AARON TORNELL
University of California, Los Angeles

FRANK WESTERMANN
CESifo, Munich

LORENZA MARTÍNEZ
Banco de México

Liberalization, Growth, and Financial Crises: Lessons from Mexico and the Developing World

BY NOW THERE is widespread agreement that trade liberalization enhances growth. No such agreement exists, however, on the growth-enhancing effects of financial liberalization, in large part because it is associated with risky capital flows, lending booms, and crises. The Mexican experience is often considered a prime example of what can go wrong with liberalization. Mexico liberalized its trade and finance and entered the North American Free Trade Agreement (NAFTA), yet despite these reforms, Mexico's growth performance has been unremarkable in comparison with that of its peers. A particularly worrisome development is that, since 2000, there has been a slowdown in Mexico's exports.

That financial liberalization is bad for growth because it leads to crises is the wrong lesson to draw. Our empirical analysis shows that, in countries with severe credit market imperfections, financial liberalization leads to more rapid growth, but also to a higher incidence of crises. In fact, most of the fastest-growing countries of the developing world have

We would like to thank Pedro Aspe, Sascha Becker, Pierre Gourinchas, Gordon Hanson, Graciela Kaminski, Timothy Kehoe, Aart Kraay, Anne Krueger, Norman Loayza, Romain Ranciere, Luís Servén, Sergio Schmukler, Carolyn Sissoko, and Alejandro Werner for helpful discussions. For providing data we thank Josúe Campos, Jaime de la Llata, Gerardo Leyva, and Arturo López at the National Institute of Statistics, Geography, and Informatics of Mexico (INEGI), and Alfonso Guerra and Jessica Serrano at the Banco de México. Miguel Díaz, Pedro J. Martínez, Juan P. Medina, Paulina Oliva, and Roberto Romero provided excellent research assistance.

experienced boom-bust cycles. We argue that liberalization leads to faster growth because it eases financial constraints, but that this occurs only if agents take on credit risk, which makes the economy fragile and prone to crisis. An implication of our analysis is that the international bank flows that follow financial liberalization and increase financial fragility are an important component of a rapid-growth path.

We also find that asymmetries between the tradables (T) and nontradables (N) sectors are key to understanding the links among liberalization and growth, boom-bust cycles, and the Mexican experience. Asymmetric sectoral responses to liberalization and crisis are the norm.

At first glance, the experience of Mexico, a prominent liberalizer, challenges the argument that liberalization promotes growth. However, when we compare Mexico against an international norm, we find that the growth in Mexico's exports during the 1990s was outstanding. We also find that, although its pattern of boom and crisis is similar to that of the average liberalizing country, Mexico's credit crunch in the wake of its crisis has been atypically severe and long-lasting. This credit crunch, together with a lack of structural reform since 1995, has resulted in stagnation of the N-sector, generating bottlenecks that have contributed to Mexico's less-than-stellar growth performance and to the more recent fall in exports.

To document these points, we analyze the empirical relationship among liberalization, crises, and growth across the set of countries with active financial markets, and we characterize the typical boom-bust cycle. To substantiate our interpretation of the data and to explain the Mexican experience, we present a model that establishes a causal link from liberalization to growth, and in which the same forces that lead to faster growth also generate financial fragility. The model leads us to divide our data set into countries with high and intermediate degrees of contract enforceability (which we call high-enforceability and medium-enforceability countries, or HECs and MECs, respectively).

Our data analysis shows that, across MECs, trade liberalization has typically been followed by financial liberalization, which has led to financial fragility and to occasional crises. On average, however, both trade liberalization and financial liberalization have led to more rapid long-run growth in GDP per capita across the set of countries with active financial markets. Furthermore, we find that this positive link is not generated by a few fast-growing countries that experienced no crisis. Instead, it is typi-

cally the fastest-growing countries that have experienced crises. This suggests that the same mechanism that links liberalization with growth in MECs also generates, as a by-product, financial fragility and occasional crises.

These facts do not contradict the negative link between growth and the *variance* of several macroeconomic variables—the typical measure of volatility in the literature. A high variance reflects not only the uneven progress, or "bumpiness," associated with occasional crises, but also high-frequency shocks. Instead we measure the incidence of occasional crises by the (negative) *skewness* of real credit growth. Our findings show that fast-growing MECs tend to have negatively skewed credit growth paths.

Our explanation for the links among liberalization, bumpiness, and growth is based on the fact that countries like Mexico have severe contract enforceability problems. Because liberalization has not been accompanied by judicial reform, these problems have persisted. The key point is that these problems affect firms asymmetrically: whereas many T-sector firms can overcome these problems by accessing international capital markets, most N-sector firms cannot. Thus N-sector firms are financially constrained and depend on domestic bank credit. Using microlevel data from the Mexican economic census and from firms listed on the stock market, we document this asymmetry for the case of Mexico.

Trade liberalization increases GDP growth by promoting T-sector productivity. Financial liberalization adds even more to GDP growth by accelerating financial deepening and thus increasing the investment of financially constrained firms, most of which are in the N-sector. However, the easing of financial constraints is associated with the undertaking of credit risk, which often takes the form of foreign currency–denominated debt backed by N-sector output. Credit risk arises because financial liberalization not only lifts restrictions that preclude risk taking, but also is associated with explicit and implicit systemic bailout guarantees that cover creditors against systemic crises.[1] Not surprisingly, an important share of capital inflows takes the form of risky bank flows, and the economy as a whole experiences aggregate fragility and occasional crises.

1. We distinguish two types of bailout guarantees: unconditional and systemic. The former are granted whenever an individual borrower defaults, whereas the latter are granted only if a critical mass of borrowers default. Throughout this paper we focus on systemic guarantees.

Rapid N-sector growth helps the T-sector grow faster by providing abundant and cheap inputs. Thus, as long as a crisis does not occur, growth in a risky economy is more rapid than in a safe one. Of course, financial fragility implies that a self-fulfilling crisis may occur. And, during a crisis, GDP growth falls and typically turns negative. Crises must be rare, however, in order to occur in equilibrium—otherwise agents would not find it profitable to take on credit risk in the first place. Thus average long-run growth may be faster along a risky path than along a safe one. Our model follows this intuition to establish a causal link from liberalization to GDP growth. This link is independent of the nominal exchange rate regime.

The argument imposes restrictions on the behavior of credit and of the N-to-T output ratio that help us identify the mechanism. First, credit growth and the N-to-T output ratio should fall drastically in the wake of a crisis, and because crises are infrequent, they should exhibit a negatively skewed distribution. Second, during normal times the N-to-T output ratio should vary with credit. Finally, the N-to-T output ratio should decrease following trade liberalization and increase following financial liberalization. We show that the bumpiness of credit growth and these asymmetric sectoral responses are indeed an empirical regularity across MECs. We are not aware of other theoretical arguments that relate the N-to-T output ratio to liberalization, growth, and crises and that explain the empirical regularities we have found.

As we noted previously, relative to its initial GDP, Mexico's growth has been decent but not stellar. However, when we control for bumpiness, Mexico is an underperformer. Even in the period since liberalization, the Mexican economy has grown 2 percentage points less per year than the average for other countries with comparably risky paths. When we compare Mexico's boom-bust cycle with that of the typical MEC, we find that Mexico's boom phase and subsequent crisis are typical; it is Mexico's response to the crisis that is the outlier. Relative to the typical MEC, Mexico's credit crunch was both more severe and more protracted. The credit-to-GDP ratio in Mexico fell from 49 percent in 1994 to 18 percent in 2002.

This severe credit crunch is in contrast to the fast recovery of GDP growth in the wake of the tequila crisis of 1994–95. GDP growth can mask a sharp sectoral asymmetry between an impressive increase in exports and a lagging N-sector. The N-to-T output ratio fell about five times as much in Mexico as in the average MEC. Microlevel data reveal

that the prolonged postcrisis credit crunch mainly affected the N-sector, whereas the T-sector received a large share of foreign direct investment (FDI) and was insulated from the credit crunch because it could access international financial markets and shift away from domestic bank credit. Over the past eight years, tight domestic credit has limited investment and growth in the financially constrained N-sector, with the result that it is the T-sector, in large part, that has enjoyed the beneficial effects of liberalization and NAFTA.

Mexico's persistent credit crunch is puzzling. It cannot be explained by a fall in loanable funds: deposits have grown in parallel with GDP, and a large share of the banking system (88 percent by 2001) has been sold to foreigners. What accounts, then, for the credit crunch? Evidence suggests that the fall in credit has been associated both with a sharp deterioration in contract enforceability and with the policy response to the problem of nonperforming bank loans.

Since 2001 Mexican exports and GDP have stopped growing. The empirical evidence indicates that the U.S. recession can account for part of this slowdown, but not all of it. Our conceptual framework points out some internal factors that can help us account for this residual: fire sales and the bottleneck effect. In our model, access to international financial markets combined with a real depreciation allows the T-sector to buy inputs at fire-sale prices and thus to grow rapidly in the wake of the crisis. However, this rosy scenario cannot go on forever. Lack of credit and of structural reform depresses N-sector investment, and the resulting decline in N-sector output generates bottlenecks that eventually block T-sector growth. Does this prediction of the model apply to Mexico? Sectoral evidence shows that the subsectors where exports have declined the most are those that use N-sector inputs most intensively. Given the lackluster performance of the N-sector, this suggests that bottlenecks are contributing to the slowdown.

Consider next the question of the structure of capital flows. Although several observers have advocated limiting bank flows and promoting FDI as a way to reduce financial fragility, our framework makes it clear that limiting bank flows may hinder growth. We document that the lion's share of FDI goes to the T-sector or to financial institutions and, moreover, that the small share that goes to the N-sector is allocated to very large firms. Thus most of the inflows that end up in the N-sector are intermediated by domestic banks. In countries with severe contract

enforcement problems, a policy that limits bank flows constrains the N-sector at best, and at worst prevents it from growing for years. Thus FDI is not a substitute for risky bank flows.

The findings of this paper do not imply that crises are a good thing. They are the price that must be paid to attain rapid growth in the presence of contract enforceability problems. The first-best policy is to improve domestic credit markets by implementing judicial reform. If this is not feasible, liberalization will likely lead to financial fragility, as risky bank flows become the only source of finance for a large group of firms. Such flows are necessary to avoid bottlenecks and ensure long-run growth.

The Mexican experience shows that long-run growth cannot be based solely on export growth. Because the T-sector depends on N-sector inputs, the N-sector must also grow in order for the economy to attain a balanced and sustainable growth path. This requires adequate financing for domestically oriented firms. In the wake of a crisis, the economy can attain spectacular export growth for a few years through a real depreciation and the T-sector's use of inexpensive N-sector inputs. However, low N-sector investment eventually generates bottlenecks, which block further growth.

The link between liberalization and growth has generated controversy, because some researchers have found no significant positive link between the two. This finding might be due either to the country sample being considered or to the use of openness indicators. The model we present shows that the asymmetric sectoral responses and the links among liberalization, bumpiness, and growth arise only if contract enforceability problems are severe without being *too* severe. This underlies the importance of the country sample one considers and leads us to focus on the set of countries with functioning financial markets. In order to analyze the effects of liberalization, we construct de facto indexes of trade and financial liberalization that distinguish the year of liberalization. This allows us to compare the behavior of several macroeconomic variables in both closed and open country-years.

The paper is structured as follows. The next two sections analyze the links among liberalization, bumpiness, and growth. The third section analyzes Mexico's performance. The fourth analyzes the structure of capital flows. The final section presents some economic policy lessons and concludes. Appendixes to the paper describe our model and the construction of our variables.

The Effects of Liberalization

In this section we analyze empirically the links among liberalization, financial fragility, and growth across the set of countries with functioning financial markets. The mechanism described in the introduction operates only in countries with a basic level of contract enforcement that permits agents to attain high enough leverage and reap the benefits of liberalization. Thus we restrict our data set to countries where the ratio of stock market turnover to GDP was greater than 1 percent in 1998. This set consists of sixty-six countries, fifty-two of which have data available for the period 1980–99. Throughout the paper we partition this set into seventeen HECs and thirty-five MECs. The former group includes the Group of Seven large industrial countries and those countries in which the rule of law index of Daniel Kaufmann, Aart Kraay, and Pablo Zoido-Lobaton is greater than 1.4.[2]

To assess the effects of liberalization, we analyze several macroeconomic variables before and after dates of liberalization. To do this, we construct two de facto indexes that signal the year during which an MEC switches from closed to open. The trade liberalization index signals that a country is open if its ratio of trade (exports plus imports) to GDP exhibits a trend break or is greater than 30 percent. The financial liberalization index signals an opening when the series of cumulative capital inflows experiences a trend break or if they exceed 10 percent of GDP. The idea is that a large change in a measure of openness indicates that a policy reform has taken place and that the reform has had a significant effect on actual flows.

As explained in more detail in appendix B, we identify the breakpoints using the cumulative sum of residuals (CUSUM) method. In most cases the opening dates identified by our indexes are similar to those identified

2. Kaufmann, Kraay, and Zoido-Lobaton (1999). The HECs are Australia, Austria, Canada, Denmark, Finland, France, Germany, Italy, Japan, Luxembourg, the Netherlands, New Zealand, Norway, Sweden, Switzerland, the United Kingdom, and the United States. The MECs are Argentina, Bangladesh, Belgium, Brazil, Chile, China, Colombia, Ecuador, Egypt, Greece, Hong Kong, Hungary, India, Indonesia, Ireland, Israel, Jordan, Korea, Malaysia, Mexico, Morocco, Pakistan, Peru, Philippines, Poland, Portugal, South Africa, Spain, Sri Lanka, Thailand, Tunisia, Turkey, Uruguay, Venezuela, and Zimbabwe. The sample includes forty-one of the forty-four countries in the International Finance Corporation's emerging markets database, the exceptions being Costa Rica, Jamaica, and Singapore. Of these, the first two do not satisfy the 1 percent stock market turnover criterion, and for Singapore we do not have data.

by the stock market liberalization index of Geert Bekaert, Campbell Harvey, and Christian Lundblad, the financial liberalization index of Graciela Kaminski and Sergio Schmukler, and the trade liberalization index of Jeffrey Sachs and Andrew Warner.[3]

The country-years identified as liberalized by our indexes do not always coincide with good economic times, during which capital is flowing in and the economy is booming. Liberalized country-years include both boom and bust episodes.

All the HECs in our sample have been open since 1980, which is the beginning of our sample period. Figure 1 exhibits the shares of MECs in our sample that have become open to trade and financial flows. It shows that in 1980 only 25 percent of these countries were open to trade. Most of these countries started to liberalize in the mid-1980s, and 84 percent had liberalized their trade by 1999.

Several observers have suggested that, to avoid volatility, countries should liberalize trade but not financial flows. Our first stylized fact indicates that this has typically not occurred.

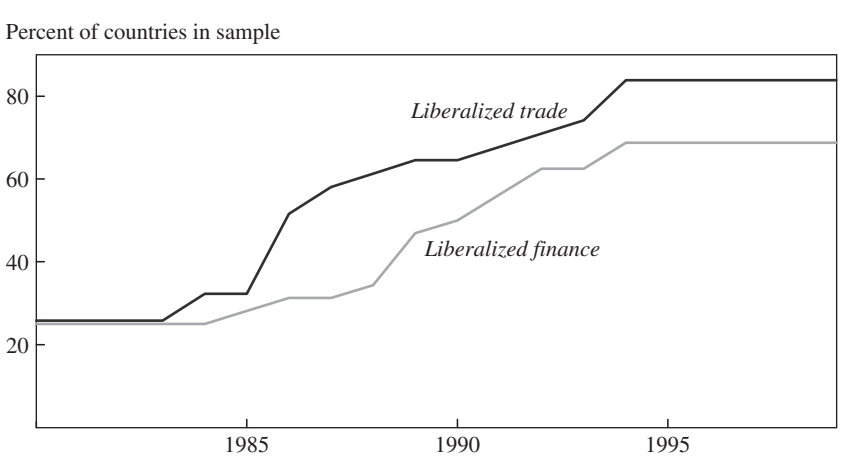
Stylized fact 1. *Over the last two decades trade liberalization has typically been followed by financial liberalization.*

Our indexes show that, by 1999, 72 percent of countries that had liberalized trade had also liberalized financial flows, bringing the share of MECs that are financially liberalized from 25 percent in 1980 to 69 percent. This close association suggests that an open trade regime is usually sustained with an open financial regime, because exporters and importers need access to international financial markets. Since capital is fungible, it is difficult to insulate the financial flows associated with trade transactions. A few exceptions such as India, Sri Lanka, and Venezuela have liberalized trade but have not liberalized their financial markets.

The hypothesis that trade liberalization leads to financial liberalization can be tested with Granger causality tests. The null hypothesis that trade

3. Bekaert, Harvey, and Lundblad (2001); Kaminski and Schmukler (2002); Sachs and Warner (1995). Bekaert, Harvey, and Lundblad focus on stock market liberalization, which, although highly correlated with, is distinct from financial or capital account liberalization. Listed firms are a privileged set. Stock market liberalization gives them even more opportunities but does not by itself relax the credit constraints on all other firms. Our argument is that financial liberalization promotes growth because it eases the borrowing constraints faced by the latter set of firms. Kaminski and Schmukler's (2002) index of financial liberalization covers only a small subset of countries.

Figure 1. Countries with Liberalized Trade and Financial Flows, 1980–99[a]



Source: Authors' calculations.
a. Sample consists of thirty-four countries with medium contract enforceability.

liberalization does not lead to financial liberalization is rejected, with an F statistic of 3.671, which corresponds to a p value of 0.05. By contrast, the null hypothesis that financial liberalization does not lead to trade liberalization cannot be rejected, with an F statistic of only 0.018, which corresponds to a p value of 0.98.

Liberalization and GDP Growth

Here we show that, across the set of countries with functioning financial markets, both trade and financial liberalization have been, on average, good for growth. This result confirms similar links established in the literature. In the next two subsections we address the point, made by several observers, that liberalization might not be growth enhancing because it leads to crises. We will show that, indeed, financial liberalization has typically been followed by booms and busts, but also that financial fragility has been associated with faster GDP growth in spite of the fact that it leads to crises.

In this section we will not say anything about causality. Appendix A presents a model that shows that, in the presence of credit market imperfections, liberalization leads to faster growth because it allows financially constrained firms to undertake credit risk, which both eases borrowing

constraints and generates financial fragility, leading to occasional crises. The model establishes a causal link from liberalization to growth and has testable implications, which we will use to identify the mechanism in the next section.

Figure 2 shows that financial liberalization is associated with faster GDP growth. The figure depicts GDP growth rates in MECs before and after financial liberalization, after controlling for initial income per capita and population growth.[4] This simple graphical representation reveals two patterns: first, growth is on average more rapid in open country episodes than in closed;[5] second, in almost every country the open episode exhibits more rapid growth than the closed episode.[6]

In order to assess the link between liberalization and growth, we add our liberalization variables to a standard growth regression:

$$\Delta y_{it} = \lambda y_{i,\text{ini}} + \gamma X_{it} + \phi_1 TL_{it} + \phi_2 FL_{it} + \varepsilon_{jt} \quad (1)$$

where Δy_{it} is the average growth rate of GDP per capita; $y_{i,\text{ini}}$ is the initial level of GDP per capita; X_{it} is a vector of control variables that includes initial human capital, the average population growth rate, and life expectancy; and TL_{it} and FL_{it} are our trade and financial liberalization indicators, respectively. We do not include investment among the control variables, because we expect trade and financial liberalization to affect GDP growth through higher investment.

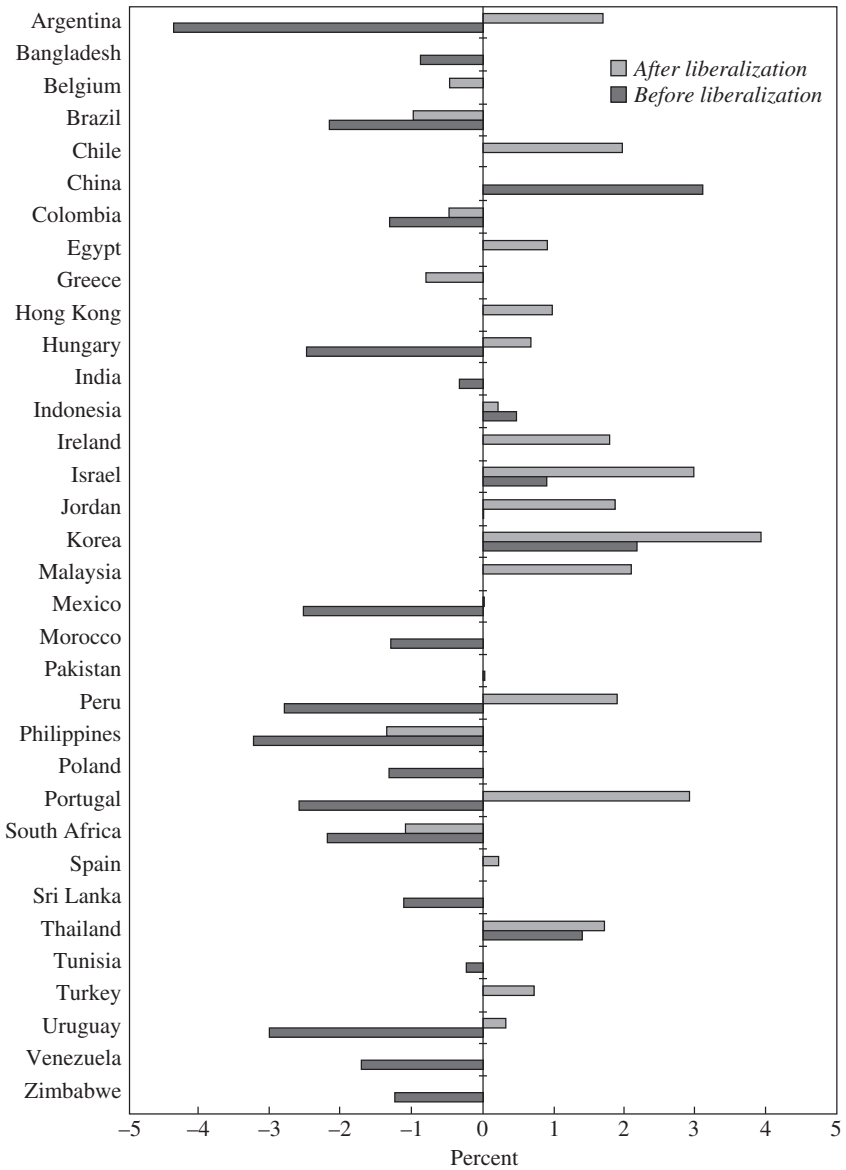
We estimate the regression in three different ways. First, we estimate a standard cross-sectional regression by ordinary least squares. In this case 1980 is the initial year. TL_{it} and FL_{it} take values between 0 and 1, specifying the share of years that the country was liberalized during our sample period $\{0, 0.05, 0.1, \ldots, 1\}$. Second, we estimate a panel regression using two nonoverlapping windows of time: 1980–89 and 1990–99. Here the liberalization variables again take a value between 0 and 1 during each

4. Only one growth rate is shown for countries that were open or closed throughout the period. Country episodes of less than five years are excluded.

5. Exceptions are China, which performed better than predicted in spite of being closed, and Greece, which is an underperforming open economy.

6. Here an exception is Indonesia, which grew marginally less rapidly during the open period. However, given Indonesia's major crisis in the postliberalization period, the fact that it recorded a growth rate above the predicted value in the second period is still remarkable. Note that even in cases (such as Brazil and the Philippines) where the growth rate is less than predicted, the gap between the actual and the predicted value is smaller in the open period.

Figure 2. Estimated Annual Growth Rate of GDP per Capita before and after Financial Liberalization, 1980–99[a]



Sources: World Bank, World Development Indicators; International Monetary Fund, International Financial Statistics.

a. The country episodes are constructed using windows of different lengths for each country. Country episodes shorter than five years are excluded. Averaging over these periods, a simple growth regression is estimated by ordinary least squares in which real GDP growth per capita is the dependent variable and the country's initial income and population growth are the only independent variables. The figure plots the residuals from this regression.

subperiod. Last, we use overlapping time windows. For each country and each variable, we construct ten-year averages starting with the period 1980–89 and rolling forward to the period 1990–99. Thus each country has up to ten data points in the time-series dimension. In this case the liberalization variables take values in the interval [0,1], depending on the proportion of liberalized years in a given window. We estimate the panel regressions using generalized least squares. We deal with the resulting autocorrelation in the residuals by adjusting the standard errors according to the method of Whitney Newey and Kenneth West.[7]

Table 1 reports the estimation results. The financial liberalization variable enters significantly at the 5 percent level in all regressions in which it appears. The cross-sectional regression (column 1-1) shows that, following financial liberalization, growth in GDP per capita increases by 2.4 percentage points a year, after controlling for the standard variables. The corresponding estimates are 1.7 percentage points in the nonoverlapping panel regression (column 1-2) and 2.5 percentage points in the overlapping-windows regression (column 1-3). The last regression is similar to those estimated by Bekaert, Harvey, and Lundblad using stock market liberalization dates. They find that GDP growth increases in the range of 0.4 to 1.5 percentage points.

Column 1-4 in table 1 shows that, following trade liberalization, GDP growth increases 1.8 percentage points a year. This estimate is similar to the 2-percentage-point increase found by Jeffrey Sachs and Andrew Warner.[8] Notice that the increase in GDP growth is greater following financial liberalization than following trade liberalization. Moreover, column 1-5 shows that when we include both variables in the growth regression, the marginal effect of trade liberalization falls to 1.6 percentage points, whereas that of financial liberalization increases (to 2.8 percentage points). These findings suggest that financial liberalization has growth-enhancing effects, in addition to the productivity gains from trade liberalization. The effect of financial liberalization will be the focus of the model we present in appendix A. Finally, column 1-6 shows that the positive link between liberalization and growth is also evident in the larger sample that includes HECs as well as MECs.

