame for these crises? It has become customary to speak of three generations of models of speculative attacks. The first-generation models point to overly expansionary macroeconomic policies, but as Caballero points out, “The most traditional macroeconomic maladies of the emerging world—such as chronic fiscal imbalances and monetary gimmicks—are gradually being left behind.” It was particularly difficult to implicate overly expansionary macroeconomic policies in the East Asian crises. The third-generation models of speculative attacks blame banks and other so-called crony capitalists who partake of moral hazard. I agree with Caballero’s implication that this is part of the story, but not the whole story: “If not only misbehavior and corruption, then what else?” This leaves the villains of the second-generation models: namely, speculators and other participants in international financial markets that are prone to multiple equilibriums. Herd behavior and panics can bring about a crisis even without a change in fundamentals.

When capital inflows turn sharply to capital outflows, it is difficult to disentangle the roles of domestic versus foreign residents. The author offers one small piece of evidence that could be interpreted as pointing the finger at foreign residents: equity prices for large companies, counterintuitively, are more volatile in emerging markets than are prices for small companies. I would offer a stronger piece of evidence, albeit still far from conclusive, that points the other way. At the time of the December 1994 Mexican peso crisis, the price of a basket of stocks in Mexico City turned down sooner and more strongly than the New York–traded price of the country fund that consisted of the identical basket of stocks.<sup>1</sup>

A key external influence on the financial fortunes of emerging market countries is the U.S. interest rate. Caballero notes that interest rates in Argentina, Brazil, Mexico, and even Chile are more volatile than the U.S. corporate interest rate. But again, the situation is worse than that, because the Federal Reserve is often the source of the fluctuations. When the U.S. central bank raises the Fed Funds rate, interest rates tend to rise worldwide, and the increase is higher in Latin America than within the United States. The author neglects this factor in his description of the origins of the Mexican peso crisis.<sup>2</sup> Similarly, he overlooks political factors that contributed to the Mexican crisis, including the Chiapas uprising in January 1994 and assassinations of PRI leaders, which scared investors; the election timetable, which encouraged the authorities to sterilize reserve outflows (or to do more than sterilize, in the case of M2); and the change in personnel with the new administration in December 1994, which may have led to the so-called botched devaluation.

Let us now turn to the implications for policy, which are divided into long-run structural solutions and short- or medium-run macroeconomic policy. In addition to the usual proposals for strengthening the international financial architecture (for example, banking supervision and corporate governance), Caballero tentatively includes the issue of Chilean-style capital controls in his list of structural solutions. I agree with the appraisal that under certain conditions, such penalties on short-term inflows into emerging markets can play a useful role in changing the com-

1. However, the country fund statistics suggest that the subsequent contagion to the rest of Latin America does indeed come via New York. See Frankel and Schmukler (1996, 1998).

2. In countries with a flexible exchange rate, such as Mexico more recently, interest rates can actually be even more sensitive to the U.S. Federal Reserve funds rate than they are in countries that use currency boards or dollarization to tie their monetary fates rigidly to the United States, as do Argentina and Panama (Frankel, 1999, table 1.)

position of capital inflows, even if they have little effect on the total inflow and even if financial markets increasingly find ways around them. However, such controls should not be used permanently, nor should they, as many have suggested, play a continuous role that diminishes gradually as financial markets develop. Rather they should be used episodically, via a temporary activation at a specific stage in the boom-bust cycle. When instruments such as sterilized intervention and appreciation are not helping to control large short-term capital inflows and when it is still not clear whether the inflows are going to finance high-return investment, it may be appropriate to try a year or two of Chilean-style penalties as a way of playing for time. In this view, capital controls are a tool of short-term macroeconomic policy, not a structural solution. In making such recommendations, one must be wary of the danger that sanctioning capital controls will encourage their indiscriminate use, for example, by policymakers seeking protection from the international consequences of their own unsound policies.