7. Newey and West (1987). Our panel is unbalanced because not all series are available for all periods. Our source of data is the World Development Indicators of the World Bank. See appendix B for the specific sources.

8. Sachs and Warner (1995).

Table 1. Regressions Explaining Growth in GDP per Capita with Trade and Financial Liberalization[a]

Independent variable	*1-1*[b]	*1-2*[c]	*1-3*[d]	*1-4*[d]	*1-5*[d]	*1-6*[e]
Financial liberalization	2.363** (0.533)	1.691** (0.603)	2.502** (0.101)		2.777** (0.115)	2.278** (0.172)
Trade liberalization				1.784** (0.155)	1.606** (0.105)	0.147** (0.021)
Summary statistics:						
Adjusted R^2[f]	0.546	0.633	0.692	0.544	0.747	0.802
No. of observations	34	59	290	300	280	440

Source: Authors' regressions.

a. The estimated equation is equation 1 in the text; the dependent variable is the average annual growth rate of real GDP per capita. Control variables include initial income per capita, secondary schooling, population growth, and life expectancy. Standard errors are reported in parentheses and are adjusted for heteroskedasticity according to Newey and West (1987). ** indicates significance at the 5 percent level.

b. Standard cross-sectional regression estimated by ordinary least squares for the period 1980–99.

c. Nonoverlapping panel regression estimated by generalized least squares (GLS) with two periods, 1980–89 and 1990–99.

d. Overlapping panel regression estimated by GLS with data as ten-year averages starting with 1980–89 and rolling forward to 1990–99.

e. Same as column 1-5 but with the addition of high-enforceability countries.

f. The adjusted R^2 is likely to overestimate the share of the variance explained by our right-hand-side variables because of the overlapping nature of the regression. No method comparable to that of Newey and West for the standard errors exists for adjusting the R^2, and therefore the values need to be interpreted carefully.

To deal with the possible endogeneity of the liberalization variables, table B3 in appendix B reports estimation results from two-stage least squares regressions using as instruments the legal origin index of Rafael La Porta and others,[9] as well as lagged values of all the variables in the regression. The table also reports results of regressions with fixed effects and of regressions excluding China and Ireland, which may be driven by other factors. Our benchmark results in the first three columns are robust to these different estimation methods.

The following stylized fact summarizes our findings.

Stylized fact 2. *Over the period 1980–99, both trade liberalization and financial liberalization are associated with more rapid growth in GDP per capita across the set of countries with functioning financial markets.*

The existing literature provides mixed evidence on whether openness promotes long-run growth.[10] This can be attributed either to the indicators

9. La Porta and others (1999).

10. See, for instance, Bekaert, Harvey, and Lundblad (2001), Chari and Henry (2002), Dollar and Kraay (2003), Edison and others (2002), Edwards (1998), Frankel and Romer (1999), Gourinchas and Jeanne (2003), Prasad and others (2003).

of openness used or to the sample considered. We find a statistically significant link for two reasons. First, we identify liberalization *dates* that allow us to compare performance during liberalized country-years with that during nonliberalized ones. Second, we restrict our analysis to the set of countries that have functioning financial markets, because only in these countries do we expect our mechanism to work.

In contrast, many papers that do not find a significant link use de jure liberalization indexes or de facto indexes that do not identify liberalization dates. However, the de jure indexes currently available for a large set of countries do not accurately reflect countries' de facto access to international financial markets. A country that has liberalized de jure may not implement the new policy for many years or may simply lack access to international financial markets despite having liberalized. For example, some African countries are de jure more financially liberalized than most Latin American countries yet have much smaller international financial flows. Several de facto "openness indexes" measure the size of some capital flow categories over the sample period. But because these openness indexes do not identify a specific year of liberalization, they are not appropriate for comparing the behavior of macroeconomic variables before and after liberalization.

Liberalization and Financial Fragility

We have shown that both trade and financial liberalization are associated with faster long-run growth across countries with functioning financial markets. Financial liberalization has often been criticized on the grounds that it leads to crises, which are bad for growth. This argument is neither empirically nor conceptually correct: that financial liberalization leads to infrequent crises does not mean that financial liberalization is bad for growth over the long run. We will show that financial liberalization does indeed lead to a greater incidence of crisis. Then we will show that the average positive link between liberalization and growth documented above *is not* driven by those rapid-growth countries that have had no crises. Instead, countries that grow faster tend to have crises. That is, there is a strong statistical link between the incidence of crises and long-run growth. This finding does not imply that crises are good for (or cause) growth.

The model we present in the appendix will show that, in the presence of severe credit market imperfections, the forces that generate financial deepening and growth also generate—as a by-product—financial fragility. Because financial liberalization generates both financial deepening and crises, any analysis of the effects of financial liberalization must weigh its benefits against its costs. In short, it would be a mistake to reject financial liberalization by focusing only on its costs and its tendency to lead to crises.

To address systematically the issues discussed above, we need a measure of financial fragility. Unfortunately, no existing indexes of financial fragility are comparable across countries. In keeping with the spirit of this paper, we use instead a de facto measure of fragility: negative skewness of credit growth. That is, we capture the existence of fragility by one of its symptoms: infrequent, sharp, and abrupt falls in credit growth. These abrupt falls occur during the banking crises that are characteristic of the boom-bust cycles that typically follow financial liberalization. During the boom, bank credit expands very rapidly and excessive credit risk is undertaken. As a result, the economy becomes financially fragile and prone to crisis. Although the likelihood that a lending boom will crash in a given year is low, many lending booms do eventually end in a crisis.[11] During such a crisis, new credit falls abruptly and recuperates only gradually.

It follows that a country that experiences a boom-bust cycle exhibits rapid credit growth during the boom, a sharp and abrupt fall during the crisis, and slow credit growth during the credit crunch that develops in the wake of the crisis. Since credit does not jump during the boom, and crises happen only occasionally, in financially fragile countries the distribution of credit growth rates is characterized by negative outliers. In statistical terms, countries that experience boom-bust cycles exhibit a *negatively skewed* distribution of credit growth. In plain language, the path of credit growth is "bumpy."[12]

11. On the link between lending booms and crises, see Gourinchas, Landerretche, and Valdés (2001), Kaminski and Reinhart (1999), Sachs, Tornell, and Velasco (1996a), and Tornell and Westermann (2002). See Bordo and Eichengreen (2002) for a historical perspective.

12. During a lending boom a country experiences positive growth rates that are above normal. However, these are not positive outliers because the lending boom takes place for several years, and so most of the distribution is centered around a very high mean. Only a

If we had infinite data series, the financial liberalization index would be an ideal measure of financial fragility. But in a finite sample the index may overlook some cases of fragility that do not—yet—reflect bumpiness. Because most MECs that have followed risky credit paths experienced at least one major crisis during our sample period (1980–99), we find that negative skewness of credit growth is a good indicator of the riskiness of the credit path followed by a given country.

Figure 3 depicts the kernel distributions of credit growth rates for India, Mexico, and Thailand.[13] Credit growth in India, a typical example of a nonliberalized country, has a low mean, and the data are quite tightly distributed around the mean, with skewness close to zero. Meanwhile credit growth in Thailand, a prime example of a liberalized economy, has a very asymmetric distribution and is characterized by negative skewness. Mexico, like Thailand, has a very asymmetric distribution, and its mean is closer to that of Thailand than to that of India.

Table 2 shows that the link between financial liberalization and bumpiness holds more generally across MECs. The table partitions country-years into two groups: years before financial liberalization and years after. The table shows that financial liberalization leads to an increase in the mean of credit growth of 4 percentage points (from 3.8 percent to 7.8 percent) and a fall in the skewness of credit growth from near zero to –1.08, and has only a negligible effect on the variance of credit growth. This illustrates the following stylized fact.

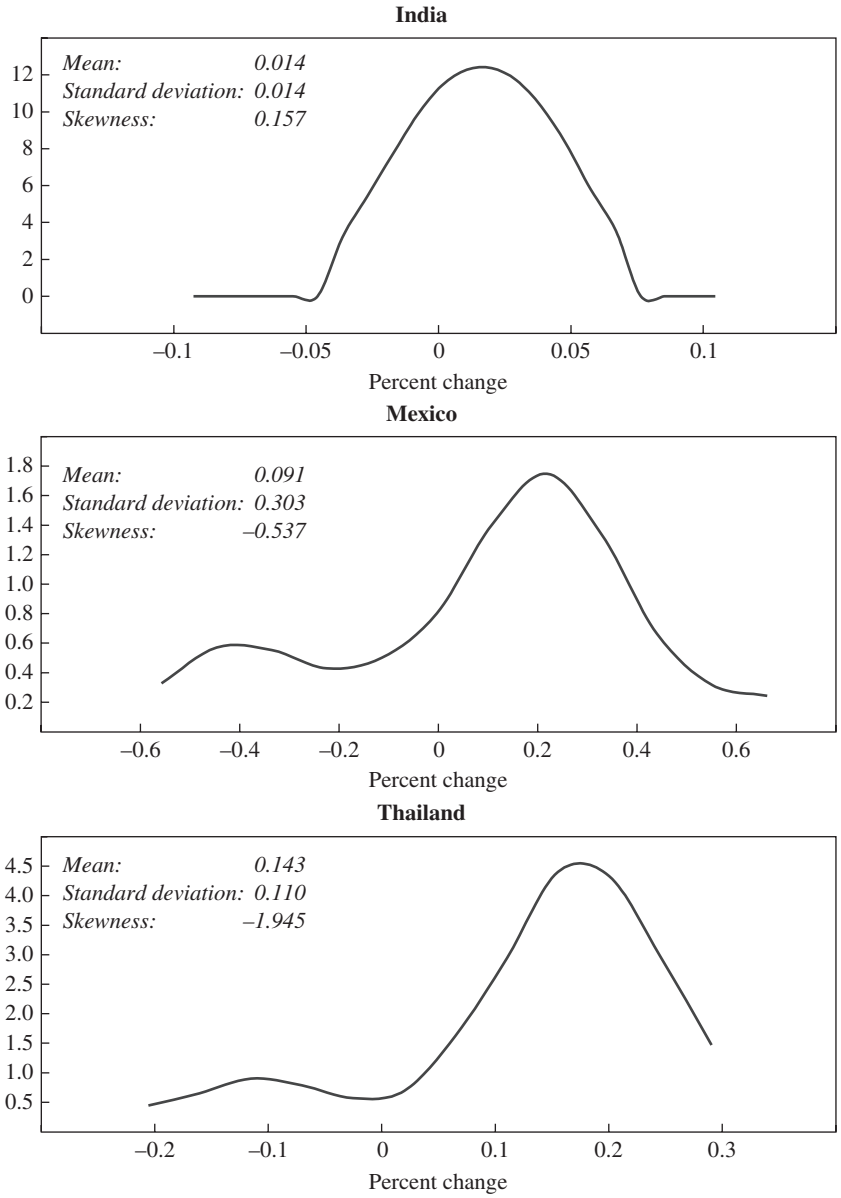
Stylized fact 3. *Across MECs financial liberalization has been followed by financial deepening. This process, however, has not been smooth but is characterized by booms and occasional busts.*

---

positive one-period jump in credit would create a positive outlier in growth rates and generate positive skewness. For instance, the increase in capital inflows that takes place when a country liberalizes might generate such positive skewness.

13. The simplest nonparametric density estimate of a distribution of a series is the histogram. A histogram, however, is sensitive to the choice of origin and is not continuous. We therefore choose the more illustrative kernel density estimator, which smoothes the bumps in the histogram (see Silverman, 1986). Smoothing is done by putting less weight on observations that are further from the point being evaluated. The kernel function by Epanechnikov is given by $(3/4)[1 - (\Delta B)^2]I(|\Delta B| \leq 1)$, where ΔB is the growth rate of real credit and I is an indicator function, which takes the value of 1 if $|\Delta B| \leq 1$ and zero otherwise.

Figure 3. Distribution of Credit Growth in India, Mexico, and Thailand, 1988–99[a]



Source: Authors' calculations using data from World Bank, World Development Indicators.
a. Epanechnikov $h = 0.1$ for Thailand, $h = 0.2$ for Mexico, and $h = 0.05$ for India.

Table 2. Moments of Credit Growth before and after Financial Liberalization[a]

Moment	*Liberalized country-years*	*Nonliberalized country-years*
MECs		
Mean	0.078	0.038
Standard deviation	0.151	0.170
Skewness	–1.086	0.165
HECs		
Mean	0.025	…[b]
Standard deviation	0.045	…
Skewness	0.497	…

Source: Authors' calculations.

a. The sample is partitioned into two country-year groups: liberalized and nonliberalized. Before the standard deviation and skewness are calculated, the means are removed from the series and data errors for Belgium, New Zealand, and the United Kingdom are corrected for.

b. High contract enforceability countries were liberalized throughout the period.

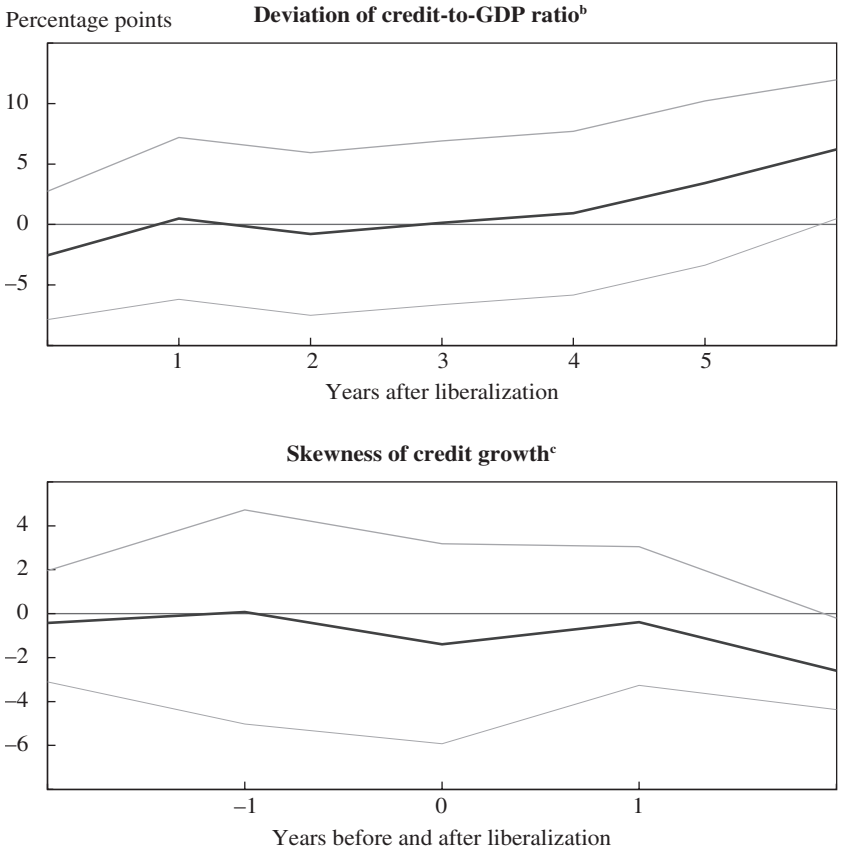
Notice that, across HECs, credit growth exhibits near-zero skewness, and both the mean and the variance are smaller than across MECs. As we will argue below, this difference reflects the absence of severe credit market imperfections in HECs.

The effect of financial liberalization on the mean and the bumpiness of credit growth is represented visually in the event study in figure 4. The top panel shows the deviation of the credit-to-GDP ratio, after liberalization, from its mean in normal times (that is, the years not covered by the dummy variables in the regression). Over the six years following the liberalization date, the credit-to-GDP ratio increases on average by 6 percentage points, and this cumulative increase is significant at the 5 percent level. The bottom panel shows the increase in negative skewness, which reflects the increase in bumpiness.[14] Here the average negative skewness increases from about zero to –2.5, which is also significant at the 5 percent level.

In the literature, variance is the typical measure of volatility. We choose not to use variance to identify growth-enhancing credit risk because a high variance of credit growth reflects not only the presence of boom-bust cycles, but also the presence of high-frequency shocks. This may lead to false inferences about the links among liberalization, fragility, and growth. In the sample we consider, this problem is particu-

14. Skewness is computed over a ten-year period. Since the event window is based on only ten data points, we consider a shorter window.

Figure 4. Deviation of Credit-to-GDP Ratio and Skewness of Credit Growth Following Liberalization[a]



Source: Authors' calculations.

a. Shaded lines represent 95 percent confidence intervals around the estimates. The event windows were constructed from panel regressions of the respective variable on dummy variables that take the value of 1 in periods when a country liberalized and zero otherwise. The panel regressions are estimated with fixed effects, using a generalized least squares estimator.

b. Deviation of credit-to-GDP ratio from its preliberalization mean.

c. Skewness of real credit growth in the ten-year event windows beginning in the indicated year.

larly acute because high-frequency shocks are more abundant than the rare crises that punctuate lending booms.

In short, variance is not a good measure for distinguishing economies that have followed risky, growth-enhancing credit paths from those that have experienced high-frequency shocks. By contrast, negative skewness of credit growth is a good indicator of the incidence of occasional crises.

There might be other, more complex indicators of crises. We have chosen skewness because it is a parsimonious way to capture the existence of risky credit paths. Furthermore, it complements the variance in the regressions we estimate by allowing us to distinguish between "good" volatility (bumpiness) and "bad" volatility (variance).[15]

Financial Fragility and Growth

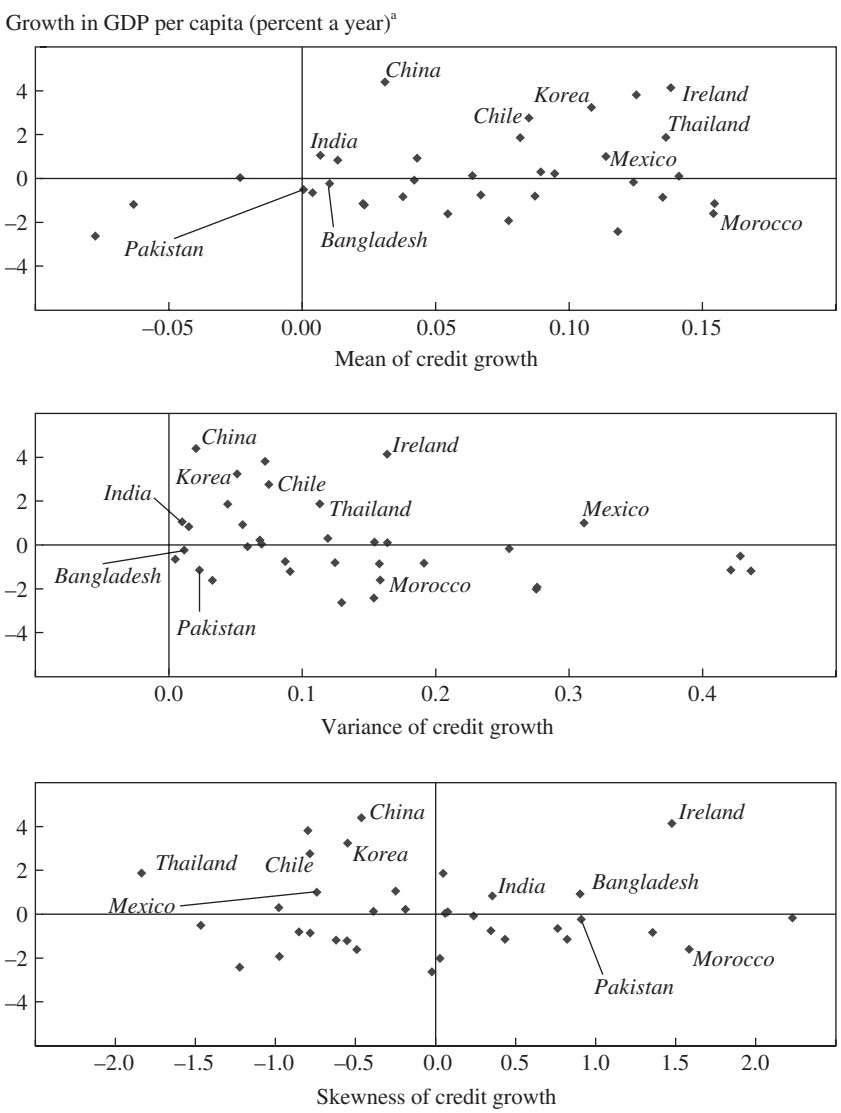
We have shown that trade liberalization is typically followed by financial liberalization, which in turn leads not only to financial deepening but also to booms and busts. On the one hand, in an economy with severe credit market imperfections, financial deepening is good for growth because financing constraints are eased. On the other hand, crises are bad for growth because they generate systemic insolvencies and fire sales. Ultimately, which of these two effects dominates is an empirical question. The following stylized fact summarizes the results that will be discussed below.

Stylized fact 4. *Over the last two decades, countries with bumpy credit paths have grown faster than those with smooth credit paths, when the standard variables are controlled for.*

Our results are foreshadowed by figure 5, which shows the link between GDP growth and the moments of credit growth across MECs, controlling for initial GDP and population growth. Rapid long-run GDP

15. Skewness is sufficient to identify a risky path. High kurtosis may come on top of it, but it is neither necessary nor sufficient. The combination of the two is sufficient but identifies the extreme cases only. For instance, it does not capture many countries that have experienced boom-bust cycles (such as Chile, Mexico, and Turkey). Kurtosis could in principle provide further information about the distribution. However, in practice it is not useful in identifying the risky and the safe paths. If there is a single, short-lived crisis, an outlier in the distribution leads to a long tail on the left and a high kurtosis. However, if there is autocorrelation in the growth rates and the crisis is somewhat persistent, or if there is more than one crisis, the distribution becomes bimodal, and kurtosis can easily become very low. It is therefore an excessively sensitive measure of bumpiness. Depending on the degree of autocorrelation in the shocks, it could be anything from one to infinity (the kurtosis of a normal distribution is equal to 3). In principle, one could argue that other low-frequency shocks affect both safe and risky economies. Therefore skewness could pick up countries that did not undertake credit risk but had exogenous negative low-frequency shocks that led to a negatively skewed distribution. We are not aware that such shocks have hit MECs during the last two decades. Veldkamp (2002) has used skewness to analyze asset price crashes.

Figure 5. Correlation of Average GDP Growth with Moments of Credit Growth Distribution, 1988–99



Source: World Bank, World Development Indicators.
a. Residuals of a regression of growth in GDP per capita on initial GDP per capita and population growth.

growth is associated with a higher mean growth rate of credit, lower variance, and negative skewness.

As the figure shows, countries that have followed a risky path, such as Chile, Korea, and Thailand, exhibit negatively skewed credit growth and rapid GDP growth. In contrast, countries that have followed a safe path do not exhibit negative skewness and have slow growth; examples are Bangladesh, Morocco, and Pakistan. China and Ireland are notable exceptions: they have experienced very rapid GDP growth in the last twenty years but have not experienced a major crisis despite a high rate of credit growth.

In order to assess the link between bumpiness and growth, we add the three moments of real credit growth to the regression in equation 1:

$$\Delta y_{it} = \lambda y_{i,\text{ini}} + \gamma X_{it} + \beta_1 \mu_{\Delta B,it} + \beta_2 \sigma_{\Delta B,it} + \beta_3 S_{\Delta B,it} + \phi_1 TL_{it} + \phi_2 FL_{it} + \varepsilon_{i,t}, \tag{2}$$

where Δy_{it}, $y_{i,\text{ini}}$, X_{it}, TL_{it}, and FL_{it} are defined as in equation 1, and $\mu_{\Delta B,it}$, $\sigma_{\Delta B,it}$, and $S_{\Delta B,it}$ are the mean, standard deviation, and skewness of the real credit growth rate, respectively. We do not include investment as a control variable because we expect the three moments of credit growth, our variables of interest, to affect GDP growth through higher investment.

We estimate equation 2 using the same type of overlapping panel data regression as for equation 1. For each moment of credit growth and each country, we construct ten-year averages starting with the period 1980–89 and rolling forward to the period 1990–99. Similarly, the liberalization variables take values in the interval [0,1], depending on the proportion of liberalized years in a given window.[16] Given the dimension of equation 2, the overlapping-windows regression is the most appropriate method for the analysis we perform here.[17]

16. Since the higher moments of credit growth cannot be computed in a meaningful way when the observations are few, we consider only series for which we have at least ten years of data.

17. The overlapping-windows regression captures the spirit of the model we present below for the following reason. In the risky equilibrium of a liberalized economy there is a probability $1 - u$ that a crisis will occur at time $t + 1$, given that a crisis does not occur at t. Meanwhile, in a nonliberalized economy, the probability of a crisis is always zero. Therefore, according to the model, ten-year windows with more liberalized years should exhibit both greater negative skewness and more rapid growth than windows with fewer liberalized years.

Table 3 reports the estimation results. Consistent with the literature, we find that, after controlling for the standard variables, the mean growth rate of credit has a positive effect on long-run GDP growth, and the variance of credit growth has a negative effect. Both variables enter significantly at the 5 percent level in all regressions.[18]

The first key point established in table 3 is that the credit that accompanies rapid GDP growth is bumpy. Columns 3-1 and 3-2 show that bumpy credit markets are associated with higher growth rates across countries with functioning financial markets. That is, negative skewness—a bumpier growth path—is on average associated with faster GDP growth. This estimate is significant at the 5 percent level.[19]

To interpret the estimate of 0.27 for bumpiness, consider India, which has near-zero skewness, and Thailand, which has a skewness of –2. A point estimate of 0.27 implies that an increase in the bumpiness index of 2 (from zero to –2) increases the average long-run GDP growth rate by 0.54 percentage point a year. Is this estimate economically meaningful? To address this question, note that, after controlling for the standard variables, Thailand grows about 2 percentage points faster per year than India. Thus about a quarter of this growth differential can be attributed to credit risk taking, as measured by the skewness of credit growth.

One can interpret the negative coefficient on variance as capturing the effect of "bad" volatility generated by, for instance, procyclical fiscal policy.[20] Meanwhile the positive coefficient on bumpiness captures the "good" volatility associated with the type of risk taking that eases financial constraints and increases investment. Notice that a country with high variance need not have negative skewness.[21]

The second key point is that the association between bumpiness and growth does not imply that crises are good for growth. Crises are costly. They are the price that has to be paid in order to attain faster growth in the

18. The link between financial deepening and growth is well established in the literature. See, for instance, Demirgüç-Kunt and Levine (2001) and Levine, Loayza, and Beck (2000). See also the seminal work of McKinnon (1973). Robustness tests of the findings in table 3 are presented in table B3.

19. Notice that the estimated coefficient on bumpiness is not capturing country fixed effects. Recall that, for each country, skewness varies over time, like all other variables, as we use ten-year rolling averages.

20. Ramey and Ramey (1995) and Fatas and Mihov (2002) show that fiscal policy-induced volatility is bad for economic growth.

21. Imbs's (2002) results are consistent with this view.

Table 3. Regressions Explaining Growth in GDP per Capita with Moments of Credit Growth[a]

Independent variable	*3-1*[b]	*3-2*[c]	*3-3*[b]	*3-4*[c]
Mean of real credit growth rate	0.170**	0.154**	0.093**	0.110**
	(0.012)	(0.009)	(0.007)	(0.009)
Standard deviation of real credit growth rate	–0.029**	–0.030**	–0.014**	–0.019**
	(0.007)	(0.003)	(0.003)	(0.004)
Negative skewness of real credit growth rate	0.174**	0.266**	–0.095*	0.135**
	(0.069)	(0.021)	(0.053)	(0.031)
Financial liberalization			1.894**	1.811**
			(0.122)	(0.163)
Trade liberalization			0.838**	0.895**
			(0.155)	(0.198)
Summary statistics:				
Adjusted R^2[d]	0.667	0.629	0.752	0.731
No. of observations	269	424	253	408

Source: Authors' regressions.

a. Equation 2 in the text is estimated using panel data and generalized least squares; the dependent variable is the average annual growth rate of real GDP per capita. Standard errors are reported in parentheses and are adjusted for heteroskedasticity according to Newey and West (1987). Control variables include initial income per capita, secondary schooling, population growth, and life expectancy. ** indicates significance at the 5 percent level.

b. Sample includes MECs only.

c. Sample includes HECs and MECs.

d. The adjusted R^2 is likely to overestimate the share of the variance explained by our right-hand-side variables because of the overlapping nature of the regression. No method comparable to that of Newey and West for the standard errors exists for adjusting the R^2, and therefore the values need to be interpreted carefully.

presence of credit market imperfections. To see this, consider column 3-3 in table 3. When the financial liberalization indicator is included in the growth regression, bumpiness enters with a negative sign (and is significant at the 10 percent level). In the MEC set, given that there is financial liberalization, the lower the incidence of crises, the better. We can see the same pattern in the sample that includes HECs as well as MECs: the point estimate of bumpiness in column 3-4 is lower than that in column 3-2.[22]

Clearly, liberalization without fragility is best, but the data suggest that this combination is not available to MECs. Instead, the existence of contract enforceability problems implies that liberalization leads to faster growth because it eases financial constraints but, as a by-product, also induces financial fragility. Despite the rare occurrence of crises, on net, financial liberalization has led to more rapid long-run growth, as shown by the estimates in tables 1 and 3.

22. The reason why bumpiness enters with a positive sign in the fourth column is that all HECs are liberalized and have near-zero skewness. Thus negative skewness acts like a dummy that selects MECs that have liberalized financially.

To deal with the possible endogeneity of the moments of credit growth, table B3 in appendix B reports estimation results from two-stage least squares regressions using as instruments the legal origin index of Rafael La Porta and others, as well as lagged values of all the variables in the regression in column 3-2. Table B3 also reports results of regressions with fixed effects and of regressions excluding China and Ireland, which may be driven by other factors. The results in column 3-2 are robust to these different estimation methods.

Identifying the Mechanism: Sectoral Asymmetries and the Boom-Bust Cycle

We have documented statistically significant correlations between liberalization and growth; among liberalization, financial deepening, and bumpiness; and between the latter two and growth. But what mechanism underlies these links? Which way does the causation run?

Appendix A presents a model that establishes a causal link from liberalization to financial deepening and GDP growth. Furthermore, the same forces that generate growth also generate financial fragility, which leads to rare crises. The theoretical mechanism has unambiguous implications for the behavior of credit and the ratio of N-sector to T-sector output. Testing whether these predictions are confirmed by the data will help identify the direction of causation.

We start by describing the model intuitively. We then explain how the model accounts for the main features of the typical boom-bust cycle experienced by MECs, and after that we test the predictions of the model regarding the N-to-T output ratio. Finally, we discuss why the evidence strongly supports the view that causation goes from liberalization to growth and not the other way around.

The Mechanism

We consider a two-sector economy in which there are asymmetries in financing opportunities across sectors. T-sector firms have perfect access to international capital markets. Meanwhile, N-sector financing is subject to two credit market imperfections: contract enforceability problems and systemic bailout guarantees.

Enforceability problems arise because managers of N-sector firms cannot commit to repaying debt: they are able to divert funds to themselves by incurring a cost. As a result, in the model, lenders impose on each N-sector firm a borrowing constraint that is proportional to its cash flow. This setup captures the fact that, across MECs, T-sector firms can, in general, access international capital markets more easily than most N-sector firms. The latter are financially constrained and dependent on domestic bank credit (except for the largest firms, which are in telecommunications, energy, and finance).[23] Since trade and financial liberalization have typically not been accompanied by judicial reform, enforceability problems have remained. Thus liberalization has exacerbated the asymmetric financing opportunities across sectors.

The second imperfection found in MECs is that financial liberalization not only lifts restrictions that preclude risk taking but also is associated with explicit and implicit bailout guarantees that protect creditors against the effects of systemic crises. Because domestic banks have been the prime beneficiaries of these guarantees, this has created incentives for investors to use domestic banks to channel resources to firms that cannot pledge international collateral. Thus liberalization has resulted in biased capital inflows. T-sector firms and very large N-sector firms are the recipients of FDI and portfolio flows, whereas most of the inflows that end up in the N-sector are intermediated through domestic banks, which enjoy systemic bailout guarantees.

A key result of the model is that systemic guarantees may induce banks and their clients to take on credit risk, but they do not eliminate borrowing constraints. Why does this happen? Systemic guarantees are promises to step in and repay debt obligations *only* in case of widespread insolvencies. If there is *systemic risk* in the economy, agents can exploit the subsidy implicit in the guarantees by undertaking credit risk. If a borrower *defaults* in a state of the world where many other borrowers are also defaulting, lenders will get repaid in full by the bailout agency. Because the market anticipates this contingent subsidy, taking on credit risk reduces the cost of capital. Thus borrowers will find it profitable to take

23. There are several reasons why T-sector firms can access international financial markets more easily than N-sector firms. For instance, since T-sector firms tend to export, they can more easily establish long-term relationships with foreign firms, and they can pledge export receivables as collateral. Also, on average, T-sector firms are larger than N-sector firms.

on credit risk if the probability of insolvency is small enough. At the same time, guarantees do not neutralize enforceability problems, and thus borrowing constraints are not eliminated. This is because a bailout is not granted when only a few borrowers default.[24]

How is this *systemic risk* generated? Over the past few decades, credit risk has become common in bank and corporate balance sheets in MECs in the form of short maturities and currency mismatches. As a result, an important share of banks' liabilities is denominated in foreign currency, whereas their assets either are denominated in domestic currency or are loans to the N-sector. If a reversal of capital inflows were to occur, there would be a real depreciation, fire sales, and a meltdown of bank balance sheets. It is in these circumstances that bailouts are generally granted. In other words, the interaction of contract enforceability problems and systemic bailout guarantees sets in motion a self-reinforcing mechanism. On the one hand, the expectation of real exchange rate variability makes it optimal for agents to denominate debt in foreign currency and run the risk of going bankrupt. On the other hand, the resulting currency mismatch at the aggregate level makes the real exchange rate variable, validating agents' expectations.[25]

We have seen that, in the presence of contract enforceability problems, the credit of most N-sector firms is constrained by their cash flow, even though there are bailout guarantees. This happens because guarantees are systemic, so that lenders will lend only as much as they are sure that the borrower will be willing to repay. A second key observation is that taking on credit risk reduces expected debt repayments because the bailout agency will cover part of the debt obligation in the event of a systemic crisis. Thus the bailout guarantee allows financially constrained firms to borrow more than they could otherwise. This increase in borrowing and investment is accompanied by an increase in credit risk. When many firms take on credit risk, aggregate financial fragility rises, together with N-sector investment and growth.

24. This is why it is important to distinguish systemic from unconditional guarantees, which are granted whenever there is an individual default. Notice that if all guarantees were unconditional, enforceability problems would not generate borrowing constraints, because a bailout would be granted whenever there is a single default, regardless of the state of the world. The results in this paragraph are proved in Schneider and Tornell (forthcoming).

25. From a theoretical perspective, several other self-reinforcing mechanisms link credit risk with aggregate financial fragility. We focus on currency mismatches because they capture the recent experience of MECs.

Faster N-sector growth helps the T-sector grow faster because N-sector goods are used in T-sector production. Therefore the T-sector will enjoy more abundant and cheaper inputs than otherwise. As a result, as long as a crisis does not occur, growth in a risky economy is faster than in a safe one. This does not, however, guarantee that, in the long run, average growth in a risky economy is also faster than in a safe one, because financial fragility implies that a self-fulfilling crisis may occur, in which case GDP growth will fall.

As we show in appendix A, if crises are rare events, average long-run growth will be faster along a risky path than along a safe path unless the costs of a crisis are excessively high. In fact, if crises were not rare, agents would not find it profitable to take on credit risk in the first place. This explains why financial fragility leads to faster mean GDP growth.

The argument has thus established a joint causal link: financial liberalization promotes both long-run growth and financial fragility. Since, in any equilibrium, crises both are rare and result in an abrupt and drastic fall in credit, which recuperates only gradually, credit growth will be *negatively skewed* if the time sample is long enough. Thus negative skewness of credit growth is a symptom of financial fragility. This explains why skewness of credit growth is a valid right-hand-side variable in the regressions we estimate.

Before moving on to the other predictions of the model, we emphasize that both guarantees and enforceability problems are essential to the argument. If there were no guarantees, agents would not be willing to take on credit risk to claim the implicit subsidy. Alternatively, if contract enforceability problems were not severe enough, borrowing constraints would not arise in equilibrium, and if enforceability problems were too severe, firms could not attain enough leverage, and systemic risk would not arise. To link these remarks to the data, we note that explicit and implicit systemic bailout guarantees are present in most countries. They capture the "too big to fail" principle: when a systemic meltdown occurs, governments tend to grant bailouts.[26] The degree of contract enforceability varies

26. One might argue that, in the aftermath of crises, guarantees cease to exist temporarily (for instance, because of fiscal constraints). However, after a few years they come back. One might also argue that regulations precluding fraud or extreme risk taking might be imposed as a result of a crisis. In terms of the model in appendix A, we would say that, in that case, systemic guarantees are still in place, but either regulations do not allow agents to exploit them or there is a shift in expectations in the wake of the crisis (that is, agents

from country to country. We have identified those countries where contract enforceability problems are not too severe as those where the stock market turnover-to-GDP ratio was greater than 1 percent in 1998. We partition this set into countries with either a high or a medium degree of contract enforceability (HECs and MECs) as described earlier. The mechanism we have described is operative only in the MEC set.

The Boom-Bust Cycle and the Bottleneck Effect

In addition to helping us identify the mechanism that links liberalization, fragility, and long-run growth, an attractive feature of our approach is that it can account for higher-frequency phenomena, such as the boom-bust cycles typically experienced by MECs, and the bottleneck effect. This will allow us, in the next section, to evaluate the Mexican performance.

We represent the typical boom-bust cycle by means of an event study. Figure 6 shows the average behavior, across our set of thirty-five MECs, of several macroeconomic variables around twin currency and banking crises during the period 1980–99. Year 0 refers to the year during which twin currency and banking crises take place.[27] In each panel the heavy line represents the average deviation relative to tranquil times, the dotted lines represent the 95 percent confidence interval, and the thin solid lines correspond to Mexico.[28]

Typically, before a crisis there is a real appreciation and a lending boom, during which credit grows unusually fast. During the crisis there is a drastic real depreciation, which coincides with a meltdown of the

believe that others will not take on credit risk, and so a meltdown and hence a bailout cannot take place in the next period).

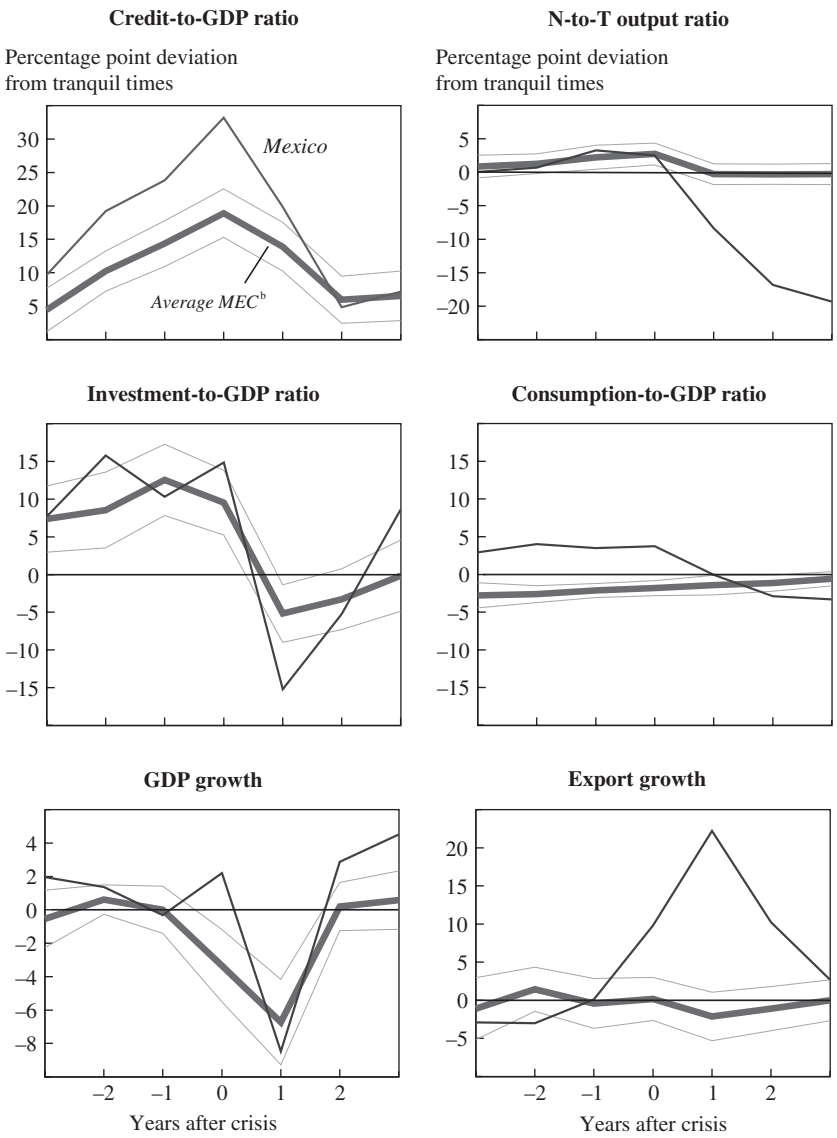
27. We say that there is a twin crisis at year 0 if both a currency and a banking crisis occur during that year, or if one occurs at year 0 and the other at year 1.

28. The graphs are the visual representations of the point estimates and standard errors from regressions in which the variable depicted in the graph is the dependent variable, regressed on time dummies preceding and following a crisis. We estimate the following pooled regression:

$$y_{it} = a_i + \sum_j \beta_j \, \text{Dummy}_{\tau+j} + \varepsilon_{it},$$

where y is the variable of interest in the graph; $i = 1, \ldots, 35$ denotes the country; $t = 1980, \ldots, 1999$; and $\text{Dummy}_{\tau+j}$ equals 1 at time $\tau + j$ and zero otherwise, where τ is a crisis year. The panel data estimations account for differences in the mean by allowing for fixed effects, as well as for differences in the variance by using a generalized least squares estimator, using the estimated cross-sectional residual variances.

Figure 6. Characteristics of the Boom-Bust Cycle in Mexico and in the Average Medium Contract Enforceability Country[a]



Source: Authors' calculations using data from World Bank, World Development Indicators; IMF, International Financial Statistics; National Institute of Statistics, Geography, and Informatics; and Banco de México.

a. Event windows are constructed from panel regressions of the variable in each graph on dummy variables that take on a value of 1 in the period where a joint banking and currency crisis occurred and zero otherwise. The panel regressions are estimated with fixed effects, using a generalized least squares estimator. The N-to-T and GDP series were computed as midyear changes. The plots are results from pooled regressions.

b. Shaded lines indicate 95 percent confidence intervals.

banking system, widespread insolvencies, and fire sales. In the aftermath of the crisis there is typically a short-lived recession and a fall in credit that is both sharper and longer-lasting than the fall in GDP. Thus the credit-to-GDP ratio declines. The milder fall in aggregate GDP than in credit masks the asymmetric sectoral response we emphasize in this paper: N-sector output falls more than T-sector output in the wake of a crisis and recuperates more sluggishly thereafter. This asymmetry is also present during the boom that precedes the crisis, as the N-sector grows faster than the T-sector and a real appreciation occurs.[29] Finally, the figure also shows that investment fluctuations are quite pronounced along the boom-bust cycle, whereas those of consumption are not.

The model can account for these features because financial constraints and credit risk (in the form of currency mismatches) coexist in equilibrium, and their interaction generates real exchange rate variability. In a risky equilibrium, currency mismatch is optimal and borrowing constraints bind, so that there can be a self-fulfilling, steep real depreciation that generates widespread bankruptcies of N-sector firms and the banks that lend to them. Because N-sector net worth falls drastically and recuperates only gradually, there is a collapse in credit and N-sector investment, which take a long time to recuperate. Since T-sector firms do not face financial constraints, and the real depreciation allows them to buy inputs at fire-sale prices, this leads to rapid growth of T-sector output and GDP in the wake of the crisis. As a result, the N-to-T output ratio falls drastically and recuperates sluggishly.

However, rapid GDP growth cannot be sustained over a long period if it is driven only by T-sector growth, because T-sector production needs inputs from the N-sector. If the credit crunch continues for a long period, depressed N-sector investment eventually leads to bottlenecks: the T-sector no longer enjoys an abundant and cheap supply of N-sector inputs, and its growth starts falling. This is the *bottleneck effect*, which implies that sustainable growth cannot be supported only by export growth. This effect is key to understanding Mexico's recent performance.[30]

29. This asymmetric sectoral response parallels the regressions using the N-to-T output ratio in the previous subsection.

30. The fact that T-sector production uses N-sector inputs is key. This is an essential difference between our model and the standard dependent-economy models, where the linkage between the N- and the T-sectors derives from the fact that both use the same nonreproducible factor. In such a model, rapid N-sector growth does not cause rapid T-sector growth, and there is no bottleneck effect. In the short run, a shock that negatively affects

Sectoral Asymmetries

We have shown that, in MECs, T-sector firms can in general access international markets and overcome these problems more easily than N-sector firms. This asymmetry in financing opportunities imposes restrictions on the behavior of credit and the response of the N-to-T output ratio to various shocks. Testing whether these restrictions are present in data from MECs will help us identify the mechanism that links liberalization and long-run growth.

First, consider the response of the N-to-T output ratio to trade and financial liberalization. Since trade liberalization benefits mostly T-sector firms and allows them to establish financing channels in international markets, the N-to-T output ratio should decrease following trade liberalization. Because financial liberalization is typically followed by a lending boom that benefits the financially constrained N-sector relatively more than the T-sector, the N-to-T output ratio should increase following financial liberalization.

Second, consider the response of the N-to-T output ratio to a crisis. The sharp real depreciation that occurs during crises worsens the balance sheets of the N-sector firms and leads to fire sales, which benefit the T-sector at the expense of the N-sector. Thus the N-to-T output ratio falls in the wake of crises. Because N-sector credit is constrained by the sector's net worth, and because it takes a long time for that net worth to recover, the N-to-T output ratio might continue to fall for a prolonged period.

Third, because the N-sector is more financially constrained than the T-sector, and banks are highly exposed to the N-sector, the N-to-T ratio should move together with credit in normal times and should collapse together with credit during crises.

To test whether these patterns are present in the data, we construct two different indexes of N-sector and T-sector production for our set of countries. We then estimate regressions of the following form:

$$(3) \qquad \Delta N/T_{it} = c + \beta_1 TL_{it} + \beta_2 FL_{it} + \beta_3 \text{credit}_{it} + \sum_{j=0}^{5} \delta_j \text{crisis}_{i,t+j} + \varepsilon_{it},$$

the N-sector's investment and output generates a real depreciation and benefits the T-sector in both models. In the medium run the predictions of the two models differ. In our model the T-sector will suffer a bottleneck as N-sector inputs become scarce. This is not the case in the dependent-economy model.

where N/T_{it} is the N-to-T output ratio in country i at time t; credit_{it} is real credit growth; TL_{it} and FL_{it} equal 1 if there has been trade or financial liberalization, respectively, in country i in or before year t, and zero otherwise; and $\text{crisis}_{i,t+j}$ equals 1 in country i and year $t + j$, where t denotes the year when twin banking and currency crises occur in country i, and j denotes the number of years after the crisis.[31]

Our first N-to-T output index is used in table 4. This index is constructed by looking at the behavior of the sectoral exports-to-GDP ratio. We consider construction, manufacturing, and services, and for each country we classify as the tradables sector the one of these three in which this ratio is the highest, and as nontradables the one in which the ratio is lowest. In appendix B we consider another index based on the variability of the sectoral real exchange rate. The correlation between both indexes is 0.74, and the results of regressions using the two indexes are very similar.

We estimate equation 3 using the MEC sample in a panel data regression that includes fixed effects and uses a generalized least squares estimator. The sample covers the period from 1980 to 1999 with annual data. Column 4-1 in table 4 shows that, across MECs, the N-to-T output ratio responds in the way predicted by the model. The liberalization variables are significant at the 5 percent level in all regressions. The estimates show that the N-to-T output index falls following trade liberalization, whereas it increases following financial liberalization. The table also shows that the N-to-T output index falls in the wake of a crisis. The strongest effect is observed in the first period after the eruption of the crisis. After a small rebound in period $t + 2$, the index continues to fall until $t + 4$.

Consider now the link between bank credit and the N-to-T output ratio. As column 4-2 of table 4 shows, credit growth enters with a positive sign and is significant at the 5 percent level. This indicates that the co-movement of credit and the N-to-T output ratio is not conditional on the occurrence of either a crisis or policy reform. To control for the fact that the ratio can move in response to other shocks that generate movements in the real exchange rate, we also estimate equation 3 including the rate of real depreciation as an explanatory variable. As column 4-3 shows, both liberalization variables and credit remain significant at the 5 percent

31. Rajan and Zingales (1998) examine the sectors in the United States that use external finance more intensively than others. They then test whether these same sectors have grown faster in countries that have experienced greater financial deepening.

Table 4. Regressions Testing for Sectoral Asymmetries[a]

Independent variable	*4-1*	*4-2*	*4-3*
Financial liberalization	1.147**	0.989**	1.007**
	(0.140)	(0.148)	(0.141)
Trade liberalization	–0.780**	–0.581**	–0.782**
	(0.189)	(0.198)	(0.203)
Credit		0.481**	0.440**
		(0.205)	(0.192)
Rate of real depreciation			2.233**
			(1.372)
Crisis year dummy	–0.243*	–0.205*	–0.274**
	(0.143)	(0.125)	(0.121)
Crisis year +1	–2.434**	–2.124**	–2.228**
	(0.143)	(0.184)	(0.177)
Crisis year +2	0.193*	0.439**	0.370**
	(0.127)	(0.155)	(0.147)
Crisis year +3	–0.793**	–0.652**	–0.693**
	(0.127)	(0.130)	(0.122)
Crisis year +4	–0.499**	–0.248	–0.348*
	(0.192)	(0.204)	(0.194)
Crisis year +5	0.872**	0.837**	0.916**
	(0.183)	(0.162)	(0.154)
Summary statistics:			
Adjusted R^2	0.655	0.728	0.734
No. of observations	443	426	360

Source: Authors' regressions.