Finally, Caballero favors contingent rules for fiscal policy, labor contracts, and the exchange rate. In the case of the exchange rate, he presumably has in mind an escape clause that specifies what kind of external event will trigger a devaluation. While he recognizes that such contingent rules must be simple and easily verifiable if they are to work, in my judgment this makes the proposal impractical in most cases. The idea behind contingent rules is to specify in advance that changes will be linked, in particular, to exogenous changes in the terms of trade. This would work in Chile, for example, with a bond issue indexed to the price of copper and in Mexico to the price of oil, and I am not sure why this long-standing proposal has met with so little successful implementation.<sup>3</sup> It would be an efficient means of risk sharing, and it would make private sector burden sharing automatic: in the event of a collapse in the terms of trade, the authorities would not encounter the usual excruciating difficulties of convincing bankers or bondholders to allow “voluntary” rollovers or stretch-outs.

Contingent rules are less practical, however, in the case of most other countries, where a single mineral commodity with an exogenously determined, easily verified price does not occupy such a large share of exports as it does in Chile. They are also less effective with regard to budget rules, labor contracts, and exchange rate regimes, since the typical player has a lower level of understanding of the issues than does a finance specialist.

3. For example, Lessard and Williamson (1985).

Even highly skilled economists cannot agree on whether the recent crises were caused by exogenous shifts in the terms of trade, domestic policy failure, or other factors. We cannot even agree on the causes after the fact, let alone in the heat of the moment. Was the 1982 international debt crisis caused, in part, by a fall in international commodity prices? Then why did it originate in Mexico, a commodity exporter? Was the 1997 East Asian crisis caused, in part, by a fall in international prices of semiconductors and other manufactured products? If so, what are the corresponding products that increased in relative price? I do not know the answer to these questions, and that is the point. If we don't know the answers, then contingent rules are not easily verifiable. There is never a single agreed-upon measure of the terms of trade. When the central bank devalues, it will always point to circumstances beyond its control, and many in the markets will always consider the devaluation a failure of the government's will to abide by its commitment. Moreover, every country that devalues, regardless of the cause, exhibits a deterioration in its terms of trade by most measures.

The author is on the right track: we need more research into what sorts of rules and contracts are verifiable by the person in the street. However, the act of writing down an exogenous disturbance term in a theoretical model does not mean that the model and disturbance are necessarily knowable and observable in the real world.

**Enrique G. Mendoza:** This interesting article by Ricardo Caballero should be read carefully by anyone interested in understanding the causes of the excess macroeconomic volatility of emerging markets in recent years, particularly in Latin America. The paper's main argument is that accounting for the high volatility displayed by emerging market economies requires a careful reexamination of the major distortions that result from the severe financial frictions affecting these economies.

In emphasizing the role of the financial sector, this paper adds to the growing body of research that emphasizes financial frictions and financial transmission channels in explaining modern capital markets crises of the kind inaugurated by the Mexican crash of 1994.<sup>1</sup> As one crisis after another repeated the same message over the last six years, the lesson was learned painfully that in the context of the global financial market created in the 1990s, these financial factors were the key causes of capital market

1. See Calvo and Mendoza (1996).

crises, instead of the traditional explanations of currency crises based on sticky prices or fiscal slippage. Several of the larger events through which this message was conveyed are easy to recall. Mexico, 1994: a managed exchange rate regime collapsed despite a fiscal surplus for the general government and under the weight of a massive run on short-term, dollar-denominated debt by international investors. Korea, 1997–98: in the aftermath of the financial crisis, export volumes fell for several months despite the massive devaluation of the won as Korea's trade credit lines were severely curtailed. Russia, 1998: the default on government bonds triggered a domino effect of massive margin calls through the world's financial system, causing the demise of the U.S. hedge fund Long-Term Capital Management and forcing U.S. monetary authorities to lower interest rates when domestic indicators suggested otherwise.

The framework that Caballero proposes for examining the role of financial frictions in generating macroeconomic volatility in Latin America was developed in previous joint work with Arvind Krishnamurthy.<sup>2</sup> In this important work, they take the discussion of financial frictions in emerging markets crises beyond the superficial debate of episodes and circumstances to formalize some of the key issues at hand. They make a major contribution to recent work that seeks to develop analytical frameworks for understanding financial transmission channels in the developing world and for deriving their policy implications.