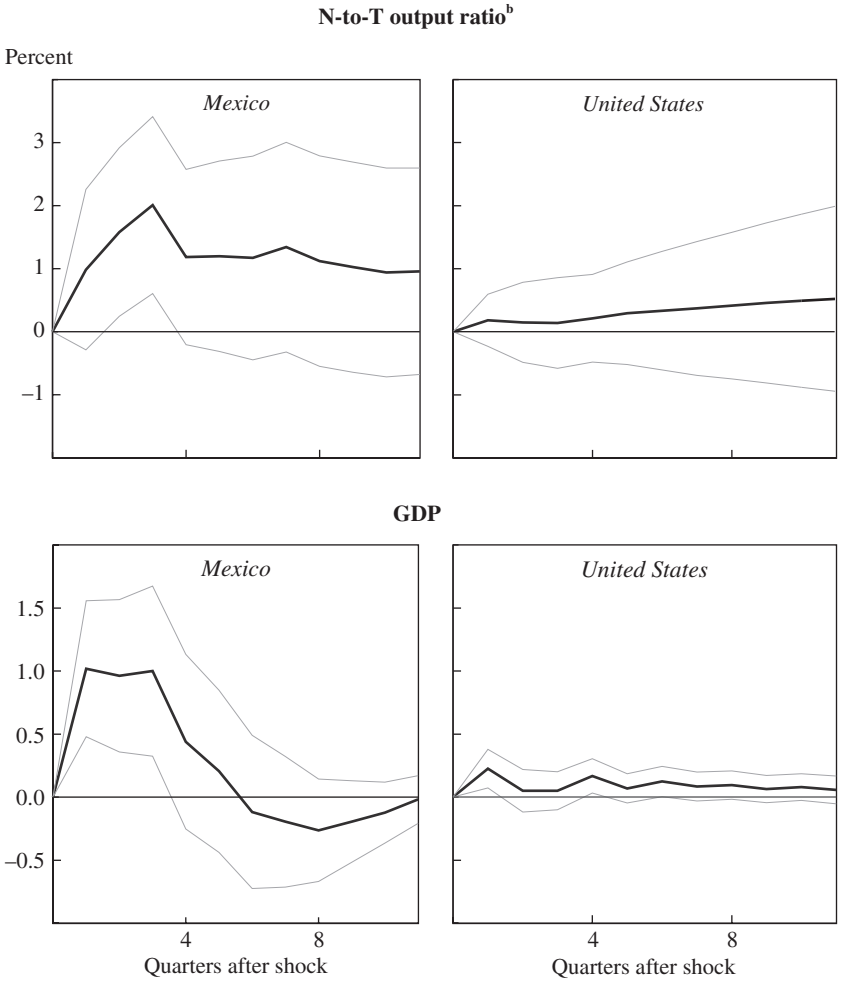
a. Equation 3 in the text is estimated using panel data and generalized least squares; the dependent variable is the ratio of nontradables sector output to tradables sector output. Standard errors are reported in parentheses. * indicates significance at the 10 percent level, ** at the 5 percent level.

level when this variable is included. The $\text{crisis}_{i,t+j}$ dummies enter significantly at the 5 percent level in almost all cases.

An alternative way to examine the close link between the N-to-T output ratio and credit growth is through vector autoregressions (VARs). If we impose the restriction that output within a quarter is predetermined by past investment, and thus does not respond to variations in credit, our model implies that we can run bivariate VARs of credit with the N-to-T output ratio, or of credit with GDP. Figure 7 shows the impulse responses of the N-to-T output ratio and GDP to a 1-standard-deviation shock to real credit growth in Mexico and the United States. The contrast is impressive. In Mexico both GDP and the N-to-T output ratio react significantly to a credit shock even when the effects of crisis and liberalization are accounted for.[32]

32. The crisis and liberalization dates have been dummied out in the VARs.

Figure 7. Responses of Nontradable-to-Tradable Output Ratio and GDP to a One-Standard-Deviation Positive Shock to Credit in Mexico and in the United States[a]



Source: Authors' calculations.

a. Response estimated from two-variable vector autoregressions with four lags, a time trend, and dummy variables for liberalization and crisis periods using quarterly data. Growth in credit and either GDP or the N-to-T output ratio are the variables; the sample period is 1980:1 to 1999:4. Finite-sample critical values are generated by Monte Carlo repetitions.

b. Shaded lines indicate the 95 percent confidence interval.

By contrast, in the United States the effect of credit on GDP is only mildly significant and negligible in magnitude. Similarly, the effect on the N-to-T output ratio in the United States is smaller than in Mexico and not statistically significant. This difference is consistent with the view that contract enforceability problems are more severe in Mexico than in the United States. T-sector firms can overcome these problems, but most N-sector firms cannot, and this asymmetry is reflected in a strong response of the N-to-T output ratio. Furthermore, this effect is strong enough to be reflected in aggregate GDP, which is the sum of N-sector and T-sector production.

Are Other Mechanisms Consistent with the Data?

We have presented a mechanism (based on the model presented in appendix A) in which causation runs from liberalization to growth, with financial fragility arising as a by-product: liberalization allows the undertaking of credit risk by financially constrained firms, most of which are in the N-sector. This eases borrowing constraints and increases GDP growth, but it also generates endogenous financial fragility. Thus a liberalized economy will experience occasional self-fulfilling crises, during which a real depreciation coincides with sharp falls in the credit-to-GDP and N-to-T output ratios, as financially constrained N-sector firms are hit especially hard.

This mechanism implies, first, that credit growth and the credit-to-GDP ratio are negatively skewed, experiencing sharp falls during the occasional crisis; second, that the N-to-T output ratio collapses during crises and moves in tandem with credit in normal times; and third, that the N-to-T output ratio responds positively to financial liberalization and negatively to trade liberalization. Our data analysis has shown that MECs have all these predicted characteristics.

Would we observe this behavior of credit and the N-to-T output ratio if causation went in another direction, or if financial constraints did not play a key role? Consider, for instance, an alternative view in which faster GDP growth causes liberalization and an increase in capital inflows and in credit growth. In such a framework, faster GDP growth would lead to a higher N-to-T output ratio following financial liberalization, to a greater incidence of crises, and to a protracted decline in the ratio in the wake of a crisis. We are not aware of any argument in which the causation runs

from GDP growth to liberalization and financial fragility that is also able to explain these patterns and a negatively skewed credit growth path.[33]

Liberalization may increase long-run growth by improving the quality of institutions, for instance through a discipline effect that induces structural reforms that improve property rights and reduce taxation.[34] This channel does not generate financial fragility, and it can work side by side with the mechanism we have identified here.[35]

Finally, the asymmetry in financing opportunities between the N- and T-sectors is key to our argument. In the next section we provide evidence from microlevel data from the Mexican economic census and stock market supporting this sectoral asymmetry.[36]

The Effects of Liberalization in Mexico

Mexico is a prime example of a country that has shifted from a highly interventionist to a liberalized economic regime. Given Mexico's far-reaching reforms, the signing of NAFTA, and the large capital inflows into Mexico, many observers expected stellar growth performance. In terms of GDP per capita, Mexico's performance has in fact been reasonable but unremarkable. Even during the 1990s Mexico's annual growth rate was only about 1 percentage point above the value predicted by its initial income and population growth (figure 5), less than in some other countries that have also liberalized. Moreover, during the last two years exports and GDP have stopped growing. Why has Mexico's aggregate growth performance failed to meet expectations? Why has there been an export slowdown? Where can we see the effects of liberalization and NAFTA?

Some have argued that countries like Mexico could have grown faster had they not liberalized their financial markets so fast, and had they

33. Consider, for instance, the traditional dependent-economy model where the N- and T-sectors use a common, nonreproducible factor (such as labor or land) and where there are no credit market imperfections. There is no force in such an economy that would lead to a greater incidence of crises following financial liberalization, generate a negatively skewed credit growth distribution, or generate a protracted decline in the N-to-T output ratio in the wake of a crisis.

34. As in Tornell and Velasco (1992).

35. On this point see Kaminski and Schmukler (2002), Levine, Loayza, and Beck (2000), and Loayza and Ranciere (2001).

36. Tornell and Westermann (2003) also provide evidence for this sectoral asymmetry for a set of MECs by looking at survey data from the World Bank.

received more FDI and less capital in the form of risky bank flows. In this way Mexico could have avoided the lending boom and the tequila crisis.[37] We do not agree. We have seen that, across MECs, liberalization leads to faster growth, but also to financial fragility and occasional crises. Mexico is thus no exception in experiencing a boom and a bust. Something else must be at work. To find out what that is, we compare Mexico's experience with the empirical norm presented in the previous sections.

We argue that Mexico's less-than-stellar growth is not due to liberalization or the lending boom and crisis it engendered, and that, in all likelihood, GDP growth would have been slower without liberalization and NAFTA. In fact, in the wake of the crisis, exports experienced extraordinary growth and GDP growth recovered quite quickly. Instead we argue that a lack of structural reform and Mexico's credit crunch, which was deeper and more protracted than that of the typical MEC, are important factors behind Mexico's unremarkable growth performance and the recent slowdown in exports.[38]

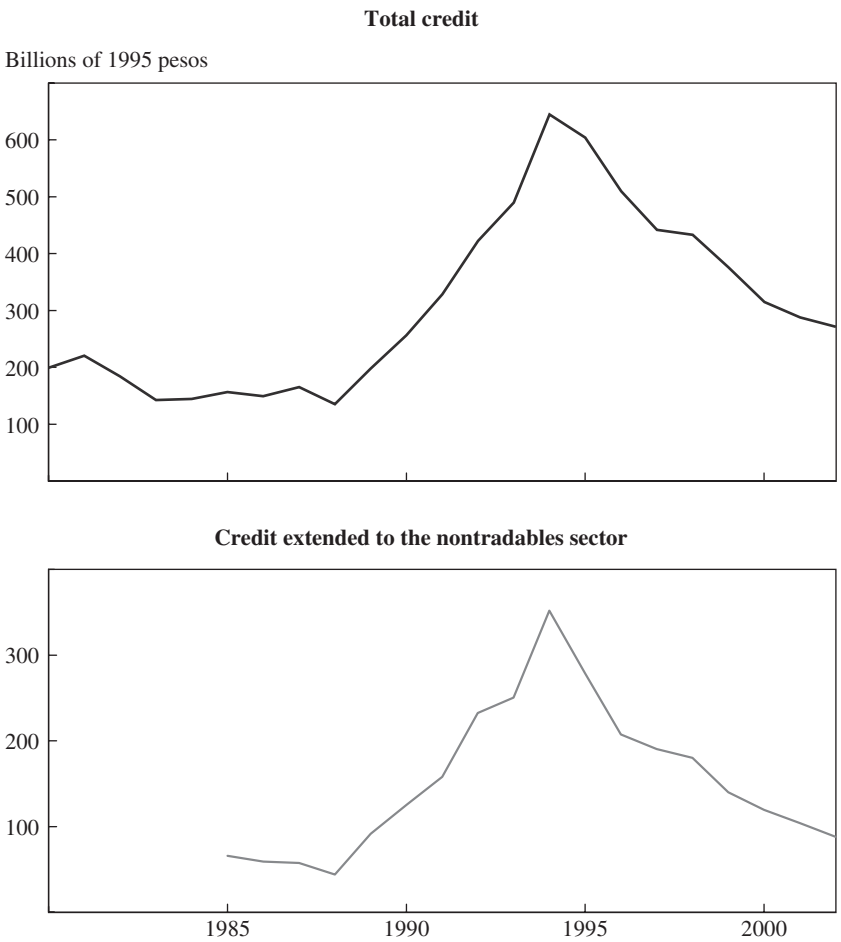
A distinctive fact about Mexico is that, in the wake of the tequila crisis, the rapid resumption of GDP growth was accompanied by a protracted credit crunch. Real credit fell an astounding 58 percent between 1994 and 2002 (top panel of figure 8). As a result, the credit-to-GDP ratio, which had increased from 13 percent in 1988 to 49 percent in 1994, fell back to 17 percent in 2002. This credit crunch hit the N-sector particularly hard and generated bottlenecks that have blocked T-sector growth. As the bottom panel of figure 8 shows, real credit to the N-sector fell 75 percent between 1994 and 2002. The policy response to the banking problem and the sharp deterioration of contract enforceability are key factors contributing to the credit crunch.

We start by summarizing Mexico's reforms and by comparing several aspects of Mexico's performance with international norms. We then investigate the role of developments in the U.S. economy and of internal factors in explaining the differences between Mexico's economic cycle and that of the typical MEC. Finally, we analyze the credit crunch and

37. See, for instance, Stiglitz (2002).

38. This view is consistent with Bergoeing and others (2002), who find that most of the difference in growth between Mexico and Chile over the period 1980–2000 is due to differences in total factor productivity (TFP), not differences in capital and labor inputs. They conclude that the crucial factor that drives the difference in TFP is differences in banking systems and bankruptcy procedures.

Figure 8. Credit in Mexico, 1980–2002[a]



Source: Banco de México.
a. Credit does not include nonperforming loans for the period 1995–2002.

provide microeconomic evidence on the sectoral asymmetry in financing opportunities that we have emphasized throughout the paper.

Reforms

Mexico acceded to the General Agreement on Tariffs and Trade in 1986, and by 1987 it had eliminated most of its trade barriers (except in

agriculture). Mexico went from being a very closed economy to one of the most open in the world, and it experienced a dramatic increase in exports. Between 1985 and 2000 nonoil exports jumped from $12 billion to $150 billion, and the share of trade in GDP rose from 26 percent to 64 percent (figure 9).

Financial liberalization began in 1989. Although Mexico's capital account was not totally closed, financial markets and capital flows were heavily regulated. The rules that restricted the opening of bank accounts and the purchase of stocks by foreigners were relaxed, as were the rules that had strictly restricted FDI.[39] At about the same time, banks were privatized, and reserve requirements, interest rate ceilings, and directed lending were eliminated. Finally, the limits on the amount of commercial paper and corporate bonds that firms could issue, as well as the prohibition against issuing indexed securities, were lifted.[40]

NAFTA was signed in 1993 and went into effect on January 1, 1994. The treaty did not significantly reduce trade barriers from their already low levels. Its significance resides in the fact that it codified the new rules of the game and greatly reduced the uncertainty faced by investors. On the one hand, it solidified the reforms that had been implemented and reduced the likelihood that the Mexican government would violate investors' property rights as it had in the past. On the other hand, it made it very unlikely that the United States or Canada would suddenly impose trade barriers on some products. NAFTA also established a supranational body to settle disputes arising under the treaty.[41]

A key shortcoming of the liberalization program is that it was not accompanied by badly needed judicial and structural reforms. First, Mexico had and still has severe contract enforceability problems, which make it very difficult for a creditor to take over the assets of defaulting debtors. The problems include long delays in the adjudication of commercial disputes, very low salaries for judges, and poor enforcement of judicial decisions.[42] Second, structural reforms in key sectors, such as energy, have

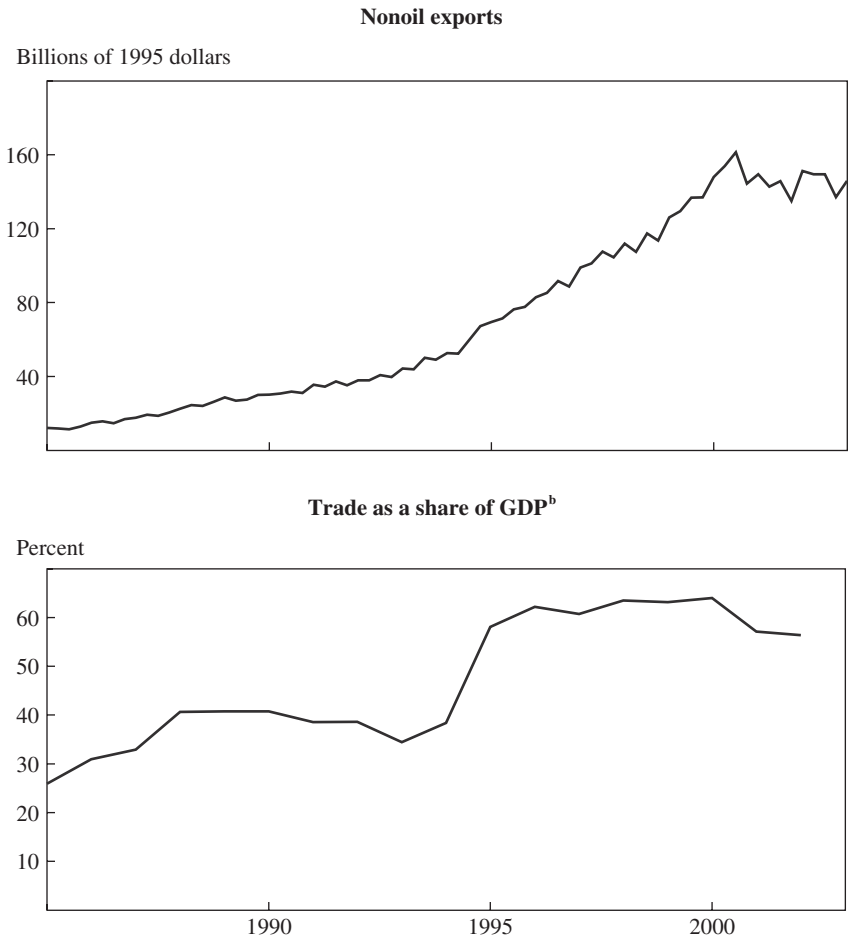
39. In 1989 a new *reglamento* to the Ley para Promover la Inversión Mexicana y Regular la Inversión Extranjera (Law for the Promotion of Mexican Investment and the Regulation of Foreign Investment) was introduced. Then, in 1993, a new FDI law was passed by congress. This law was subsequently revised in 1998.

40. For a detailed description see Babatz and Conesa (1997) and Martínez and Werner (2002a).

41. Aspe (1993); Esquivel and Tornell (1998); Lustig (2001); Perry and others (2003).

42. It was not until 2000 that new bankruptcy and guarantee laws were introduced.

Figure 9. Measures of International Trade in the Mexican Economy, 1980–2003[a]



Sources: National Institute of Statistics, Geography, and Informatics; and International Monetary Fund, International Financial Statistics.

a. Nonoil exports are quarterly data annualized; data for trade as a share of GDP are annual.

b. The sum of exports and imports divided by GDP.

not been implemented. This has implied higher costs for other sectors in the Mexican economy.

The Mexican Experience in Perspective

We have seen that risky lending booms and rare crises are the norm across fast-growing MECs. Thus it cannot be the case that financial liberalization and crisis are the causes of Mexico's lack of stellar growth. Given the bumpiness it experienced, could Mexico have attained faster GDP growth? To address this issue we look again at GDP growth rates (figure 5). Even during the period of liberalization (1988–99), Mexico's GDP grew at an annual rate that was less than 1 percentage point above the value predicted by its initial income and population growth. This is around 2 percentage points less than countries with similar bumpiness, as measured by the skewness of real credit growth. For instance, Chile, Korea, and Thailand grew at rates of 2 or 3 percentage points above the predicted values. This indicates that, given its bumpiness, Mexico was an underperformer during the 1990s. Furthermore, from the first quarter of 2001 through the second quarter of 2003, GDP growth has stagnated and nonoil exports have fallen 1 percent a year on average.[43]

To explain the negative growth differential and the recent slowdown in export growth, we compare Mexico's boom-bust cycle with the average cycle across the MEC sample (figure 6). As we explained in the previous section, this figure depicts the deviation from the mean in tranquil times of several macroeconomic variables before, during, and after twin currency and banking crises.

As the figure shows, GDP growth in Mexico behaved quite typically both before and during the crisis. Mexico experienced a recession that was more severe but also shorter-lived than in the typical MEC during a crisis. The decline in GDP of about 8 percent in comparison with the mean during tranquil times lies within the 95 percent confidence interval of the average MEC. During the immediate recovery phase, GDP growth in Mexico has been faster than in the typical MEC. In the second and third

43. From 1980 to 1989 Mexican GDP grew at an average annual rate of 2 percent a year. Growth then averaged 4 percent a year during the five boom years preceding the crisis (1990–94); GDP then fell by 6 percent during the crisis year (1995), and GDP growth averaged 5 percent in the following five years (1996–2000). The last two years have witnessed stagnation, with an average growth rate of zero. Dornbusch and Werner (1994) analyze Mexico's performance prior to 1994.

years after the crisis, Mexico grew 3 to 4 percent above its rate of growth in tranquil times, which is outside the 95 percent confidence bands.

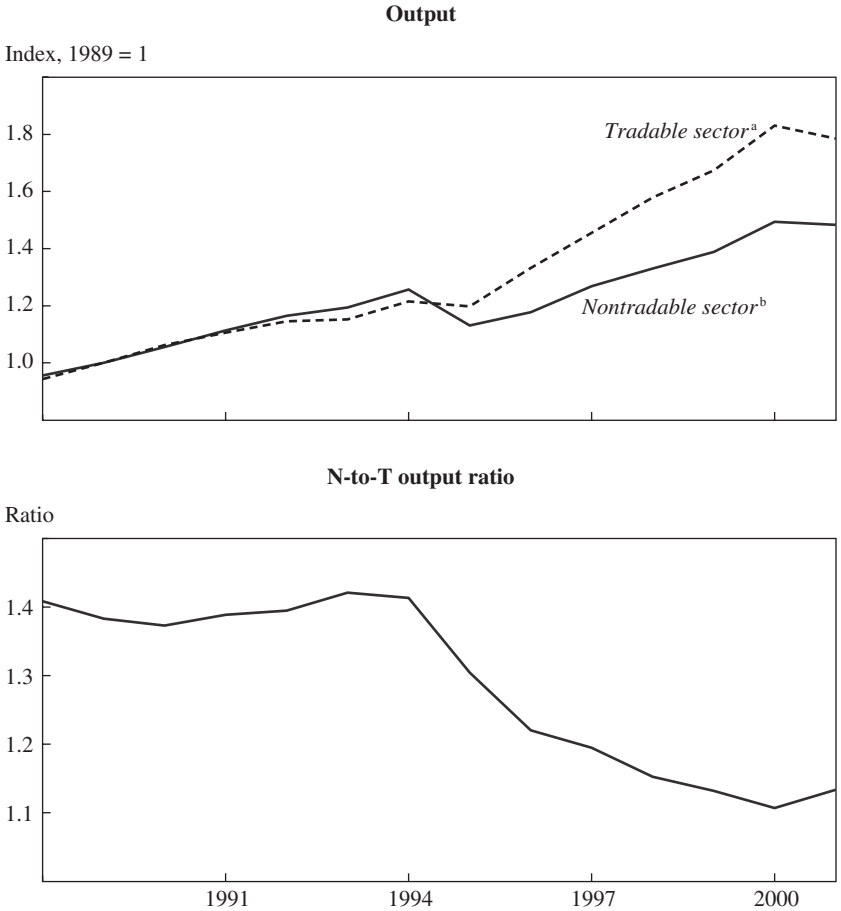
The behavior of GDP growth masks the sharp sectoral asymmetry that we emphasize throughout this paper. As figure 6 also shows, in the three years preceding the crisis, the N-to-T output ratio increased by a cumulative 3 percent, despite a negative long-term trend toward T-sector production. This change lies within the 95 percent confidence interval of the average MEC. In contrast, in the three years after the crisis, the N-to-T output ratio declined cumulatively by about seven times as much as in the average MEC—a significantly larger drop than is typical. Furthermore, even by the third year after the crisis, this ratio showed no signs of reversion toward its mean in tranquil times. This persistent decline of the N-to-T output ratio can also be seen in figure 10, which depicts N-sector and T-sector production in Mexico from 1988 to 2001.

The abnormal behavior of the N-to-T output ratio in Mexico is closely linked to that of bank credit. Although the level of credit to GDP, relative to tranquil times, was already higher, three years before the crisis, than the international norm, the change in the credit-to-GDP ratio in Mexico was typical during the boom but was an outlier in the postcrisis period. As figure 6 reveals, Mexico experienced a change in the credit-to-GDP ratio of about 23 percentage points in the three years preceding the crisis. This change is above the MEC average, although it lies within the 95 percent confidence interval for the typical MEC. However, in the wake of the tequila crisis, Mexico's credit crunch was both more severe and more protracted than in the typical MEC. In the three years after the crisis, the credit-to-GDP ratio in Mexico fell by 26 percentage points, significantly more than in the average MEC.

The credit crunch affected mainly the N-sector. As the bottom panel of figure 8 shows, total bank credit to the N-sector fell in each year from 1995 to 2002. In contrast, the T-sector was not hard hit by the credit crunch. As we will show below using microlevel data from the economic census and from the set of firms listed on the stock market, in the wake of the crisis, T-sector firms in Mexico had significantly greater access to international financial markets than did N-sector firms.

Rapid T-sector growth thus explains why GDP, which is the sum of N-sector and T-sector output, did not fall as much as either N-sector output or credit, and why robust GDP growth resumed one year after the crisis. This remarkably fast T-sector growth is associated with the extra-

Figure 10. Output in the Tradables and Nontradables Sectors in Mexico, 1988–2001



Source: National Institute of Statistics, Geography, and Informatics.
a. Manufacturing, mining, and agriculture.
b. Construction, commerce, restaurants and hotels, transportation, storage, and communications and communal services.

ordinary export growth that can be observed in figure 6. Whereas, remarkably, export growth in the typical MEC does not display any significant deviation from tranquil times in the wake of a crisis, Mexico's exports increased more than 20 percent above their mean in tranquil times in 1995. This increase is certainly an outlier.

The investment-to-GDP ratio behaved typically during the boom phase. During the crisis, however, it fell significantly more than in the

typical MEC, with a –15 percent deviation from tranquil times recorded in the year after the crisis. Its recovery was also more pronounced, as the ratio climbed to 8 percent above its level in tranquil times in the third year after the crisis. Finally, consumption displays a similar cyclical pattern, although with a much smaller amplitude than that of investment.

In sum, our findings indicate that the lack of spectacular growth in Mexico during the 1990s cannot be blamed on liberalization, the boom, or the crisis. In fact, the effects of liberalization and of NAFTA can be observed in the extraordinary growth of exports, which drove the fast and robust recovery of GDP growth in the years following the crisis. However, the dynamism of exports has faded: since the first quarter of 2001, exports have fallen in absolute terms and GDP has stagnated. What role have developments in the U.S. economy played in Mexico's export performance? And what role have internal factors played?

Export Growth

Because a large share of Mexican exports goes to the United States, a natural question is to what extent developments in the U.S. economy explain the behavior of exports. In particular, we investigate to what extent developments in U.S. imports or U.S. manufacturing can account for the extraordinary growth in Mexico's exports in 1995–2000 and the stagnation in 2001–03.[44] We will show that developments in the United States can explain part but not all of the fluctuations in export growth. We then discuss how the predictions of the model can help explain the residual export growth. We explain the boom in exports with reference to the fire sales that occurred during the crisis, and the recent stagnation with reference to the lack of structural reform, the protracted credit crunch, and the N-sector bottlenecks they generated.

Before presenting the results, we wish to emphasize that the strict macroeconomic policies that Mexico put in place in the wake of the crisis were necessary for the extraordinary growth in exports. These policies kept the fiscal balance under control and ensured that the peso did not become overvalued in real terms.

44. We choose U.S. imports and manufacturing instead of a broader aggregate, such as U.S. GDP, because our objective is to determine an upper bound on the effect of trends in the U.S. economy on Mexican exports.

First, we investigate the link between U.S. imports and Mexican exports at a quarterly frequency over the period 1988:1–2003:2.[45] We estimate a bivariate VAR that allows for two lags. Since both series have a unit root and their growth rates are stationary, we perform our analysis using growth rates.[46]

It is incorrect to look at the correlation between the levels of two nonstationary series. In fact, a high correlation coefficient between the levels of U.S. imports and Mexican exports is meaningless. This is why it is necessary to look at growth rates when considering nonstationary series, and a vector autoregression is the appropriate tool to analyze such series.

The top left panel of figure 11, which traces the response of Mexican exports to a 1-standard-deviation shock to U.S. imports, shows that the response is equivalent to 3.5 percent of a standard deviation in the first quarter, and to 3, 2.6, and 2.2 percent in the following quarters. All of these responses are significant at the 5 percent level.

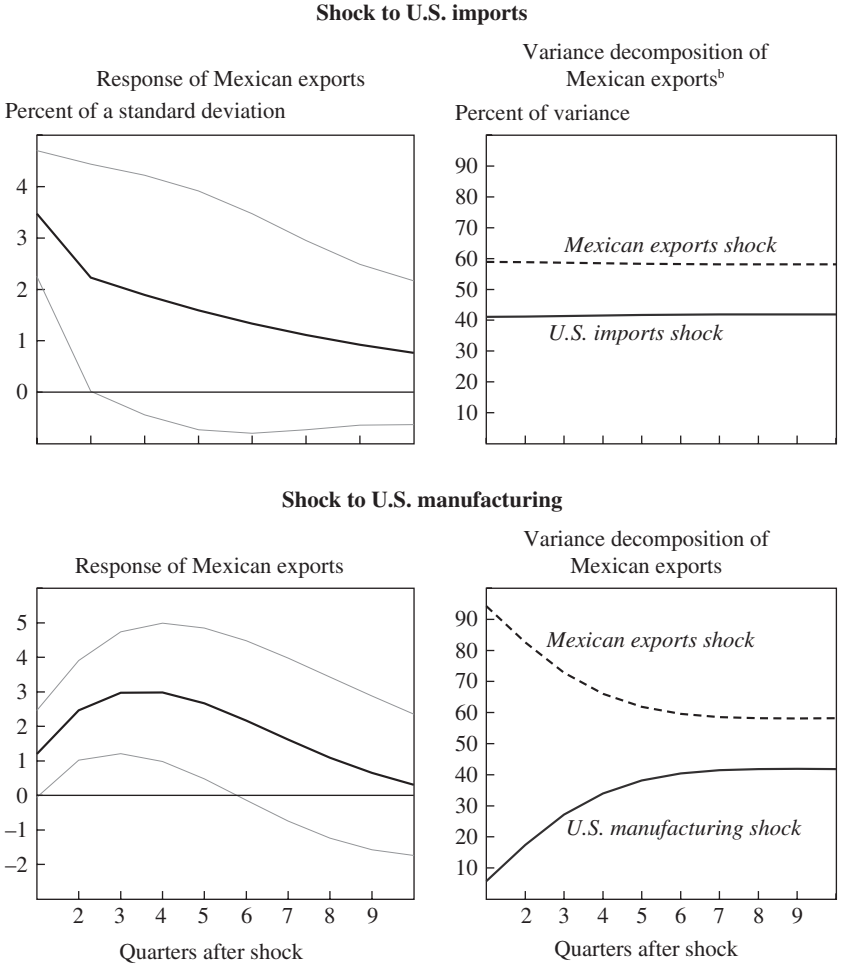
Although these impulse responses provide information on the effect of a standardized shock, they do not indicate the extent to which a given shock contributes to the total forecast error variance of Mexico's exports. To assess the relative importance of shocks to U.S. imports, we decompose the forecast error variance of Mexican exports into the part that is attributable to shocks emanating from the United States and the part attributable to shocks emanating from Mexico. The top right panel of figure 11 shows that U.S. shocks account for approximately 40 percent of the forecast error variance, and shocks from Mexico the remaining 60 percent. In other words, unexpected changes in Mexico's export growth are mainly generated by shocks to its own economy. Although statistically significant, U.S. shocks play only a secondary role.

A similar pattern emerges when we estimate the VAR using U.S. manufacturing instead of imports. The long-run effects are of similar magnitude, with shocks to U.S. manufacturing accounting for around 40 percent of the unexpected forecast error variance. However, compared with a shock to U.S. imports, it takes longer for a shock to U.S. manufacturing to fully translate into a reaction by Mexican exports.

45. An earlier starting date is not appropriate, because the two countries did not trade much before 1987.

46. We cannot reject the null hypothesis of no cointegration according to finite-sample critical values of Cheung and Lai (1993).

Figure 11. Estimated Effect on Mexican Exports of Shocks to the U.S. Economy[a]

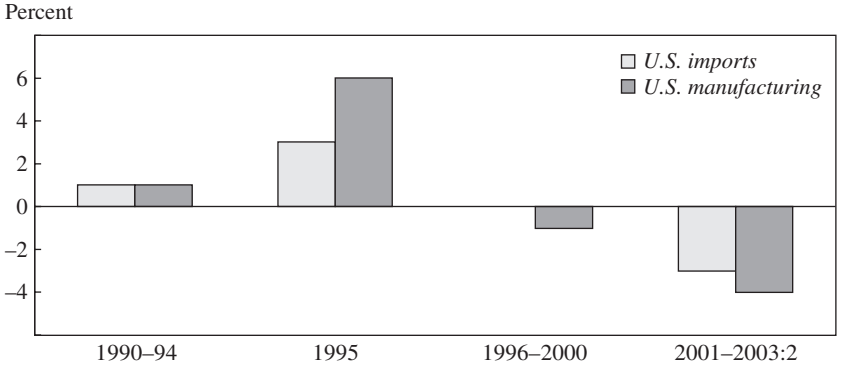


Source: Authors' calculations.

a. Effects are estimated by vector autoregressions for a 1-standard-deviation shock to U.S. imports or to output of the U.S. manufacturing sector. Shaded lines indicate the 95 percent confidence interval.

b. Shares of forecast error variance in the vector autoregression attributable to the indicated U.S. shock and of the remaining forecast variance ("Mexican exports shock").

Figure 12. Unexplained Export Growth in Mexico, 1990–2003[a]



Sources: National Institute of Statistics, Geography, and Informatics; International Monetary Fund, International Financial Statistics; and authors' calculations.

a. Average residuals from authors' vector autoregression model explaining Mexican export growth.

To illustrate what periods account for the low relative importance of U.S. shocks, we plot in figure 12 the average residuals from the VARs. The unusually high residual growth of exports in the crisis episode and the negative outliers of recent years indicate that the performance of the U.S. economy does not fully account for the skyrocketing 28 percent increase in Mexican exports during 1995, or for the 1 percent fall in exports in the last two years.

A simpler way to make the same point is to compare the growth rate of Mexican exports with those of U.S. imports and U.S. manufacturing. Table 5 shows the average annual growth rates and figure 13 the detrended growth differentials. For the comparison with U.S. imports, the largest deviations occurred during the crisis (1995), with an abnormally large growth residual of 14 percent (bottom panel), and from 2001:1 to 2003:2, with a residual of –11 percent. In fact, during some quarters the residuals are more than 2 standard deviations away from the expected value of zero. In contrast, the average residuals were relatively small in 1990–94 and 1996–2000 (1 percent and zero, respectively). A similar pattern is observed in the export growth residuals obtained in the comparison with U.S. manufacturing.[47]

47. These detrended growth differentials have the same interpretation as the residuals of an ordinary least squares regression of Mexican export growth on U.S. import growth. The slope coefficient in that regression is 0.83 and is significant at the 5 percent level, and the R^2 is 0.3. This shows that 30 percent of the total variance in Mexican exports is

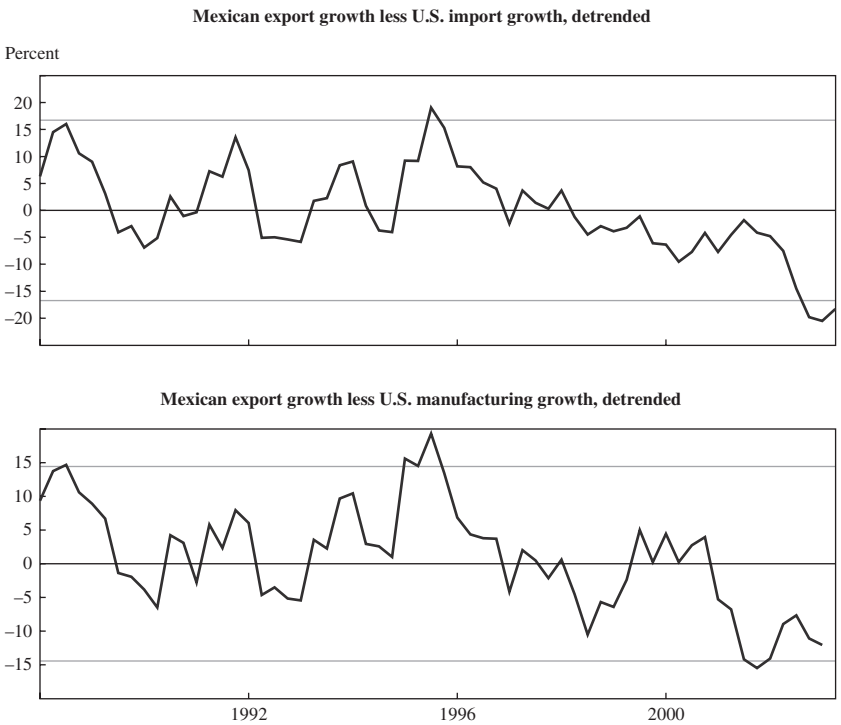
Table 5. Growth in Mexican Exports and in U.S. Manufacturing and Imports, 1990–2003[a]

Percent a year

Indicator	*1990–94*	*1995*	*1996–2000*	*2001–03[b]*
Export growth in Mexico	15	32	17	–1
Manufacturing growth in the United States	2	5	5	–2
Import growth in the United States	7	11	10	2

Source: Authors' calculations using data from INEGI and International Monetary Fund, International Financial Statistics.
a. Averages of quarter-to-quarter growth rates.
b. Through 2003:2.

Figure 13. Relating Mexican Exports to U.S. Performance, 1988–2003[a]



Source: Authors' calculations using data from National Institute of Statistics, Geography, and Informatics and International Monetary Fund, International Financial Statistics.
a. Shaded lines represent 95 percent confidence intervals.

Next we explain how the fire sales and bottlenecks generated by the credit crunch and lack of structural reform help account for these large deviations. We then provide empirical evidence in support of these effects.

Fire Sales and the Bottleneck Effect

In our model economy the real depreciation that accompanies a crisis severely affects the cash flow of N-sector firms with currency mismatches in their borrowing and lending. As a result, N-sector credit and investment fall. In contrast, access to international financial markets combined with the real depreciation allows T-sector firms to buy inputs at fire-sale prices. This leads to rapid growth of exports, T-sector output, and GDP in the wake of the crisis.

However, as we discuss in the section on the model, rapid GDP growth cannot be sustained over a long period if it is driven only by T-sector growth, because T-sector production needs inputs from the N-sector. The real depreciation and the credit crunch depress N-sector investment, which eventually leads to bottlenecks: exporters then no longer have an abundant and cheap supply of N-sector inputs. Thus, ceteris paribus, at some point export growth starts falling as competitiveness erodes.

To test whether these predictions of the model apply to Mexico, we look at the annual manufacturing survey of Mexico's National Institute of Statistics, Geography, and Informatics (INEGI), which includes medium-size and large firms in the manufacturing sector, covers more than 80 percent of manufacturing value added, and includes 206 five-digit subsectors. First we assess the importance of N-sector inputs in T-sector production, and then we contrast the behavior over time of exports that are highly dependent on N-sector inputs and of exports that are less dependent on the N-sector.

According to this survey, N-sector inputs represented on average 12.4 percent of total variable costs in the manufacturing sector over the period 1994–99. This share ranges from 5 percent in some food manufacturing subsectors to 28 percent in some chemical subsectors. Table 6 shows the shares of the main N-sector inputs used in several manufacturing subsectors that use N-sector inputs intensively. For example, the

explained by U.S. imports. Recall that the VAR showed that 40 percent of the unexpected forecast error variance is explained by developments in the United States.

Table 6. Use of Nontradable Inputs in Selected Mexican Tradable Goods Industries, 1994–99[a]

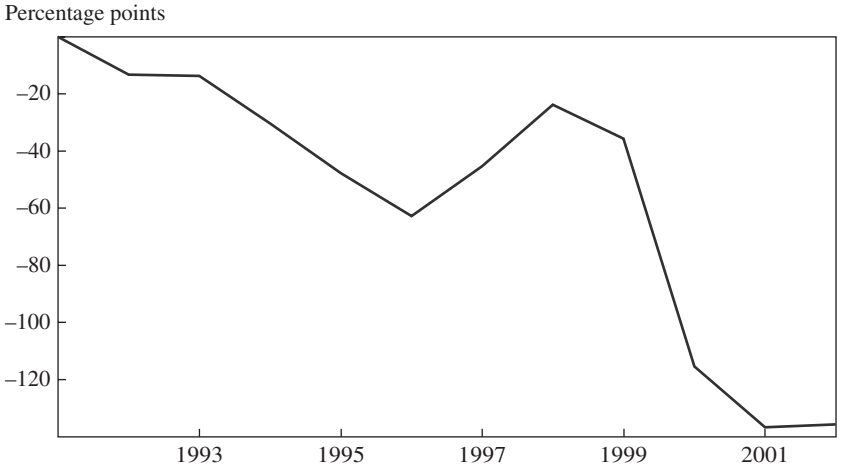
Percent of total expenses

	Input industry						
Tradable industry	*Total*	*Out-sourcing*	*Repairs and maintenance*	*Freight and transport*	*Electricity*	*Rentals and leases*	*Other*
Textiles and apparel	23.0	16.5	2.4	1.7	0.8	1.2	0.5
Paper and printing	24.8	11.5	3.5	1.1	3.1	3.3	2.3
Basic inorganic chemical products, perfumes and cosmetics, and plastic and rubber	27.7	1.1	6.8	1.0	8.2	8.2	2.4
Nonmetallic mineral products	23.4	0.3	9.5	2.0	5.6	4.9	1.0
Discs and magnetophonic tapes	22.6	4.8	8.8	1.0	1.2	4.0	2.7
Total manufacturing	12.4	2.1	3.4	2.2	1.7	1.3	1.7

Source: Annual Industrial Survey, National Institute of Statistics, Geography, and Informatics.

a. Data are for expenditures on those N-sector inputs that are part of total variable cost; they are averages over the period; investment and expenditure on fixed assets are excluded.

Figure 14. Difference in Cumulative Export Growth between Most-Nontradable-Intensive and Least-Nontradable-Intensive Sectors in Mexico, 1991–2002[a]



Source: National Institute of Statistics, Geography, and Informatics.

a. Most- and least-nontradable-intensive sectors are those manufacturing sectors that fall in the highest and lowest quintile, respectively, as measured by the proportion of nontradable inputs in their exports. Nontradable inputs are total inputs less material inputs, containers, combustibles, labor remunerations, technology transfers and royalties, and commissions on sales and other expenditures.

nonmetallic minerals products subsector devotes 9.5 percent of its expenditure to repairs and maintenance, 4.9 percent to rents and leases, 2 percent to freight and transport, 5.6 percent to electricity, and so on.

Not only are N-sector inputs a significant fraction of T-sector production, but those subsectors that are intensive in N-sector inputs display precisely the pattern that the model predicts. Figure 14 shows the ratio of manufacturing exports of the subsectors that use N-sector inputs most intensively to those that use these inputs least intensively (we call this the X-difference). The figure shows three things. First, during the lending boom period, when the N-sector was booming and investing heavily, N-sector goods were expensive and the X-difference fell. Second, after the crisis the situation reversed: in 1996–98 N-sector inputs could be bought at fire-sale prices, and the X-difference increased. Third, the recent lack of N-sector investment has generated a dramatic fall in the X-difference.

In sum, the asymmetric behavior of different export subsectors supports the view that fire sales contributed to the extraordinary export

growth in the wake of the crisis, and that the bottleneck effect has contributed to the export slowdown over the last two years. We do not rule out the possibility that other external factors, such as competing exports from China, have also contributed to the export slowdown. However, it is unlikely that such external factors could generate the asymmetric export response we have documented.

How Did Financial Fragility Emerge?

The early 1990s saw a dramatic increase in the resources available to domestic banks. In addition to the increase in capital inflows, the consolidated public sector balance swung from a deficit of 8 percent of GDP in 1987 to a surplus of 1 percent in 1993, and credit from the banking system to the public sector fell from 14 percent of GDP to 2 percent.

Although bank liabilities were often denominated in foreign currency, the income streams that serviced those liabilities were ultimately denominated in domestic currency. Sometimes the banks lent in pesos, and when they lent in dollars, a large share of bank credit went to households and N-sector firms, whose products were valued in pesos. In both cases the banks were incurring the risk of insolvency through currency mismatch.[48] As is well known, currency mismatch was also present on the government's books through the famous dollar-denominated *tesobonos*.

Agents both in the government and in the private sector understood that they were taking on credit risk. However, as the model explains, taking on such risk was individually optimal because of the presence of systemic bailout guarantees and the rosy expectations generated by the prospect of NAFTA. These expectations may have been well founded, but unfortunately in 1994 several negative shocks to expectations befell the country. The first day of the year brought the news of the revolt in the southern state of Chiapas. Then March witnessed the assassination of the leading presidential candidate, Luis Donaldo Colosio. Although presidential elections took place in July without civil unrest, and Ernesto Zedillo won with an ample majority, a full-blown crisis erupted at the end of 1994, a few weeks after he took office.

48. The share of bank credit allocated to the N-sector reached 63 percent in 1994. Martínez and Werner (2002b) and Tornell and Westermann (2003) document the existence of currency mismatch.

In terms of the model, March 1994 marks the date of the crisis, because it is the "tipping point" that marks a reversal of capital inflows. Instead of letting the peso depreciate, the monetary authorities responded by letting reserves fall.[49] Central bank reserves net of *tesobonos* fell from $27 billion in February to $8 billion in April. They stood at negative $14 billion at the end of 1994.

What Accounts for Mexico's Credit Crunch?

As mentioned earlier, Mexico's credit crunch is an outlier relative to that experienced by the typical postcrisis MEC. Not only did real credit suffer a sharp fall during the crisis, but it continued falling until 2002. Credit growth resumed in 2002, but it again turned negative in the first quarter of 2003. This path of credit is all the more puzzling when one considers that the share of bank assets owned by foreigners increased from 6.4 percent in 1994 to 88 percent in 2001 (figure 15), and the foreign banks are arguably well capitalized.

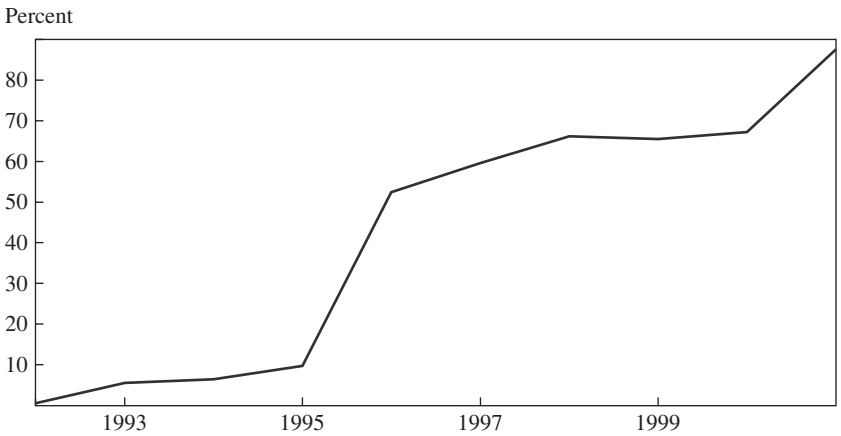
Two important factors have contributed to the deepening credit crunch: the deterioration in contract enforceability and the policy response to the nonperforming loans (NPLs) problem. We consider each in turn.

In the wake of the crisis, many borrowers stopped servicing their debts, and this noncompliance went unpunished by the authorities. As a result, a *cultura de no pago* (culture of nonpayment) developed: borrowers that could have paid chose not to pay. This deterioration in law enforcement has manifested itself in other ways, such as an increase in tax evasion and in crime generally. Figure 16 shows that whereas tax collection improved and crime fell through the mid-1990s, both have deteriorated since. In terms of our model, this pattern implies a decline in the coefficient of enforceability, which induces a fall in the credit multiplier and in the investment of credit-constrained firms.

Because of the currency mismatch, all banks were de facto bankrupt in the wake of the crisis. However, regulatory discipline was not immediately established: only a small share of NPLs were officially recognized. The banks' bailout took the form of exchanging the officially recognized NPLs for ten-year government bonds that paid interest but could not be traded.[50] This piecemeal rescue program, which was meant

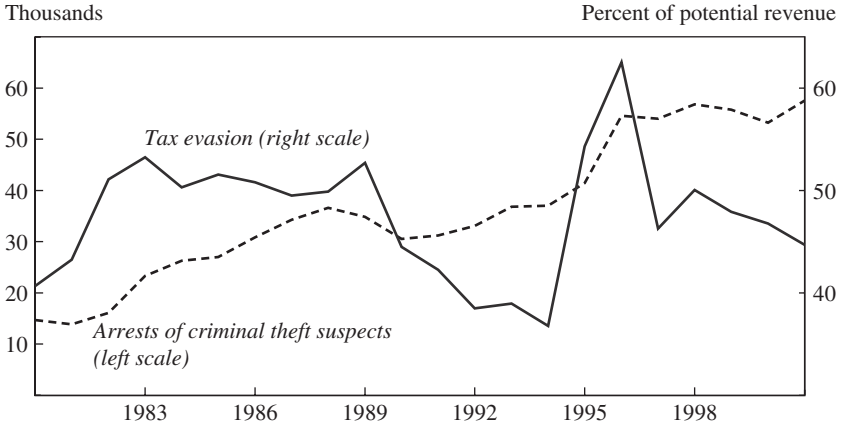
49. See, for instance, Lustig (2001) and Sachs, Tornell, and Velasco (1996b).
50. For an analysis of the banking problem see Krueger and Tornell (1999).

Figure 15. Share of Assets in the Mexican Banking System Held by Foreigners, 1992–2001



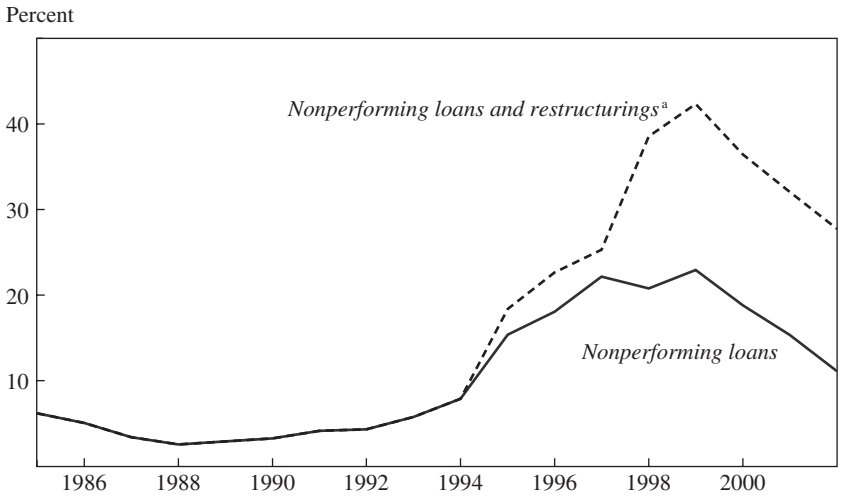
Source: *Bank Failure Management*, prepared by Secretaría de Hacienda y Crédito Público for the Asia Pacific Economic Cooperation, 2001.

Figure 16. Measures of Law Enforcement in Mexico, 1980–2001



Source: Sistema Municipal de Bases de Datos, National Institute of Statistics, Geography, and Informatics.

Figure 17. Nonperforming Loans as a Share of Total Corporate Lending in Mexico, 1985–2002[a]



Source: Banco de México.
a. Data for nonperforming loans did not include restructured loans prior to 1995.

to be temporary, soon became an open-ended bailout mechanism.[51] Despite rapid GDP growth, the share of NPLs in total loans kept rising, from 15 percent in 1995 to 21 percent in 1998, before gradually declining. During this period banks were not making new loans but were making profits because they were receiving interest income on the government bonds they had received in exchange for their NPLs.

The increased cost of the rescue package is associated with the fact that banks were saddled with nonrecognized de facto NPLs (that is, evergreen accounts) and failed to increase their capital in order to make new loans (figure 17).[52] The quality of the portfolio deteriorated over time as moral hazard problems developed and the accrued interest of the evergreen accounts had to be capitalized.