The paper fits into a body of literature that can be traced back in spirit to Mackinnon's classic work on financial repression. Some early finance studies that deal with default risk in the context of sovereign borrowing, like the classic work of Eaton and Gersovitz, are early efforts at developing models of credit frictions for developing countries.<sup>3</sup> In the context of the emerging markets crises, Calvo was among the first to raise the red flag about the potentially devastating role that financial imbalances could play shortly before the Mexican crisis, in his comments to Dornbusch and Werner.<sup>4</sup> Over the last couple of years, several articles have addressed issues related to financial frictions and credit constraints similar to those Caballero examines.<sup>5</sup>

2. Caballero and Krishnamurthy (1999).

3. Eaton and Gersovitz (1981).

4. Calvo (1994); Dornbusch and Werner (1994).

5. See, for example, Paasche (1999); Schneider and Tornell (1999); Edison, Luangaram, and Miller (1998); Calvo (1999); Calvo and Mendoza (2000); Mendoza (2000).

The growing list of contributions to this literature reflects the fact that our understanding of the transmission mechanism of financial frictions in emerging markets is at a very early stage of development. These initial efforts have benefited enormously from recent developments in macroeconomics and finance dealing with financial and informational frictions.<sup>6</sup> In particular, Kiyotaki and Moore describe a framework that provides useful background to that of Caballero and Krishnamurthy.

The gaps in our understanding of the financial transmission mechanism in emerging markets have at least two important dimensions. The first relates to the incompleteness of the theory per se: different approaches can be used to explain how the frictions originate and how they influence the economy. There are models with margin requirements that are occasionally binding in the short run but nonbinding in the long run, models with permanently binding collateral constraints, models with occasionally binding participation constraints, and models with asymmetric or costly information. The second dimension relates to the scarce evidence on how the alternative modeling strategies fare when confronted with the data. Work still needs to be done to produce well-informed answers to questions concerning the fraction of the business-cycle regularities of a typical emerging market that can be accounted for by financial frictions, for example, or the social welfare losses associated with these frictions. Similarly, Caballero raises complex questions on the link between credit frictions and lack of credibility.

In the context of these gaps in knowledge, the paper seems overly optimistic on an issue that still requires substantial research. In particular, the article seems more confident than one can afford to be at this point on the connection between a specific financial transmission model and the data, and hence on the corresponding policy implications. The paper is also overly optimistic in its assessment of the economic conditions in Latin America. While the region has clearly made enormous progress in implementing economic reforms in the right direction, and these reforms are bearing fruit, it may be a bit early to make statements like, “The pieces of a successful Latin American economic model can be seen scattered among the leading economies of the region,” or “The most traditional macroeconomic maladies of the emerging world . . . are gradually being left behind.”

6. Kiyotaki and Moore (1997); Kehoe and Levine (1993); Aiyagari and Gertler (1999); Bernanke and Gertler (1995).

Although detailing my objections to these remarks is not the focus here, it is worth noting that at least one of the main macroeconomic maladies of Latin America has yet to be addressed: namely, the pervasive and growing income and wealth inequality. In this regard, the region has made little, if any, progress. Radical economic reform has yet to show its ability to help address this problem, and a serious revisionist trend in favor of the populism of the 1970s is emerging in some countries of the region in response to social and political frustration over the situation. (This is paradoxical, however: that wave of populism worsened distributional problems and caused most of the major macroeconomic imbalances that Latin America would so painfully have to address during the lost decade of the 1980s.)

One should resist being too optimistic about Latin America at present both because its history shows a pattern of so-called successful models that eventually collapsed and because the region still has major tasks ahead in developing and fortifying its economic and political institutions. A sense of complacency at this stage could prevent the completion of these tasks. Such was the case for former Mexican president José Lopes Portillo, who stated, just a few months before the 1982 crash, that “Mexicans should prepare to manage their opulence.”

### *The Caballero-Krishnamurthy Model*

The model that anchors Caballero’s paper can be interpreted as a variant of the Kiyotaki-Moore setup, which is modified to consider two layers of collateral constraints. First, foreigners limit their credit to intermediaries (that is, to the lucky individuals with assets or goods that are accepted as collateral in world financial markets) to a fraction  $\lambda^f$  of the discounted liquidation value of intermediaries’ assets. Second, intermediaries limit their credit to domestic distressed firms to the discounted liquidation value of the assets of these firms.

Suppose the collateral constraint binds for intermediaries. At the resulting supply of funds that intermediaries can offer distressed firms, if the collateral constraints of the latter are not binding, life is good and the domestic economy finances all desired projects. On the other hand, if the collateral constraints of distressed firms bind (that is, if the intermediaries’ supply of funds is short of the amount required to finance all profitable projects), then a fire sale of projects takes place until the value of the residual projects clears the domestic credit market.

In a neat twist, the authors also show that if the setup is enriched with even more imperfect domestic financial markets, such that distressed firms can secure credit from intermediaries only for a fraction  $\lambda^N$  of the discounted liquidation value of their assets, there is an externality that acts as a multiplier on the real effects of the credit friction. In particular, distressed firms use less credit, which reduces the expected returns on loans for the intermediaries and their investment in international collateral. Therefore, the collateral that intermediaries can offer to secure lending from abroad shrinks, triggering a negative externality on the supply of funds.

Paasche offers an interesting alternative for internationalizing the Kiyotaki-Moore setup.<sup>7</sup> His approach is particularly useful for understanding why the data may show contagion through a conventional mechanism such as terms-of-trade changes, although this may be occurring through a collateral-driven financial channel, rather than through a beggar-thy-neighbor effect. Paasche's model considers two satellite countries totally unrelated to each other, but both trading with a third country; it shows how a small productivity disturbance in one of the satellites can trigger an adverse terms-of-trade shock that tightens collateral constraints in the other satellite.

The features and predictions of Caballero's model bear close resemblance to features of the emerging markets crises of the 1990s. He argues that "While the scenario [of financial distress portrayed in the paper] can indeed represent a great source of uncertainty and volatility for a country, it is not clear that there is a role for policy." This statement ought to take into account some caveats, however. First, to date, models with collateral constraints have been used to derive interesting analytical results in highly stylized settings, but their quantitative implications are still largely unknown. Second, since collateral constraints originate in a credit market imperfection, the competitive equilibrium should be inefficient, and hence there would seem to be a role for policy at least in principle (even if at this level of generality it is unclear what kind of policy would improve welfare). Third, both Kiyotaki and Moore and Paasche explicitly lay out the strong assumptions needed for their models to function in a fully dynamic, general equilibrium setting, but this is less clear in the Caballero-

7. Paasche (1999).

Krishnamurthy model. Kiyotaki and Moore obtain as an equilibrium implication of their model that collateral constraints always bind. If this is also the case in Caballero's paper, the shift between binding and non-binding constraints, which is implicit in the fire sales shown in the article's graphs, is useful for explaining the model, but it is not observed at equilibrium (and hence its chances for explaining observed volatility are not very good). In augmenting volatility by means of financial frictions, it seems important to allow for the possibility that the economy can switch back and forth between states of nature in which credit frictions bind and those in which they do not.

These are difficult problems to deal with in dynamic, general equilibrium models because of the endogenous nature of the borrowing constraints resulting from financial frictions. In models with collateral constraints, debt is constrained not to exceed the expected liquidation value of assets, which depends on expected asset prices one period ahead in the future. In general equilibrium, asset prices are forward-looking objects that represent the discounted value of the future stream of dividends on the assets, but with binding credit constraints the discount rate itself is endogenous. The discount rate is the inverse of the exogenous world risk-free rate if the constraint does not bind, but it falls to an endogenously determined level when the constraint binds (since the effective interest rate is higher than the world interest rate). Seen from this perspective, the Kiyotaki-Moore model's features of perfect foresight with regard to equity prices and a collateral constraint that is always binding represent non-trivial simplifications.