51. Notice that this program is different from the systemic guarantees we consider in the model below. Under the latter, bailouts are not granted on an idiosyncratic basis, but only if a systemic meltdown takes place.

52. Evergreen accounts are those in which the bank lends the debtor the principal plus interest that the debtor was supposed to have repaid, and these transfers are counted as "loans."

Over time several measures have been taken to solve the banking problem. First, in 2000 the bankruptcy and guarantee laws were reformed so as to limit ex post judicial discretion in the disposition of loan collateral and in the resolution of insolvent firms. However, given certain implementation problems and the limited power under the Mexican constitution of creditors to exercise their collateral rights, it is not yet clear whether the reforms will lead in practice to better contract enforceability. Second, key loopholes in bank accounting have been eliminated. Third, part of the debt overhang problem has been resolved (mainly the smaller debts) through the Punto Final program. However, unresolved problems remain in the areas of judicial reform and the resolution of large debts.

Sectoral Asymmetries: What Do Microlevel Data Say?

The existence of sectoral asymmetries in financing opportunities is a key element in our theoretical argument, as well as in our account of the Mexican experience. Here we will show that, in Mexico, T-sector firms are on average larger than N-sector firms and have better access to international financial markets. We will also show that T-sector firms were not as hard hit by the credit crunch as N-sector firms.

To establish these facts we analyze two Mexican microeconomic data sets: the first consists of data on firms listed on the Mexican stock market (the Bolsa Mexicana de Valores, or BMV), and the second is the economic census. The BMV set contains only those firms that issue either bonds or equity (310 firms), whereas the census includes all firms in the economy (2,788,222 firms).

As table 7 shows, the BMV set contains only large firms, whereas the vast majority of firms in the economy are small and medium-size. Moreover, although the BMV set contains both N- and T-sector firms, it is more representative of the T-sector than of the N-sector. The bias is greater for the N-sector than for the T-sector both in terms of the distribution of fixed assets (figure 18) and in terms of sales. For instance, as table 7 also shows, the sales of large N-sector firms constitute only 12 percent of economy-wide N-sector sales, according to the census of 1999, whereas the corresponding share for large T-sector firms is 64 percent (excluding financial firms in both cases).

Because the BMV set is biased toward the T-sector, and firms in this set are the only ones that issue bonds and equity internationally, it follows

Table 7. Mexican Firms in Tradables and Nontradables Sectors by Firm Size, 1999[a]

	Economic Census					
	Number of firms		*Share of sector sales (percent)*		*BMV-listed firms (number)*	
Firm size	*Nontradable*	*Tradable*	*Nontradable*	*Tradable*	*Nontradable*	*Tradable*
Small[b]	2,371,468	329,242	56	10	0	0
Medium[c]	65,630	12,054	32	26	0	0
Large[d]	4,239	5,589	12	64	110	200

Sources: Economic Census of Mexico and Bolsa Mexicana de Valores.

a. Tradables sectors include primary goods and manufacturing. Nontradables sectors include construction, trade, telecommunications, transportation, hotels and restaurants, real estate, and other services. Financial services, electricity, gas, and water are not included in nontradables. For those firms entering between 2000 and 2002 or exiting between 1991 and 1999, data are for the year closest to 1999 for which data on total assets were available. The Bolsa Mexicana de Valores is the principal Mexican stock exchange.

b. Fixed assets less than $148,000 in 1994 dollars.

c. Fixed assets greater than $148,000 but less than $2,370,000 in 1994 dollars.

d. Fixed assets greater than $2,370,000 in 1994 dollars.

that the T-sector has better access to international financial markets than the N-sector. To the extent that Mexico is typical of other MECs, this fact provides an important warning. In contrast to HECs, in MECs stock market-based data sets (such as Datastream or Worldscope) do not reflect economy-wide behavior but rather are biased toward the T-sector.[53]

To get an idea of the extent to which the crisis affected the access of BMV firms to external financing, consider the ratio of issuance of long-term bonds and equity to the stock of bonds and equity. Table 8 shows that this ratio jumped from an average of 1.6 percent in 1991–94 to 4.7 percent in 1996–97.[54] This jump indicates that BMV firms were not hard hit by the credit crunch.

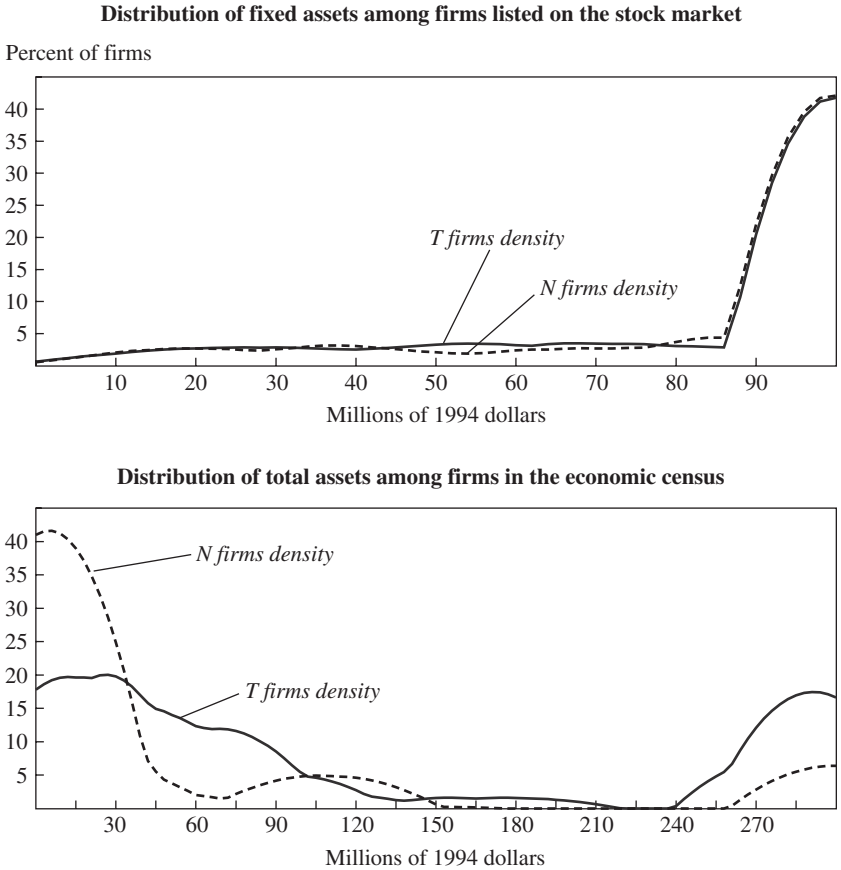
Another fact that points in the same direction is that there was no significant increase in bankruptcies among BMV firms. As table 9 shows, 6 percent of firms exited the BMV in 1995, and 3 percent in 1996. The average rate of exit over the entire sample period was 3.6 percent, with a standard deviation of 3.5 percent. The increase in bankruptcies in 1995 was therefore not statistically significant.

The availability of external finance for the BMV firms contrasts with the protracted fall in the nationwide credit-to-GDP ratio over 1995–2001.

53. Tornell and Westermann (2003), using survey data from the World Bank, find a similar sectoral asymmetry across MECs.

54. New equity issues are typically placed in New York through American depository rights (ADRs).

Figure 18. Size of Tradables and Nontradables Sector Firms[a]



Source: Banco de México.
a. Kernel densities, Epanechnikov, $h = 90{,}000$.

The reason is that the BMV firms shifted away from domestic bank credit in the wake of the crisis. This shift is reflected in the increase in the share of foreign-denominated debt from an average of 35 percent of the total in 1990–94 to 45 percent during the credit crunch period (1996–2000; table 10). Since the BMV set is biased toward the T-sector, this contrast in financing opportunities explains why T-sector production did not fall so sharply in the wake of the crisis, and why GDP recovered so fast.

Table 8. Issuance of Long-Term Bonds and Equity by Firms Listed on the Mexican Stock Market, 1991–2001[a]

Percent of outstanding stock of bonds plus equities

Year	*Long-term bonds*[b]	*Equity*	*Total*
1991	0.5	0.4	0.9
1992	1.7	0.2	2.0
1993	2.0	0.2	2.2
1994	1.1	0.1	1.3
1995	0.5	0.0	0.5
1996	3.8	0.0	3.8
1997	5.0	0.7	5.8
1998	3.0	0.0	3.0
1999	1.1	0.3	1.4
2000	3.1	0.0	3.2
2001	2.0	0.0	2.0

Source: Bolsa Mexicana de Valores.

a. Data are averages for all nonfinancial firms listed on the Bolsa Mexicana de Valores for which balance sheet data were available. Numbers may not sum to totals because of rounding.

b. Bonds with maturity of one year or longer.

Table 9. Entry and Exit from the Mexican Stock Market, 1990–2002

Percent of listed firms[a]

Year	*Firms entering*	*Firms exiting*[b]
1990	3.6	0.0
1991	16.4	1.7
1992	7.5	12.0
1993	10.2	3.9
1994	11.1	6.7
1995	2.1	6.4
1996	8.1	3.0
1997	11.2	3.5
1998	1.9	5.8
1999	0.7	1.4
2000	2.7	2.1
2001	0.7	3.4
2002	2.2	0.0

Source: Bolsa Mexicana de Valores.

a. Listed firms include some privately held firms that have issued corporate bonds.

b. Firms that left the stock market or that were suspended and remained suspended as of 2003.

Table 10. Foreign Liabilities of Firms Listed on the Mexican Stock Market, 1990–2002

Percent of total liabilities

Year	*All firms*	*Firms in tradables sectors*	*Firms in nontradables sectors*
1990	31.6	34.0	23.8
1991	32.9	36.5	23.7
1992	32.7	36.0	25.0
1993	36.0	39.3	29.3
1994	43.9	50.5	30.6
1995	46.4	53.5	34.2
1996	44.8	52.7	32.6
1997	47.4	54.8	37.2
1998	48.4	56.6	37.8
1999	44.9	52.1	36.4
2000	45.4	51.8	37.0
2001	44.4	52.1	35.6
2002	40.6	46.7	33.1

Source: Bolsa Mexicana de Valores.

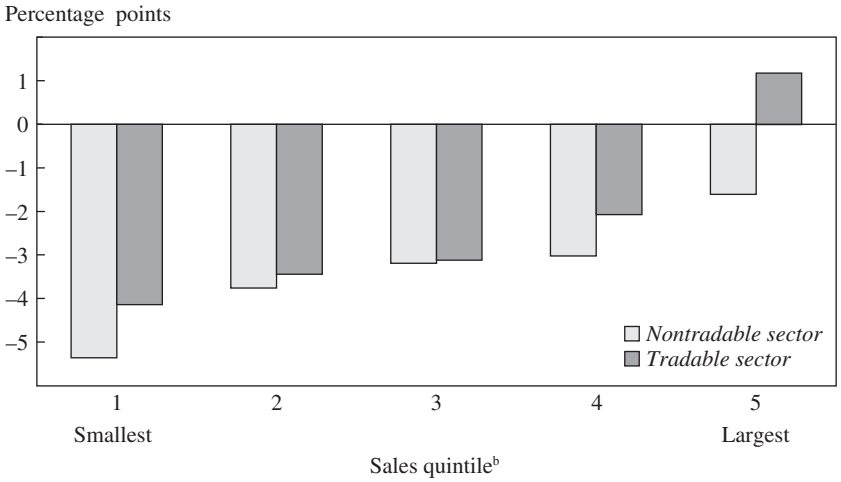
Because the economic census does not provide data on the financing of firms, we look instead at the behavior of investment. We group the observations into quintiles and compute the change in the investment rate between 1994 and 1999.[55] Figure 19 shows that, within each size class, the investment rate fell more in the N-sector than in the T-sector firms. Furthermore, the quintile that contains the largest T-sector firms is the only group that experienced an increase in the investment rate. Table 11, which reports the average investment rate across all size classes, shows that in 1994, before the crisis, both sectors had essentially the same investment rate (about 7 percent). In contrast, in 1999 the investment rate of the N-sector was almost 1 percentage point lower than that in the T-sector (3.7 percent versus 4.6 percent).

To see whether the sectoral asymmetry we observe across the quintile of largest firms in figure 19 is associated with an asymmetry in financing opportunities, we run a standard cash-flow regression similar to that by Steven Fazzari, Glenn Hubbard, and Bruce Petersen.[56] We regress the

55. Because of confidentiality requirements, each observation represents not a single firm but a group of firms. Each group contains firms that are similar in size, are in the same subsector, and are located in the same geographical area. See the appendix for details.

56. Fazzari, Hubbard, and Petersen (1988).

Figure 19. Change in the Investment Rate in Mexico by Firm Size, 1994–99[a]



Sources: National Institute of Statistics, Geography, and Informatics and authors' calculations.
a. Investment rate is measured as net investment in fixed assets divided by total fixed assets.
b. Sales are total revenue derived from the firm's own activity.

investment rate on the change in sales, on cash flow, and on cash flow interacted with a dummy that equals 1 for nonexporting firms during the years 1995–97 or 1995–98. Following Fazzari, Hubbard, and Petersen, we interpret a positive effect of cash flow on investment as an indication of financing constraints (the change in sales controls for investment opportunities). We estimate the regression including fixed effects and using a generalized least squares estimator. The positive coefficient on the interaction dummy in table 12 implies that, in the wake of the crisis, cash flow was a more important determinant of investment for nonexporters than for exporters. This means that nonexporters were more credit con-

Table 11. Investment Rates of Firms in Tradables and Nontradables Sectors, 1994 and 1999

Percent of capital stock in preceding year, and ratio

Sector	*1994*	*1999*
Nontradables	7.1	3.7
Tradables	6.9	4.6
Ratio of nontradables to tradables investment rate	1.03	0.81

Source: Authors' calculations using data from the Mexican Economic Census.

Table 12. Regressions Explaining Investment Rates with Cash Flow and Sales[a]

Independent variable[b]	*12-1*	*12-2*
Cash flow	0.04***	0.02**
	(0.01)	(0.01)
Change in sales	0.05***	0.05***
	(0.00)	(0.00)
Cash flow interacted with crisis and nonexporter dummies[c]	0.15***	0.05*
	(0.05)	(0.03)
Summary statistics:		
No. of observations	1,430	1,592
No. of firms	328	338
Adjusted R^2	0.195	0.194

Source: Authors' regressions.

a. The regressions are estimated with fixed effects by generalized least squares and include year dummies (not reported). Standard errors are reported in parentheses. * denotes significance at the 10 percent level, ** at the 5 percent level, *** at the 1 percent level.

b. Cash flow and change in sales are expressed as a ratio to the capital stock in the previous period.

c. The crisis dummy variable equals 1 for the years 1995–97 in column 12-1 and for the years 1995–98 in column 12-2. The nonexporter dummy variable equals 1 if the firm does not export.

strained in the wake of the crisis. This effect is significant at the 5 percent level in 1995–97 and at the 10 percent level in 1995–98.

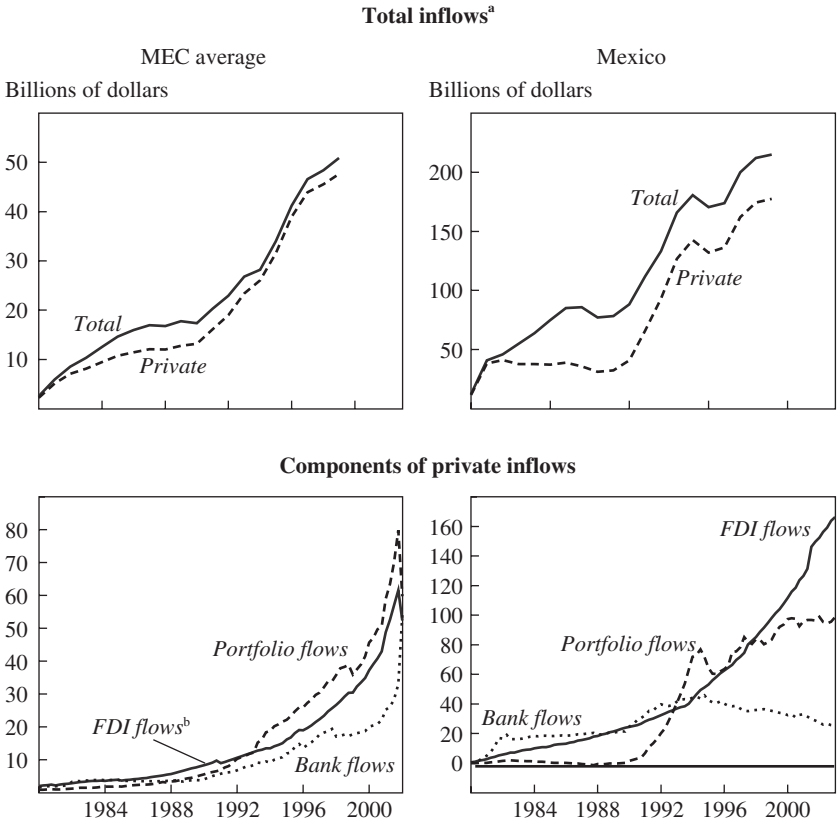
Capital Flows

During the last two decades, capital inflows to MECs have increased enormously, and so has the importance of private flows (figure 20). In the average MEC the share of private flows has increased from 60 percent in the mid-1980s to more than 90 percent by the end of the 1990s. In Mexico these shares are 40 and 80 percent, respectively.

Mexico falls in the midrange of MECs in terms of capital inflows. Between 1980 and 1999 net capital inflows to Mexico were on average equivalent to 3.3 percent of GDP (rising to 4.3 percent after liberalization). This is a remarkably high number, given that Mexico liberalized only in 1989 and experienced a crisis in 1994. During the same period the comparable ratio for Korea was 2 percent, and that for Thailand was 3.9 percent (4.9 percent after liberalization). The ratio for Chile was 8.1 percent.

FDI is considered a "good" form of capital inflow, whereas bank flows are considered "bad" because they are foreign loans to domestic banks. Such loans are risky because of the currency mismatch. In Mexico the share of bank flows peaked in 1994 at about 25 percent of cumulative

Figure 20. Cumulative Capital Inflows in Medium Contract Enforceability Countries and in Mexico, 1980–2001

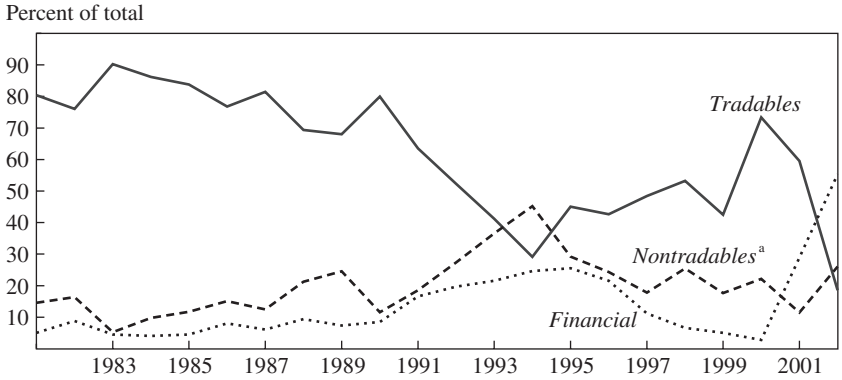


Sources: International Monetary Fund, International Financial Statistics; and Banco de México.
a. Sample data are available for total capital inflows during the period 1980–99 only.
b. Bank flows to commercial and development banks.

capital inflows since 1980.[57] This share has been declining ever since (figure 20). In contrast, the share of FDI in cumulative capital inflows has increased gradually, from 35 percent in 1980 to 57 percent in 2002, but at a faster pace after the tequila crisis. The impressive increase in FDI in the wake of the crisis can be considered one tangible effect of NAFTA.

57. This share can be viewed as a lower bound on inflows to the banking sector, because some banks also received FDI and portfolio flows.

Figure 21. FDI in Mexico by Sector, 1980–2001



Source: Banco de México.
a. Excluding financial services.

Several observers have noted that one reason why financial liberalization has led to financial fragility is that an important share of capital inflows takes the form of bank flows. Many have argued that the greater the share of inflows in the form of FDI and the lower the share of bank credit, the lower is financial fragility. To evaluate this argument we must keep in mind a key fact overlooked by the literature.

Stylized fact 5. *The lion's share of FDI is directed mostly to the T-sector or to financial institutions.*

This is illustrated in figure 21. Because the nonfinancial N-sector receives a small share of FDI, bank flows remain the main source of external finance for most N-sector firms. Since this group of firms is financially constrained, a reduction in risky bank flows and credit may mean that N-sector investment and growth will fall. As there are productive linkages throughout the economy, the unconstrained T-sector will also be negatively affected. Hence it is possible that the net effect of banning risky bank flows is to reduce long-run GDP growth. Here again we see that, in the presence of credit market imperfections, a policy that reduces financial fragility can, as a by-product, lead to a fall in growth.[58]

58. We do not analyze here how the new theories of FDI account for the stylized fact that the largest share of nonfinancial FDI is allocated to the T-sector. Vertical motives for FDI involve fragmentation of production across countries (Markusen, 2002). Horizontal

Lessons and Conclusions

We have shown that trade liberalization is typically followed by financial liberalization, which leads to lending booms and occasional financial crises. On net, however, both trade and financial liberalization have led to faster long-run growth across the set of countries with functioning financial markets.

We have presented a model that establishes a causal link from liberalization to growth. Trade liberalization promotes efficiency and growth mainly in the tradables sector. Financial liberalization adds even more to growth because it eases financing constraints, leading to an increase in investment by financially constrained firms, most of which are in the nontradables sector. However, the easing of financing constraints takes place through the undertaking of credit risk, which leads to financial fragility and occasional crises.

Mexico, a prominent liberalizer, failed to attain stellar GDP growth in the 1990s, and since 2001 its GDP and exports have stagnated. We have argued that this does not imply that liberalization is bad for growth. In fact, the benefits of liberalization can be seen in the extraordinary growth of exports and FDI during the 1990s. The key to the Mexican puzzle lies in the lack of structural reform after 1995 and in Mexico's response to crisis: the credit crunch in Mexico has been far deeper and far more protracted than in the typical country. The credit crunch has hit the N-sector especially hard and has generated bottlenecks, which have contributed to the recent fall in exports. In sum, the lack of spectacular growth in Mexico cannot be blamed on wrongheaded reforms in the early 1990s, but on the lack of further judicial and structural reform after 1995.

We conclude with a list of nine lessons that derive from the experience of countries with functioning financial markets, and of Mexico in particular. First, although several observers have claimed that financial liberalization is not good for growth because of the crises associated with it, this

motives for FDI imply that firms invest abroad when the gains from avoiding trade costs outweigh the costs of maintaining capacity in a foreign country. Helpman, Melitz, and Yeaple (2003) test this theory using U.S. data and find that the least productive firms serve only the domestic market, that relatively more productive firms export, and that the most productive firms engage in FDI. A third theory, based on the role of information in driving FDI, might also help account for this fact (Mody, Razin, and Sadka, 2003).

is the wrong lesson to draw. Our empirical analysis shows that, across countries with functioning financial markets, financial liberalization leads to faster average long-run growth, even though it also leads to occasional crises. This gain in growth is over and above the gain derived from trade liberalization.

A second, closely related lesson is that the growth-enhancing financial deepening that follows liberalization is not a smooth process. Rather, it takes place through boom-bust cycles. Occasional crises are the price that has to be paid to attain faster growth in the presence of severe contract enforceability problems. The first-best solution is to implement judicial reform and improve contract enforceability. In the absence of such reforms, liberalization permits financially constrained firms to attain greater leverage and invest more, at the cost of undertaking credit risk. Credit risk creates an environment of rapid growth and financial fragility.

Third, to analyze the effects of liberalization it is not sufficient to look at aggregate data alone. Sectoral asymmetries play a key role: many tradables (T-) sector firms have access to international capital markets, whereas most nontradables (N-) sector firms are financially constrained and depend on banks for their financing. Trade liberalization and agreements such as NAFTA promote faster productivity growth in the T-sector but are of little direct help to the N-sector. Financial liberalization leads to an increase in international bank flows, which allows financially constrained firms to borrow more. Since many of these firms are in the N-sector, a currency mismatch on firms' balance sheets develops, making the economy prone to self-fulfilling crises. In short, financial liberalization generates crises in countries with contract enforcement problems because financial liberalization is associated with international lending to the N-sector.

We agree with the general view that FDI is the safest form of capital inflow. Our fourth lesson, however, is that FDI does not obviate the need for risky international bank flows. FDI goes mostly to T-sector firms and financial institutions. As a result, bank flows are practically the only source of external finance for most N-sector firms. Curtailing such risky flows would reduce N-sector investment and generate bottlenecks that would limit long-run growth. Bank flows are hardly to be recommended, but for most firms it might be that or nothing. Clearly, allowing risky capital flows does not mean that anything goes. Appropriate prudential regulation must also be in place.

Fifth, it is possible for GDP growth to recover rapidly from a crisis. Sustainable growth, however, cannot be assured unless the banking problem is fixed. Recovery in aggregate activity is typically not uniform across the economy. The tradables sector may grow strongly while the nontradables sector recuperates only sluggishly. This asymmetric response is intimately linked to a severe credit crunch that hits the N-sector particularly hard and that goes hand in hand with a steady increase in the share of nonperforming loans. The Mexican experience shows that NPLs are unlikely to disappear on their own, even if GDP growth resumes quickly. This raises the question of whether a policy under which all NPLs are recognized at once and the fiscal costs are all paid up front is preferable to a piecemeal policy.