In principle, it seems straightforward to enrich collateral constraint models by adding uncertainty, thus capturing the possibility of switches between binding and nonbinding constraints. In fact, the Kiyotaki-Moore model allows for idiosyncratic shocks at the level of each borrower that vanish in the determination of asset prices, but in this case the collateral constraint always binds. Considering instead aggregate uncertainty raises serious difficulties related to the specification of contingent claims markets and to the solution of a rational expectations equilibrium for asset prices.<sup>8</sup>

Despite the insightful analytical results from studies like those of Kiyotaki and Moore, Paasche, and Caballero and Krishnamurthy, the lack

8. See Kiyotaki and Moore (1997).

of an operational quantitative adaptation of the collateral constraints framework (particularly one in which credit constraints can switch from binding to nonbinding depending on the state of nature) makes it difficult to gauge how much more macroeconomic volatility results from this particular credit friction relative to others, and relative to the traditional sources of volatility documented in the paper. This limitation also hampers the ability of the models to address policy issues because the policies that would emerge are likely to be distortionary per se, which requires policymakers to conduct cost-benefit welfare comparisons of mixes of credit-friction-induced and policy-induced distortions in order to evaluate policy options.

Some of the issues discussed above can be further illustrated with a simple example developed by Mendoza.<sup>9</sup> The example sketches a dynamic, general equilibrium model of excess volatility of equity prices and international capital flows based on an open economy variant of Aiyagari and Gertler's closed economy model of margin requirements.<sup>10</sup>

Consider a small open economy in which a margin requirement limits the ability of domestic agents to leverage their positions in the equity of domestic firms. The small open economy faces aggregate uncertainty, and world markets of contingent claims are incomplete. The margin requirement is similar to a collateral constraint, except that it imposes a borrowing constraint determined by a fraction of the current liquidation value of assets, instead of the discounted expected value one period ahead. Domestic agents trade their equity with foreign securities firms that specialize in the equity of the small open economy, but informational or institutional disadvantages (relative to domestic agents) result in an adjustment cost to foreign securities firms when they alter their portfolios. If the stochastic stream of dividends is assumed to be exogenous to saving behavior, equity-price determination, and portfolio decisions (but not vice versa), some illustrative results follow. In particular, the model supports switches between states of nature with and without binding margin requirements in equilibrium. If the margin requirement is not binding, equity prices equal fundamentals prices, and portfolio positions are maintained. However, if the state of nature is such that the margin constraint binds, domestic agents unload their assets in a fire sale, and when they do

9. Mendoza (2000, appendix).

10. Aiyagari and Gertler (1999).

so they deal with foreign traders that are willing to purchase those assets but at a discount over the fundamentals price. The discount reflects the partial-adjustment nature of the foreign traders' portfolio decisions, which in turn is the result of the informational and institutional frictions they face. In the absence of these frictions, they would purchase the assets sold by domestic residents instantaneously and at an infinitesimal discount, and asset prices would remain at the level of the fundamentals price.

In the above example two ingredients (namely, the urge to participate in a fire sale, which is triggered by the margin requirements, and the downward-sloping asset demand curve of foreign traders, which is induced by informational frictions) are required for equilibrium equity prices to sink below fundamentals and cause excess volatility in prices and capital flows. Unfortunately, without imposing additional structure into the problem to allow the distortions from margin requirements and trading costs to have permanent effects, equity prices can only deviate from fundamentals in the short run. In the limiting distribution that represents the model's stochastic steady state, the credit friction is unlikely to have large effects.

Caballero's paper raises an interesting question regarding the potential connection between the credibility of economic policy, particularly monetary and exchange rate policy, and credit frictions. The framework of the small open economy just described can be altered to shed some light on how this connection might work.<sup>11</sup> Consider a small open economy without equity trading, but in which agents face a credit friction in the form of a liquidity requirement, according to which lenders require borrowers to finance a fraction of their current expenses and debt obligations out of current income and liquid asset holdings. (Think of this as the standard mortgage qualification guidelines mandated by the institutions that secure mortgage markets, like Fannie Mae and Freddie Mac in the United States.) Domestic money is a non-interest-bearing asset that is held for transactions purposes; it could enter directly in utility or as a means to economize transactions costs. The monetary policy environment is that of a noncredible, managed exchange rate regime, which could be described by a regime-switching, two-point asymmetric Markov chain in terms of the depreciation rate of the currency. In one state the managed exchange rate regime

11. See Mendoza (2000) for details.

continues; in the other it is replaced with a floating exchange rate regime in the form of a constant rate of depreciation of the currency (that is, perfect inflation targeting).

The competitive equilibrium of the economy described above is distorted by both the lack of credibility of the exchange rate regime, represented by the probability of switching to the floating exchange rate regime, and the shadow value of the liquidity requirement in the states of nature in which this requirement binds. With the appropriate specifications of preferences and technology, this model can be set up so that its quantitative implications can be examined using the same numerical methods applied in modern business cycle theory. When this is done calibrating the model to Mexican data, the combined distortions of lack of credibility and credit frictions entail large social costs in excess of 9 percent of the trend level of consumption per capita.<sup>12</sup> The effects of the credit friction on the economy's long-run business cycle are small, however. As in the case of the margin requirement, the liquidity requirement does not bind in the limiting distribution that describes the stochastic steady state of the economy, and hence real variables, except for the external accounts, display similar business cycle patterns as they would without a credit friction. If one considers economic fluctuations off the stochastic steady state, in contrast, the real effects are large. In particular, the negative effects of abandoning the managed exchange rate regime are significantly larger in the presence of credit frictions when the liquidity constraint switches from nonbinding to binding as the exchange rate regime collapses. In these cases, the model reproduces several of the features of the "sudden stops" phenomenon typical of recent capital markets crises, as defined by Calvo.<sup>13</sup>

Results like these suggest that the term *economic collapse* is better than *economic fluctuation* in referring to the real effects of credit frictions in the context of capital markets crises in the developing world. That is, the circumstances generating the big kick from credit frictions are not very common, such that measuring the effects of credit frictions using the moments of long samples of smoothly detrended data can be misleading. This view is consistent with the observation that in many of the recent

12. Mendoza (2000).

13. Calvo (1999).

crises in Asia and Latin America, sharp recessions were followed by quick recoveries (a phenomenon that Martin Wolf calls the Mexican Wave).<sup>14</sup>

### *Country Case Studies*

Caballero uses three country cases to document evidence in favor of the role of credit frictions. I now turn to two of these cases, namely, Mexico and Chile.

In the case of Mexico, the picture of the weak international financial links is somewhat less bleak than the paper argues. NAFTA and the integration of the financial system to global markets have played a key role in allowing the large industrial sector—which enjoys access to what Caballero calls international collateral—to grow rapidly and operate independently of the severe problems of the domestic financial system. Once past the convulsion of Mexico's 1994–95 crash, these industries weathered the emerging markets crises that followed almost without problems. Even when portfolio flows dried up (seemingly for good) in the aftermath of the Russian crisis, these industries continued to receive outside financing that switched to foreign direct investment (FDI). Total inflows into Mexico have remained large and stable since 1996, but the composition changed dramatically to mostly FDI.

Some of the most dramatic evidence on the interaction between capital flows, credit frictions, and asset prices in Latin America is not found in the stock market, as emphasized in Caballero's paper, but in the real estate market.<sup>15</sup> This factor clearly played an important role in the 1994 crash of the Mexican banking system. Mexican banks were already vulnerable in 1993.<sup>16</sup> This growing banking fragility reflected the fact that real estate prices peaked in late 1992 and began to decline in 1993, and thus decreasing prices caused the new credit-card-style mortgages (the so-called Mexican mortgages) to yield mortgage values in excess of property values. Banks had been aggressive and reckless in taking on credit risk. The paper's assertion that "banks had little expertise in the analysis of credit risk" is difficult to defend: these banks designed and pushed risky new loans like the Mexican mortgages, lowered down payments, and relaxed

14. Martin Wolf, editorial, *Financial Times*, 8 August 1999.

15. Guerra de Luna (1997, 1998) provides data that illustrate this relation dramatically, both in Latin America and elsewhere.