A sixth and somewhat conjectural lesson of the Mexican experience is that long-run growth cannot be based solely on export growth. Because the T-sector depends on N-sector inputs, it is necessary that the N-sector also grow in order to attain a balanced and sustainable growth path. This requires adequate financing for domestically oriented firms and structural reform in key sectors, such as energy. From the data up to June 2003 it can be cogently argued that if there is a lack of N-sector investment over a long period, a bottleneck effect will eventually set in and block export growth, as has been observed in Mexico since 2001.

A seventh lesson is that crises are part of the growth process in financially liberalized countries with contract enforcement problems. At the "tipping point," beyond which it is unlikely that capital outflows will reverse, authorities should focus on what to do after the crisis instead of attempting to forestall the crisis. Delaying an inevitable crisis will tend to make the effects of the full-blown crisis far worse, as attested by the experiences of Mexico in 1994 and Argentina in 2001.

Finally, one can draw two lessons for empirical implementation. First, stock market microlevel data sets are not representative of the economy as a whole and overemphasize the T-sector. This is demonstrated by comparing the Mexican stock market data base with the Mexican Economic Census, which includes all firms in the economy. Second, statistical variance is not a good instrument with which to identify financial fragility. Fragility is associated with infrequent but severe crises and therefore with both high variance and negative skewness. High variance, however, may reflect high-frequency shocks, which may be exogenous or self-inflicted, for instance by bad economic policy. Negative skewness tests specifically

for infrequent crises. Our argument has shown that infrequent crises are a by-product of a rapid-growth path.

APPENDIX A

The Model

HERE WE FORMALIZE our intuitive argument and show that it is indeed part of an internally consistent story. The equilibrium will establish a causal link from financial liberalization to financial deepening to GDP growth. Also, it will show that, in the presence of credit market imperfections, the forces that generate financial deepening generate financial fragility as well. Furthermore, the equilibrium will impose restrictions on the sample of countries over which the mechanism operates and on the behavior of credit and the N-to-T output ratio.[59]

We consider a simple dynamic general-equilibrium model of an economy with two sectors: a tradables (T) sector, which produces the consumption good, and a nontradables (N) sector, which produces an intermediate good used as an input in the production of both goods. As will be seen, the fact that the N-sector demands its own goods is key for financial fragility to arise in equilibrium. The assumption that T-sector production uses N-sector inputs is key to generate the bottleneck effect that we have used to explain the recent slowdown in Mexican exports.[60]

We denote the relative price of N-sector goods (that is, the inverse of the real exchange rate) by $p_t = p_t^N/p_t^T$.[61] T-sector goods are produced using

59. The model is based on Schneider and Tornell (forthcoming) and Ranciere, Tornell, and Westermann (2003). It combines elements of the financial accelerator framework (Bernanke, Gertler, and Gilchrist, 2000) with elements of third-generation balance of payments crisis models. See, for instance, Aghion, Bachetta, and Banerjee (2000), Burnside, Eichenbaum, and Rebelo (2001), Caballero and Krishnamurthy (2001), Calvo (1998), Chang and Velasco (1998), Chinn and Kletzter (2000), Corsetti, Pesenti, and Roubini (1999), Edwards and Végh (1997), Krugman (1999), McKinnon and Pill (1999), and Tirole (2002). The model is also linked to Konrad (1992) and Sinn (1986), who link risk and growth.

60. The bottleneck effect implies that low N-sector investment hinders T-sector growth over the long run. Since the economy is small and open, the destination of T-sector goods is not important for our argument.

61. Betts and Kehoe (2002) find that, in a set of fifty-two countries over the period 1980–2000, real exchange rate variations mainly reflect changes in the relative price of

a nontradable input (d_t) according to $y_t = a_t d_t^{\alpha}$, with $\alpha \in (0,1)$. In any equilibrium it follows that T-sector output and T-sector demand for N-sector goods are, respectively,

$$\text{(A1)} \qquad y_t = a_t d_t^{\alpha}, \quad d(p_t) = (\alpha a_t / p_t)^{1/(1-\alpha)}.$$

N-sector goods are produced using N-sector goods as inputs (I_t) according to

$$\text{(A2)} \qquad q_{t+1} = \theta I_t.$$

The investable funds of an N-sector firm consist of the debt it issues (B_t) plus its cash flow (w_t). The firm's budget constraint, in terms of T-sector goods, is thus

$$\text{(A3)} \qquad p_t I_t = w_t + B_t.$$

To allow for the possibility of financial fragility, we assume that there are two one-period debt instruments: N-debt (b_t^n), which promises repayment in N-sector goods, $p_{t+1}(1 + \rho_t^n) b_t^n$, and T-debt ($b_t$), which promises repayment in T-sector goods, $(1 + \rho_t) b_t$. We can interpret T-sector debt as foreign currency-denominated and N-debt as domestic currency-denominated. As we will show, the price may take two values in equilibrium. Since firms produce N-sector goods, N-debt is a perfect hedge, whereas T-debt may be risky.

In modeling the N-sector we make two assumptions to capture the key features of MECs discussed previously. First, N-sector financing is subject to contract enforceability problems. Second, there are systemic bailout guarantees that cover lenders against systemic meltdowns. We follow Martin Schneider and Tornell and model the contract enforceability problem by assuming that firms are run by dynasties of two-period-lived managers who cannot commit to repay debt: if at time t the young manager incurs a nonpecuniary cost $h[w_t + B_t]$, then at $t + 1$ she will be able to divert all the returns to herself, provided the firm is solvent.[62]

N-sector and T-sector goods, not movements in the international relative prices of T-sector goods. Among some industrial countries the latter channel is more important (Engel, 1999).

62. Schneider and Tornell (forthcoming). Two comments are in order. First, one can think of N-sector firms as banks that lend to the N-sector. This captures the fact that, in MECs, banks are heavily exposed to the N-sector. The banking system is the channel

Lenders finance only those plans that do not lead to diversion. Thus, when deciding whether to lend, they take into account that the goal of every manager is to maximize the next period's expected profits net of diversion costs.[63]

The firm is solvent next period if revenue $q_{t+1}p_{t+1}$ is no lower than the promised debt repayment L_{t+1} plus the young manager's wage $(1 - \beta) \times p_{t+1}q_{t+1}$. In this case the old manager distributes the remaining profits, $\pi_{t+1} = \beta q_{t+1}p_{t+1} - L_{t+1}$, as a dividend to herself. To capture the costs of financial meltdowns, we assume that under insolvency a large share $1 - \mu_w$ of revenue is dissipated, the young manager gets a small amount of seed money $\mu_w p_{t+1}q_{t+1}$, with $\mu_w < 1 - \beta$, and the old manager gets zero. Lenders get L_{t+1} if a bailout is granted and zero otherwise. Since guarantees are systemic, bailouts are paid out if and only if many borrowers go bankrupt. For concreteness, we assume that there is a bailout agency that repays lenders 100 percent of what they were promised (L_t) if a majority of borrowers go bankrupt.[64]

To close the description of the economy, we note that the real exchange rate is determined by the N-sector goods market-clearing condition:

$$d_t(p_t) + I_t(p_t) = q_t(I_{t-1}). \tag{A4}$$

Since there are no exogenous shocks, the only source of risk is endogenous real exchange rate variability. As we will show, there are equilibria where equation A4 holds at two values of p_t: $\overline{p}_{t+1}$ if firms are solvent and $\underline{p}_{t+1}$ if they are insolvent.[65]

Trade and financial liberalization will mean a reduction in impediments to trade in goods and assets, rather than a shift away from autarky.

---

through which capital inflows reach the N-sector; it is also the weak link during crises. Second, the enforceability problem we have considered is just a simple way to introduce an agency problem and generate borrowing constraints.

63. Recall the distinction between unconditional and systemic guarantees we made earlier. If all debt were covered by unconditional guarantees and a bailout were granted whenever there was an idiosyncratic default, the enforceability problem would become irrelevant, and borrowing constraints would not arise in equilibrium.

64. Here we do not analyze how the subsidy implicit in the guarantees is paid for. This cost could be financed by domestic taxation if we assumed that T-sector goods were produced using a fixed factor. In this case the subsidy would be paid for by taxing this fixed factor. This is done by Ranciere, Tornell, and Westermann (2003).

65. There are multiple self-fulfilling equilibria as in Cole and Kehoe (2000) and Obstfeld (1986).

In a financially nonliberalized economy, regulations preclude agents from taking on credit risk that might lead to insolvency. Since the only source of risk is real exchange rate variability, this is equivalent to allowing agents to issue only N-sector debt. Financial liberalization eliminates these regulations, and so agents can issue both types of debt. As will be seen, liberalization will lead to a currency mismatch and lending booms that end in busts. The effects of trade liberalization are not the focus of the model. Since these reforms typically increase T-sector efficiency, they can be represented by an increase in the productivity parameter a_t in equation A1. To isolate the effects of financial liberalization, we set a_t to 1.[66]

Financing and Investment Decisions

Consider first a nonliberalized economy. Since lenders are risk neutral and the opportunity cost of capital is $1 + r$, the interest rate that they require satisfies $[1 + \rho_t^n]E_t(p_{t+1}) = 1 + r$. Furthermore, to avoid diversion by the firm, lenders impose a borrowing constraint: $(1 + r)b_t^n \leq h(w_t + b_t^n)$. If investment yields a return that is higher than the opportunity cost of capital, the firm will borrow up to an amount at which the credit constraint binds. Thus the budget constraint in equation A3 implies that credit and investment are

$$\text{(A5)} \quad b_t^n = [m^s - 1]w_t \quad I_t = m^s \frac{w_t}{p_t}, \quad \text{where } m^s = \frac{1}{1 - h\delta}, \delta \equiv \frac{1}{1 + r}.$$

Notice that a necessary condition for borrowing constraints to arise is $h < 1 + r$. If h, the index of contract enforceability, were greater than the cost of capital, it would always be cheaper to repay debt than to divert. Thus lenders will not impose a ceiling on the amount they are willing to lend and agents will not be financially constrained. This is why, in the empirical part of the paper, we differentiate high-h from low-h countries.

66. Clearly, in the real world financial liberalization opens the possibility for agents to take on credit risk in many other ways than by just allowing them to choose a risky debt instrument. Here we capture this idea in a parsimonious way that allows us to obtain closed-form solutions, which in turn allows us to make it clear why, in an economy with credit market imperfections, financial liberalization leads to faster growth only if it leads to fragility.

Consider now a liberalized economy. Firms can now choose between N- and T-debt. If there is enough real exchange rate variability, T-debt is risky and might lead to insolvency: $\pi(\underline{p}_{t+1}) = \beta \underline{p}_{t+1} q_{t+1} - (1+\rho_t) b_t < 0$. A firm might nonetheless choose T-debt and risk insolvency because risky T-debt is cheaper than safe N-debt. To see why, suppose for a moment that tomorrow's real exchange rate can take on two values. With probability u it takes an appreciated value $(\overline{p}_{t+1})$ that leaves every firm solvent, whereas with probability $1 - u$ it takes a depreciated value $(\underline{p}_{t+1})$ that makes all N-sector firms go bankrupt and generates a crisis. Since lenders constrain credit to ensure that borrowers will repay in the no-crisis state, it follows that in the no-crisis state debt is repaid in full and there is no bailout. Meanwhile, in the crisis state there is bankruptcy, and each lender receives a bailout equal to what he was promised. Thus the interest rate on T-debt is $1 + \rho_t = 1 + r$, whereas that on N-debt is $1 + \rho_t^n = (1 + r)/[u\overline{p}_{t+1} + (1-u)\underline{p}_{t+1}]$. It follows that choosing T-debt over N-debt reduces the cost of capital from $1 + r$ to $[1 + r]u$. Lower expected debt repayments, in turn, ease the borrowing constraint as lenders will lend up to an amount that equates $u[1 + r]b_t$ with $h[w_t + b_t]$. Therefore credit and investment are

$$\text{(A6)} \qquad b_t = [m^r - 1]w_t \quad I_t = m^r \frac{w_t}{p_t}, \quad m^r = \frac{1}{1 - u^{-1}h\delta}.$$

By comparing equation A6 with equation A5 we obtain the following result.

Result 1. *In the presence of systemic bailout guarantees, taking on credit risk allows agents to reduce the expected value of debt repayments, which eases borrowing constraints and increases the investment multiplier:* $m^r > m^s$.

This increase in leverage is possible because systemic guarantees mean that, in a crisis, lenders expect to be bailed out. The fact that T-debt is cheaper than N-debt does not imply that agents will always be willing to issue T-debt. This is because, with probability $1 - u$, T-debt will result in bankruptcy for a borrower. One can show that it is individually optimal to choose T-debt if crises are rare events and there is enough real exchange rate variability:

$$\text{(A7)} \qquad \frac{\beta\theta\overline{p}_{t+1}}{p_t} \geq \frac{1}{\delta} > h > \frac{\beta\theta\underline{p}_{t+1}}{p_t}.$$

This condition ensures that, in the good state, returns are high enough to make the production of N-sector goods profitable, and that in the bad state there is a critical mass of insolvencies so that lenders will be bailed out.[67] Next we investigate when it is that currency mismatches generate price sequences that satisfy the condition in equation A7.

Equilibria

In the two economies we have considered, investment is given by $I_t = m_t[w_t/p_t]$, and cash flow equals the representative manager's wage: $w_t = [1 - \beta_t]p_t q_t$, where β_t equals β under solvency and μ_w under insolvency. Thus the market-clearing condition in equation A4 implies that in any equilibrium

$$\text{(A8)} \qquad I_t = \phi_t q_t, \quad \phi_t = [1-\beta_t]m_t,$$

where the investment multiplier m_t can take the value m^s or m^r. Combining equation A8 with equations A1 and A2, we have that, in a symmetric equilibrium, N-sector output, prices, and T-sector output evolve according to

$$\text{(A9)} \qquad q_t = \theta\phi_{t-1}q_{t-1}$$

$$\text{(A10)} \qquad p_t = \alpha[q_t(1-\phi_t)]^{\alpha-1}$$

$$\text{(A11)} \qquad y_t = [q_t(1-\phi_t)]^{\alpha} = [(1-\phi_t)/\alpha]p_t q_t.$$

In a nonliberalized economy the share of N-sector output that the N-sector commands for investment purposes is $\phi^s = (1 - \beta)/(1 - h\delta)$ during every period. Thus there exists an equilibrium in such an economy if and only if two conditions hold: first, that the degree of contract enforceability satisfies $h < \overline{h} = \beta\delta^{-1}$ so that ϕ_t is less than 1; and second, that N-sector productivity satisfies $\theta > \underline{\theta} = [\delta\beta(\phi^s)^{\alpha-1}]^{-1/\alpha}$. so that the production of N-sector goods has a positive net present value $(\beta\theta p_{t+1})/p_t \geq \delta^{-1}$.

67. For a derivation of this result see Schneider and Tornell (forthcoming).

In a liberalized economy there are two equilibria. The safe one we have just characterized, where agents choose not to issue T-debt. There is also a risky equilibrium, which is composed of lucky paths punctuated by crises. (An economy is on a lucky path at time t if there was no crisis either at $t-1$ or at t.) Along a lucky path of this equilibrium, all debt is denominated in T-sector goods, and lenders will be bailed out in the next period if a majority of firms go bust. Since the debt burden is not indexed to p_t, there are two market-clearing prices. At the high price, firms are solvent and their cash flow is $[1-\beta]\bar{p}_t q_t$. Thus $\phi_t = (1-\beta)m^r$. However, at the low price N-sector firms are insolvent, and their cash flow is only $\mu_w \underline{p}_t q_t$. Moreover, it can be shown that when $p_t = \underline{p}_t$, leverage is too low for fragility to arise and the real exchange rate to take on two values at $t+1$. Thus, at the time of the crisis, agents find it optimal to issue N-debt, and the investment share is $\phi_t = \mu_w m^s$.

Risk taking resumes in the period after the crisis. Therefore the path of N-sector investment is

$$\text{(A12)} \qquad I_t = \phi_t q_t, \quad \phi_t = \begin{cases} \phi^l = \dfrac{1-\beta}{1-u^{-1}h\delta} & \text{if } p_t = \bar{p}_{t+1} \\ \phi^c = \dfrac{\mu_w}{1-h\delta} & \text{if } p_t = \underline{p}_{t+1}. \end{cases}$$

The sequence $\{q_t, p_t, y_t,\}$ is then determined by using equation A12 to replace ϕ_t in equations A9 through A11. One can show that if crises are rare events, there are thresholds for the degree of contract enforceability and for N-sector productivity, such that if $h \in (\underline{h}, \bar{h})$, and $\theta \in (\underline{\theta}, \bar{\theta})$, returns satisfy equation A7, and thus a risky equilibrium exists. Notice that $h < \bar{h}$ and $\theta > \underline{\theta}$ ensure that when crises are rare events, investment is profitable. Meanwhile, $\theta < \bar{\theta}$ and $h > \underline{h}$ ensure that firms with T-debt go bankrupt in the bad state, and that the fall in cash flow is translated into a large fall in credit and N-sector investment, so that the fall in prices is validated. This establishes the second result.

Result 2. *Financial liberalization increases investment in the financially constrained sector, but only if it makes the economy financially fragile and agents find it profitable to take on credit risk. This occurs only if the degree of contract enforceability satisfies* $h \in (\underline{h}, \bar{h})$.

Notice that no exogenous shocks are necessary for a crisis to occur; a shift in expectations is sufficient. A crisis can occur whenever each firm expects that others will not undertake credit risk, so that there is a reversion to the safe equilibrium. The key to having multiple market-clearing prices is that part of the N-sector's demand comes from the N-sector itself. Thus, when the price falls below a cutoff level and N-sector firms go bankrupt, the investment share of the N-sector falls (from ϕ^l to ϕ^c). This, in turn, reduces the demand for N-sector goods, validating the fall in the price.

We emphasize that the interaction of contract enforceability problems and systemic guarantees creates the fragility required for self-fulfilling crises to occur. If there were no guarantees, agents would not be willing to take on credit risk to claim the implicit subsidy, and currency mismatches would not arise. Costly enforceability of contracts would still imply that the N-sector can grow only gradually. However, there would be no endogenous force that makes a boom end in a crisis. Alternatively, if there were only guarantees but no enforceability problems, neither borrowing constraints nor balance sheet effects would arise. Thus N-sector investment would not be constrained by its cash flow.

GDP Growth and Financial Fragility

We are now ready to rationalize the link between growth and fragility. Since N-sector goods are intermediate inputs, whereas T-sector goods are final consumption goods, GDP equals the value of N-sector investment plus T-sector output: $\text{GDP}_t = p_t I_t + y_t$. It then follows from equations A8 through A11 that

$$\text{(A13)} \qquad gdp_t = y_t + p_t \phi_t q_t = q_t^{\alpha} Z(\phi_t) = y_t \frac{Z(\phi_t)}{[1-\phi_t]},$$

$$Z(\phi_t) = \frac{1-[1-\alpha]\phi_t}{[1-\phi_t]^{1-\alpha}}.$$

As is evident, the key determinants of growth in GDP are the technological coefficient in T-sector production (a_t) and the share of N-sector output invested by the N-sector (ϕ_t). In order to isolate the effects of financial liberalization, we have set a_t to 1.

In a nonliberalized (NL) economy the investment share ϕ_t is constant and equal to ϕ^s. Thus GDP and T-sector output grow at a common rate:

$$1+\gamma^{NL}=\frac{gdp_t}{gdp_{t-1}}=\frac{y_t}{y_{t-1}}=(\theta\phi^s)^{\alpha}. \tag{A14}$$

Absent technological progress in the T-sector, N-sector growth is the force driving growth in both sectors. As the N-sector expands, N-sector goods become more abundant and cheaper, allowing the T-sector to expand production. This expansion is possible if and only if N-sector productivity (θ) and the N-sector investment share (ϕ^s) are high enough so that credit and N-sector output can grow over time: $B_t/B_{t-1} = q_t/q_{t-1} = \theta\phi^s > 1$.[68]

A liberalized economy goes through a succession of lucky paths punctuated by crisis episodes. Since along a lucky path the investment share equals ϕ^l, equation A13 implies that the common growth rate of GDP and T-sector output is $1 + \gamma^l = (\theta\phi^l)^{\alpha}$. A comparison of γ^l and equation A14 reveals that, as long as a crisis does not occur, growth in a liberalized economy is faster than in a nonliberalized one. In the presence of systemic guarantees, credit risk allows financially constrained N-sector firms to borrow and invest more than in a nonliberalized economy ($\phi^l > \phi^s$). Since there are sectoral linkages ($\alpha > 0$), this increase in the N-sector's investment share benefits both the T- and the N-sectors.

Because self-fulfilling crises occur with probability $1 - u$, and during a crisis the investment share falls from ϕ^l to $\phi^c < \phi^s$, the fact that $\gamma^l > \gamma^{NL}$ does not imply that financial liberalization leads to faster mean GDP growth. The reduction in the investment share comes about through two channels: first, N-sector firms go bankrupt and their cash flow collapses, as captured by $\mu_w/(1 - \beta)$; second, leverage falls because firms cannot take on credit risk, indexed by $(1 - h\delta)/(1 - h\delta u^{-1})$. It follows from equation A13 that, in a crisis episode that lasts two periods, the mean crisis growth rate is $1 + \gamma^{cr} = \theta^{\alpha}(\phi^l\phi^c)^{\alpha/2}$. As can be seen, variations in GDP growth generated by real exchange rate changes at τ and $\tau + 1$ cancel out. Thus the average loss in GDP growth stems only from the fall in the N-sector's average investment share.

68. The mechanism by which faster growth in the N-sector induces faster growth in the T-sector is the decline in the relative price of N-sector goods that takes place in a growing economy. If there were technological progress in the T-sector, there would be a Balassa-Samuelson effect and the real exchange rate would appreciate over time.

Since a liberalized economy experiences crises over time, to see whether financial liberalization will increase long-run growth, we compute the limit distribution of the growth rate of GDP. Using the expressions for γ^l and γ^{cr}, it follows that over the long run the mean compounded growth rate of GDP in a liberalized economy is[69]

$$\text{(A15)} \qquad E(1+\gamma^{LE}) = (1+\gamma^l)^{\omega}(1+\gamma^{cr})^{1-\omega} = \theta^{\alpha}(\phi^l)^{\alpha\omega}(\phi^l\phi^c)^{\alpha\frac{1-\omega}{2}},$$
$$\text{where } \omega = \frac{u}{2-u}.$$

Notice that ω is the proportion of time that the economy is on a lucky path over the long run. A comparison of long-run GDP growth rates in equations A14 and A15 reveals the following result.

Result 3. *Average long-run GDP growth is greater in a liberalized economy than in a nonliberalized economy, provided contract enforceability problems are severe, but not too severe* $[h \in (h^*, h^{**})]$*, and financial distress during crises is not too great* $(\mu_w > \underline{\mu}_w)$.

The relationship between financial liberalization and growth is not straightforward because an increase in the probability of crisis $(1 - u)$ has ambiguous effects on long-run growth. One the one hand, a greater $1 - u$ increases investment and growth along the lucky path by increasing the subsidy implicit in the guarantee and allowing N-sector firms to be more leveraged. On the other hand, a greater $1 - u$ also makes crises more frequent. The degree of contract enforceability h plays a key role. If we increase $1 - u$, the growth-enhancing effect of more investment dominates the growth-reducing effect of more frequent crises when h is large enough. This happens because a large h increases firms' leverage and allows them to reap the benefits of risk taking. However, h cannot be arbitrarily large to ensure the existence of an equilibrium. If h were very large, borrowing constraints would not arise (by equation A6), or markets would not clear, as $\phi^l > 1$ (by equation A12).[70]

69. For the computation of the limit distribution see Ranciere, Tornell, and Westermann (2003).

70. A higher long-run growth rate comes at the cost of a higher incidence of crises. A natural question is thus whether faster growth is associated with greater social welfare. Ranciere, Tornell, and Westermann (2003) show that if T-sector agents have access to complete capital markets, so that they can hedge real exchange rate risk, then welfare in a

The central role played by the requirement that h be low, but not too low, underlies the importance of the country sample over which the empirical link between liberalization and growth exists. The above result implies that, among the set of countries where contract enforceability problems are severe, but not too severe, financial liberalization may lead to more rapid growth even if one controls for trade liberalization. This prediction establishes a causal link from liberalization to GDP growth in the earlier regressions.

Credit Growth

Here we show that economies that have followed growth-enhancing risky credit paths are identified by a negatively skewed distribution of credit growth. Since in the model N-sector firms use only N-sector inputs, the appropriate measure of real credit is $\tilde{b}_t = (b_t + b_t^n)/p_t$. It follows from equations A5 and A6 that, in a risky and in a safe economy, real credit is given, respectively, by

$$\text{(A16)} \qquad \tilde{b}_t^{LE} = \begin{cases} [\phi^l - (1-\beta)]q_t & \text{if } \pi(p_t) \geq 0 \\ [\phi^c - \mu_\omega]q_t & \text{if } \pi(p_t) < 0 \end{cases} \quad \tilde{b}_t^{NL} = [\phi^s - (1-\beta)]q_t.$$

In a safe, nonliberalized economy, credit follows a smooth path, whereas in a risky, liberalized economy it follows a bumpy path. Using equation A9, we have that in the latter the compounded growth rate of credit is $\zeta^l = \log(\theta\phi^l)$ along a lucky path, $\zeta^c = \log\{\theta\phi^l u\ (\mu_w/1 - \beta)[(1 - h\delta u^{-1})/(1 - h\delta)]\}$ during a crisis, and $\zeta^p = \log[\theta\phi^l(1/u)]$ in the postcrisis period.