16. Calvo and Mendoza (1996).

credit conditions, well aware of the risk implicit in these actions. A moral hazard argument more clearly explains their behavior: the banks acted on implicit guarantees provided by the government, which were indeed executed throughout 1994 and with the conversion of non-performing loans into public debt through Fobaproa (Mexico's bank savings protection fund).<sup>17</sup>

With regard to Mexican exchange rate and monetary policy, the paper makes an excellent point in noting the difficulties that resulted from the chronic lack of credibility of Mexican monetary policy. However, the view that Mexico has a flexible exchange rate regime (in the pure textbook sense) can be called into question on the basis of Calvo and Reinhart's fear of floating.<sup>18</sup> Moreover, given the very high pass-through to domestic prices of changes in the exchange rate, as mentioned in the paper, it follows from the definition of the real exchange rate that a policy based on a seemingly floating exchange rate combined with inflation targeting can be made to work as a policy for targeting the rate of change of the real exchange rate.

Finally, some comments on Chile. Caballero deserves a lot of credit for taking the position that the evolution of Chile's terms of trade has played a key role in the performance of the Chilean economy. Calvo and Mendoza also take this position because like Caballero, we find it to be consistent with several features of the Chilean data.<sup>19</sup> Chilean economists have been surprisingly unwilling to consider the idea, but the evidence seems very strong. However, Caballero's work does lead to one important revision to the argument linking terms-of-trade shocks and economic activity: terms-of-trade shocks may have such marked effects on the Chilean economy because of important financial multiplier effects.<sup>20</sup>

The paper's statement that Chile is more financially developed than the other countries in Latin America deserves further clarification. In particular, a broad definition of financial development may not generate as favorable an outcome as when one considers only Chile's higher ratio of market capitalization to GDP. This indicator ignores some subtle differences between Chile and the other countries in the region. For example,

17. See Calvo and Mendoza (1996).

18. Calvo and Reinhart (2000).

19. Calvo and Mendoza (1999).

20. Paasche (1999) also supports this conclusion.

Chile's export base is far more specialized than Mexico's or Brazil's. Copper and minerals related to copper extraction still make up about half of Chile's exports, while Mexico's oil exports are less than 10 percent of total export revenue. If Mexico were still as specialized as Chile, it would not have experienced the smooth shift to financing via FDI and retained earnings of the export sector. Caballero's observation that Chile displays excess sensitivity to terms-of-trade shocks due to weak financial links suggests a similar point. Moreover, Chilean financial markets are far more illiquid and have much smaller turnover ratios than those in Argentina, Brazil, and Mexico.

Chilean financial markets also still feature the very large presence of tightly controlled institutional investors (namely, the private pension funds). Until very recently, these funds were only allowed to hold a very small amount of foreign securities, and even today their foreign holdings are only about 12 percent of their portfolios. They are also subject to strange regulations like the one requiring that the returns of each fund not deviate by more than a given margin from the average of all of them (which seems a recipe for herding behavior). In addition, the financial system retains distortions such as the existence of the large Banco del Estado and the quasi-fiscal deficit of the Central Bank on account of the bad loans purchased in the aftermath of the 1983 banking crisis.

The above comments are quite minor relative to the magnitude of the task at hand for Caballero's paper and the related literature. The integration of financial transmission mechanisms into the analysis of capital markets crises and the business cycle of emerging markets is a research program in its infancy, but its paramount relevance has already placed it as one of the central themes of international macroeconomics. In this context, this article provides critical first steps into exploring the interaction between credit frictions driven by collateral constraints and the sharp fluctuations in credit, international capital flows, and economic activity observed in the emerging markets crises of the 1990s.

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