When skewness is negative, the good outcomes in the distribution lie closer to the mean than the bad outcomes. We find this credit pattern in the risky equilibrium because N-sector firms face endogenous borrowing constraints, so that N-sector credit is constrained by cash flow. Along the lucky path on which no crises occur, cash flow accumulates gradually, and credit can grow only gradually. In contrast, when a crisis erupts, there are widespread bankruptcies and cash flow collapses. Thus credit growth falls sharply ($\zeta^c < \zeta^l$). In the wake of a crisis, credit growth rebounds before returning to its lucky level ($\zeta^p > \zeta^l$). As long as crises are rare events, the credit growth rates during the postcrisis period and the lucky

risky equilibrium is greater than in a safe equilibrium provided enforceability problems are severe enough.

path are very similar: $(\zeta^p - \zeta^l) = \log(u^{-1})$. Since falls and rebounds occur with the same frequency, the distribution of credit growth is characterized by negative outliers in a long enough sample. That is:

Result 4. *In a risky, liberalized economy the limit distribution of credit growth has negative skewness. Meanwhile in a nonliberalized economy credit growth has a smooth path with zero skewness.*

To link this result to our empirical findings, recall that a risky equilibrium exists only if enforceability problems are severe but not too severe, conditions that we find in MECs. Thus the first implication of this result is that financial liberalization may lead to bumpiness of credit growth across MECs. Since negative skewness of credit growth reflects the adoption of credit risk, which eases financial constraints and leads to an increase in mean GDP growth (according to result 3), the second implication is that negative skewness is an appropriate right-hand-side variable in the growth regressions we estimate.

Notice that if enforceability problems were either not severe or too severe, there would be no endogenous force that would make credit growth negatively skewed to begin with. Thus the link between negative skewness and growth would not exist.

In the model, credit growth exhibits more variance in the liberalized economy. Empirically, however, variance is not a good means of identifying economies that have followed growth-enhancing, risky credit paths that lead to infrequent crises. High variance may also reflect high-frequency shocks, which might be exogenous or might be self-inflicted by, for instance, a procyclical fiscal policy. To generate high variance in both the safe and the risky equilibria, one could include in the model high-frequency exogenous shocks that do not lead to crises. Such shocks would increase the variance of credit growth in both economies but would not increase mean GDP growth. The two equilibria would still be distinguished by negative skewness of credit growth, because only the risky equilibrium would be crisis prone.

The N-to-T Output Ratio

We have captured the sectoral asymmetry in financing opportunities prevalent in MECs by assuming that T-sector production is not affected

by financial constraints, whereas the N-sector faces contract enforceability problems. This sectoral asymmetry generates two predictions about the behavior of the N-to-T output ratio that help us identify the mechanism that links liberalization, fragility, and growth in MECs.

Because the N-sector is more financially constrained than the T-sector, the first prediction is that, along any equilibrium path, the N-to-T output ratio is positively correlated with domestic credit. To derive the second prediction, note that it follows from equations A10 and A11 that, in a symmetric equilibrium, the N-to-T ratio is given by

$$\text{(A17)} \qquad \frac{N_t}{T_t} \equiv \frac{p_t q_t}{y_t} = \frac{p_t q_t}{\frac{1-\phi_t}{\alpha} p_t q_t} = \frac{\alpha}{1-\phi_t}.$$

The investment equations A5 and A6 imply that when there is a shift from a nonliberalized to a liberalized economy, the N-to-T output ratio increases from $\alpha/(1-\phi^s)$ to $\alpha/(1-\phi^l)$. This reflects the fact that financial liberalization eases financial constraints and allows the N-sector to command a greater share of N-sector inputs.[71]

If a crisis occurs at some date τ, there is a *fire sale*: a steep real depreciation occurs, and because of currency mismatch, all N-sector firms default. As a result, the investment share falls from ϕ^l to ϕ^c. The price of N-sector goods must then fall to allow the T-sector to absorb a greater share of N-sector output, which is predetermined by investment at $\tau - 1$. As can be seen in equation A17, the N-to-T ratio falls from $\alpha/(1-\phi^l)$ to $\alpha/(1-\phi^c)$. Thus:

Result 5. *Across MECs, the N-to-T output ratio responds positively to financial liberalization and negatively to crises and is positively correlated with credit growth.*

Both of these implications of sectoral asymmetries are consistent with our empirical findings. Furthermore, sectoral asymmetries are key to explaining several features of the boom-bust cycles experienced by many MECs, as well as Mexico's less-than-stellar growth and recent export slowdown.

71. We have set a_t to a constant. However, one can verify that an increase in a_t following trade liberalization reduces the N-to-T output ratio.

APPENDIX B

Construction of Indexes, Data Sources, and Robustness Analysis

HERE WE EXPLAIN how we construct our liberalization indexes and the N-to-T output ratio, describe the data sets we used, and present results of some robustness tests.

Liberalization Indexes

Our de facto trade and financial liberalization indexes indicate the year when a given country liberalized. We construct the indexes by looking for trend breaks in trade and financial flows. We identify trend breaks by applying the CUSUM test of Brown and others (1975) to the time trend of the data. This method tests for parameter stability based on the cumulative sum of recursive residuals.[72]

A MEC is trade liberalized (TL) at year t if its trade-to-GDP ratio either has a trend break at or before t or has exceeded 30 percent at or before t. The 30 percent criterion identifies countries where trade was liberalized at the beginning of our sample (1980) or where the increase in trade flows did not take place from one year to the next, but instead took place over a few years.[73]

To determine the date of financial liberalization, we consider net cumulative capital inflows (*KI*).[74] A country is financially liberalized (FL) at year t if *KI* has a trend break at or before t and there is at least one year with a *KI*-to-GDP ratio greater than 5 percent at or before t, or if its *KI*-to-GDP ratio is greater than 10 percent at or before t, or if the country is associated with the European Union. The 5 and 10 percent thresholds

72. All HECs have liberalized trade and financial markets through the whole sample period.

73. We compute the trade-to-GDP ratio as the ratio of exports plus imports over GDP, using data from the World Development Indicators of the World Bank.

74. We compute cumulative net capital inflows sent by nonresidents since 1980. Capital inflows include FDI, portfolio flows, and bank flows. The data series are from the International Monetary Fund's International Financial Statistics, lines 78BUDZF, 78BGDZF, and 78BEDZ. For some countries not all three series are available for all years. In that case we use inflows to the banking system only, a measure that is available for all country-years.

reduce the possibility of false liberalization and false nonliberalization signals, respectively. Table B1 lists the liberalization dates.

To determine the trend breaks, we regress each *KI* series on a constant and a time trend**.** The CUSUM test is based on the cumulative sum of residuals of this regression. The test signals parameter instability of the time trend if the cumulative sum exits the area between the two critical lines. The test is based on the following statistic:

$$W_t = \sum_{r=k+1}^{t} w_r/s, \text{ for } t = k+1,\ldots,T,$$

where w_r is the recursive residual and s is the standard error of the regression fitted to all T-sample points. If the coefficient on the time trend remains constant from period to period, $E(W_t) = 0$. But if it changes, W_t will tend to diverge from the zero mean value line. The significance of any departure from the zero line is assessed by reference to a pair of 5 percent significance lines. The distance between them increases with t. The 5 percent significance lines are found by connecting the points $k \pm 0.948(T-k)^{1/2}$ and $T \pm 3 \times 0.948(T-k)^{1/2}$. A crossing of the critical lines by W_t signals coefficient instability.[75]

When the cumulative sum of residuals starts to deviate from zero, it may take a few years until this deviation becomes statistically significant. To account for the delay problem, we choose the year in which the cumulative sum of residuals deviates from zero, provided that it eventually crosses the 5 percent significance level. In the case of Mexico, parameter instability begins in the fourth quarter of 1989 and becomes statistically significant after the fourth quarter of 1991.

Three comments are in order. First, our TL and FL indexes do not allow for policy reversals: once a country liberalizes, it never becomes closed thereafter. This means that our indexes do not capture some policy reversals that might have occurred in the latter part of the 1990s. Since our sample period is 1980–99, we consider our approach to be the correct one for analyzing the effects of liberalization on long-run growth and

75. The underlying assumption is that the time series is trend stationary before the structural break. This is confirmed for the case of Mexico by unit root tests. The unit root tests are estimated with a constant, a time trend, and a number of lags (2) determined by the Schwarz information criterion. Before liberalization the series is trend stationary. Including the postliberalization period, it has a unit root and is difference stationary.

Table B1. Dates of Financial and Trade Liberalization and Sectors Used in N-to-T Output Ratios[a]

			Sectors designated tradable and nontradable for regressions including the N-to-T output ratio[b]	
Country	*Date of financial liberalization*	*Date of trade liberalization*	*Based on export shares*	*Based on real exchange rates*
Argentina	1991	1986	C, M	C, M
Bangladesh	Never	Never	S, M	S, M
Belgium	Always	Always	C, M	C, M
Brazil	1992	1988	S, M	S, M
Chile	Always	Always	C, M	C, M
Colombia	1991	1992	S, M	S, M
Egypt	Always	1991	S, M	S, M
Greece	Always	1986	S, M	S, M
Hong Kong	Always	Always	NA	NA
Hungary	1994	1994	S, M	S, M
India	Never	1994	S, M	S, M
Indonesia[c]	1989	1987	S, M	S, M
Ireland	Always	Always	NA	NA
Israel	1990	1986	NA	NA
Jordan	1989	Always	S, M	S, M
Korea	1985	Always	C, M	C, M
Malaysia	Always	Always	C, M	C, M
Mexico	1989	1988	C, M	C, M
Morocco	Never	1986	S, M	S, M
Pakistan	Never	Never	S, M	S, M
Peru	1992	1987	M, S	S, M
Philippines	1989	1986	C, M	C, M
Poland	Never	1993	NA	S, M
Portugal	1986	1986	C, M	C, M
South Africa	1994	Never	S, M	S, M
Spain	Always	1984	S, M	S, M
Sri Lanka	Never	1989	S, M	S, M
Thailand	1988	1986	C, M	C, M
Tunisia	Never	Always	M, S	S, M
Turkey	Always	1994	C, S	C, M
Uruguay	1989	1988	NA	NA
Venezuela	Never	Always	S, M	S, M
Zimbabwe	Never	Never	S, M	S, M

Source: Authors' calculations.

a. "Always" indicates that the country has been open at least since 1980; "Never" indicates that the country was closed at least until 1999.

b. The first of each pair is the sector designated as nontradable, and the second is that designated as tradable; C, construction; M, manufacturing; S, services.

c. The sample does not cover the period before 1993; the financial liberalization date is therefore set to 1989, which fits the dates of Kaminsky and Schmukler (2002) and Bekaert, Harvey, and Lundblad (2001).

financial fragility.[76] Second, in comparing different indexes it is convenient to distinguish *liberalization* from *openness* indexes. The former identify the dates of financial liberalization, whereas the latter measure the amount of capital flows that a country receives over a certain period. For instance, Bekaert, Harvey, and Lundblad (2001) and Kaminski and Schmukler (2002) consider *liberalization* indexes as we do, whereas Kraay (1999), Lane and Milesi-Ferretti (2002), and Edison and others (2002) consider *openness* indexes. Finally, the country-years identified as financially liberalized by our index, as well as the other liberalization indexes, do not necessarily coincide with "good times," because they include both boom and bust country-years. Therefore they are not subject to the criticism that liberalized country-years coincide with good times.

The N-to-T Output Ratio

We construct the N-to-T output ratio by proxying N-sector and T-sector production with data for construction, manufacturing, and services. In the text of the paper we use the sectoral exports-to-GDP ratio as the criterion for classifying the N- and T-sectors. Construction is never classified as a T-sector. Meanwhile the classification of services and manufacturing varies from country to country. Since the price of N-sector goods tracks international prices less closely than that of T-sector goods, we construct an alternative index in which we classify as nontradable the sectors in which the sectoral real exchange rate varies the most, and as tradable the sectors in which it varies the least. Table B1 reports both indexes. The correlation between them is 0.745. Table B2 shows that the regression results reported in table 4 are robust to the choice of index.

Mexican Manufacturing Sector Data Set

The data used to test for the presence of bottlenecks come from the Annual Industrial Survey (Encuesta Industrial Annual) of the National

76. If, after liberalization, a country suffers a sharp reversal in capital flows (such as in a financial crisis), it might exhibit a second breakpoint. In our sample, however, this possibility is not present: the trend breaks due to crises are never large enough to show up in significant CUSUM test statistics.

Table B2. Regressions Testing for Sectoral Asymmetries[a]

Independent variable	*B2-1*	*B2-2*	*B2-3*
Financial liberalization	1.129**	0.979**	0.996**
	(0.142)	(0.149)	(0.141)
Trade liberalization	–0.747**	–0.5618**	–0.772**
	(0.191)	(0.198)	(0.203)
Credit		0.479**	0.439**
		(0.205)	(0.192)
Rate of real depreciation			2.260*
			(1.374)
Crisis year dummy	–0.021*	–0.019*	0.003
	(0.014)	(0.013)	(0.012)
Crisis year +1	–2.444**	–2.134**	–2.240**
	(0.144)	(0.184)	(0.178)
Crisis year +2	0.207*	0.447**	0.375**
	(0.128)	(0.155)	(0.147)
Crisis year +3	–0.784**	–0.648**	–0.690**
	(0.128)	(0.130)	(0.122)
Crisis year +4	–0.478**	–0.236	0.341*
	(0.194)	(0.204)	(0.194)
Crisis year +5	0.856**	0.827**	0.911**
	(0.184)	(0.163)	(0.155)
Summary statistics:			
Adjusted R^2	0.691	0.728	0.745
No. of observations	443	426	371

Source: Authors' regressions.

a. Equation 3 in the text is estimated using panel data and generalized least squares; the dependent variable is the N-to-T output ratio based on the variance of the sectoral real exchange rate. Standard errors are reported in parentheses. * indicates significance at the 10 percent level, ** at the 5 percent level.

Institute of Statistics, Geography, and Informatics (INEGI). In 1999 the sample contained 5,934 firms and covered more than 80 percent of manufacturing value added, 35 percent of employment, and 84 percent of sales in the manufacturing sector. The unit of observation is the manufacturing establishment. However, for confidentiality reasons we received the information at a five-digit aggregation level. To compute the share of N-sector inputs we consider the following as N-sector expenses: maintenance and repair services, outsourcing services, rents and leasing, transport, publicity, and electricity. The other expenses used to calculate total variable costs include labor costs, materials, technology transfers, commissions for sales, combustibles, and other expenses.

Mexican Stock Market Data Set

The stock market data set is derived from the information contained in the financial statements of firms listed on the Bolsa Mexicana de Valores. It is an unbalanced panel of 310 firms, excluding financial firms, of which only 64 are present for the whole sample period. We have yearly observations from 1990 to 2000. All the variables are measured at the end of the year and are deflated by the December consumer price index. The variables used in the text are constructed as in the following table.

Variable	*Definition*
Issuance	Total value of equity plus long-term bonds issued domestically and internationally. Long-term bonds are those with maturities of one year or longer. Issuances are normalized with the sum of long-term liabilities plus the stock outstanding.
Entries/listed firms	Number of new firms or firms issuing initial public offerings divided by the total number of listed firms
Exits/listed firms	Number of firms de-listing divided by the total number of listed firms
Foreign liabilities/ total liabilities	Liabilities denominated in foreign currency, divided by total liabilities
Capital stock	Fixed assets, including real estate, machinery, and equipment
Investment	Change in fixed assets from year $t - 1$ to year t
Cash flow	Total sales minus operating expenses
Change in sales	Change in total sales from year $t - 1$ to year t

Mexican Economic Census

The economic census covers the whole Mexican economy and is available at five-year intervals from INEGI. The information at the establishment level is confidential. Thus each observation corresponds to a group of establishments with a similar number of employees, in the same economic activity (six-digit classification) and in the same geographical region (municipality).[77] The number of establishments is omitted for some

77. Within each six-digit class and each municipality, establishments were grouped according to the following stratification: 0–2 employees, 3–5, 6–10, 11–15, 16–20, 21–30, 31–50, 51–100, 101–250, 251–500, 501–1,000, and 1,001 or more.

Table B3. Robustness Tests

Independent variable	*B3-1*[a]	*B3-2*[b]	*B3-3*[c]	*B3-4*[d]	*B3-5*[e]
Regressions of growth on liberalization[f]					
Financial liberalization	2.980** (0.363)	3.036** (0.668)	1.571** (0.181)	2.686** (0.132)	2.467** (0.119)
Summary statistics:					
Adjusted R^2	0.615	0.615	0.953	0.547	0.568
No. of observations	423	423	460	450	450
Regressions of growth on bumpiness measures[g]					
Mean of real credit growth rate	0.051** (0.010)	0.130** (0.019)	0.065** (0.009)	0.123** (0.010)	0.127** (0.009)
Standard deviation of real credit growth rate	–0.027** (0.006)	–0.030** (0.007)	–0.001 (0.003)	–0.027** (0.004)	–0.032** (0.004)
Negative skewness of real credit growth rate	0.354** (0.071)	0.212** (0.097)	0.066** (0.025)	0.207** (0.036)	0.216** (0.037)
Summary statistics:					
Adjusted R^2	0.617	0.619	0.901	0.562	0.630
No. of observations	383	383	424	414	414

Source: Authors' regressions.

a. Instrumental variables regression estimated by two-stage least squares, using the legal origin index of La Porta and others (1999) as an instrument. All regressions include the combined MEC and HEC sample of countries. Standard errors are reported in parentheses. ** indicates significance at the 5 percent level.

b. Instrumental variables regression estimated by two-stage least squares, using lagged values as instruments.

c. Regression estimated by the generalized least squares method allowing for fixed effects.

d. Regression estimated with a common intercept, but leaving out China.

e. Regression estimated with a common intercept, but leaving out Ireland.

f. Regressions correspond to that reported in column 1-3 of table 1 in the text.

g. Regressions correspond to that reported in column 3-2 of table 3 in the text.

observations. In such cases an average of the number of establishments by group is used in order to weight each. There are 286,866 observations in 1994 and 400,120 in 1999.

Robustness Tests

Table B3 shows results of tests of the robustness of the benchmark regressions in columns 1-3 and 3-2 in tables 1 and 3, respectively.

Comments and Discussion

Timothy J. Kehoe: Aaron Tornell, Frank Westermann, and Lorenza Martínez have written an excellent paper that deals with important issues and that has caused me to reexamine my own thinking on these issues. The authors attempt to answer the question, Why has Mexico experienced less-than-spectacular growth since its *apertura,* or opening to foreign trade and investment, in the late 1980s? I agree with much of what this paper has to say: Those of us who would gladly teach that free trade and open capital markets are the best policies for developing economies to follow have a challenging task in accounting for the ambiguous evidence on that score from some countries over the past decade or so.

What are the major points in this paper with which I agree?

—Mexico's economic performance following its *apertura,* although good compared with that over the period 1982–88, is disappointing compared with what policymakers and proponents of free trade and capital flows had expected.

—It is important to identify the feature or features of Mexico's openness policies that have been responsible for retarding economic growth since 1988. Circumstantial evidence on the performance of the Mexican domestic financial system—in particular that of commercial banks—identifies poorly designed reform of the banking system as a likely culprit.

—Data on both output levels and relative prices indicate that a key ingredient in any successful theory of what has happened in Mexico since 1988 will be a mechanism that accounts for the ups and downs of the nontradables sector relative to the tradables sector.

—Ultimately, to account for the growth, or lack of it, in Mexico and in other countries that have undergone similar experiences with trade and

financial liberalization, models are needed that focus on data on productivity and sources of financing at the firm or plant level.

The bulk of the authors' analysis relies on regressions run on cross-country data for the period 1980–99. Raphael Bergoeing, Patrick Kehoe, Raimundo Soto, and I (BKKS) have studied the determinants of Mexican economic performance since 1980 by focusing on the contrast between the experience of Mexico and that of Chile.[1] BKKS's analysis produces many conclusions that echo those of the present authors. I will highlight here these areas of agreement, but I will also emphasize the areas of disagreement. In particular, the contrast between Mexico and Chile and the timing of events in Mexico cast some doubt on the authors' conclusion that the source of Mexico's disappointing growth performance has been that producers of nontradables were starved of investment funds after the 1995 crisis.

Before exploring the contrast between Mexico and Chile, I want to stress how much more important it is to study economic fluctuations in a country like Mexico than it is to study economic fluctuations in a country like the United States. Figure 1 compares aggregate economic performance in Mexico over the period 1920–2002 with that of the United States.[2] Notice that, apart from the period of the Great Depression and World War II, the path of real GDP per working-age (sixteen to sixty-four years old) person in the United States closely follows a 2 percent growth trend. Business cycle fluctuations in the United States since World War II have been relatively trivial. In contrast, economic fluctuations in Mexico since 1980 are closer in magnitude to those of the 1930s and 1940s in the United States than they are to what we in this country now call the business cycle.

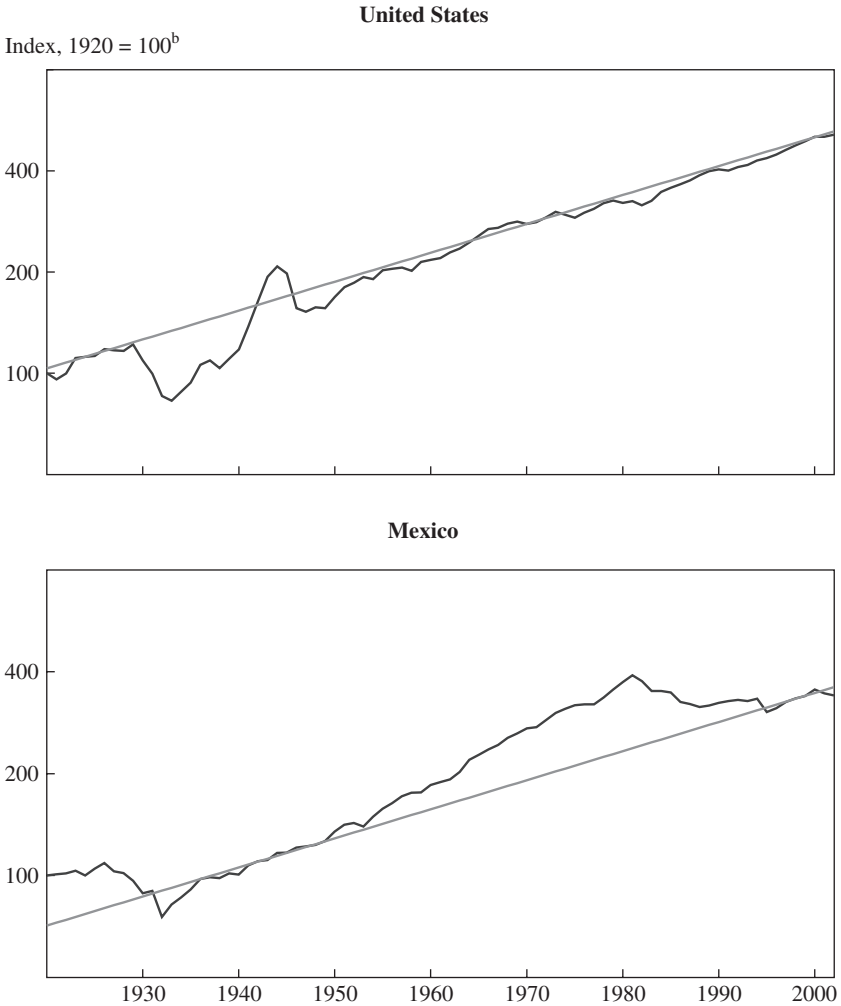
GREAT DEPRESSIONS IN CHILE AND MEXICO. BKKS examine the economic crises that occurred in Chile and Mexico in the early 1980s and their aftermaths using the Great Depressions methodology developed by Harold Cole and Lee Ohanian and by Edward Prescott and myself.[3] This methodology uses growth accounting and simple calibrated dynamic general equilibrium models to examine alternative explanations for large economic fluctuations like that of the Great Depression in the United States.

1. Bergoeing and others (2002).

2. The data used here are taken from Bergoeing and others (2002) and updated to 2002. These data are available at www.econ.umn.edu/~tkehoe/.

3. Cole and Ohanian (1999); Kehoe and Prescott (2002).

Figure 1. Real GDP per Person of Working Age, United States and Mexico, 1920–2002[a]

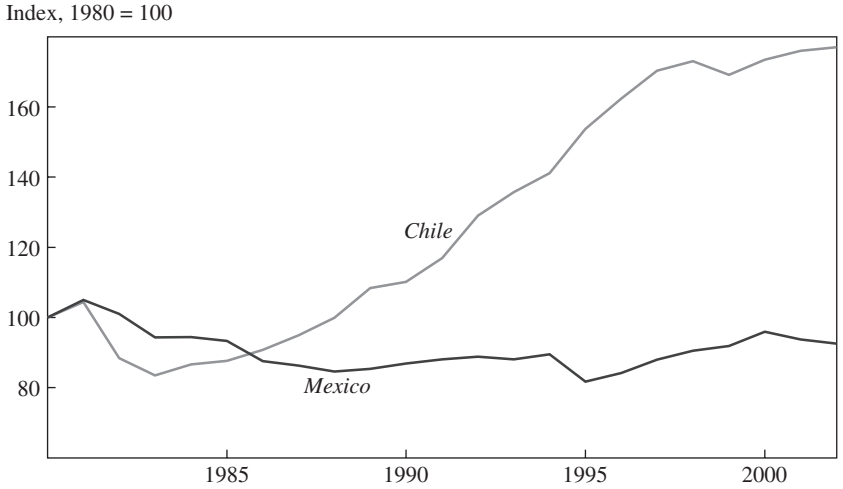


Sources: Author's calculations using data from Bureau of Economic Analysis; National Institute of Statistics, Geography, and Informatics; Maddison (1995); the International Monetary Fund's International Financial Statistics; and the World Bank's World Development Indicators.

a. Persons aged sixteen to sixty-four.

b. Logarithm base 2 scale.

Figure 2. Real GDP per Person of Working Age in Mexico and in Chile, Detrended, 1980–2002[a]



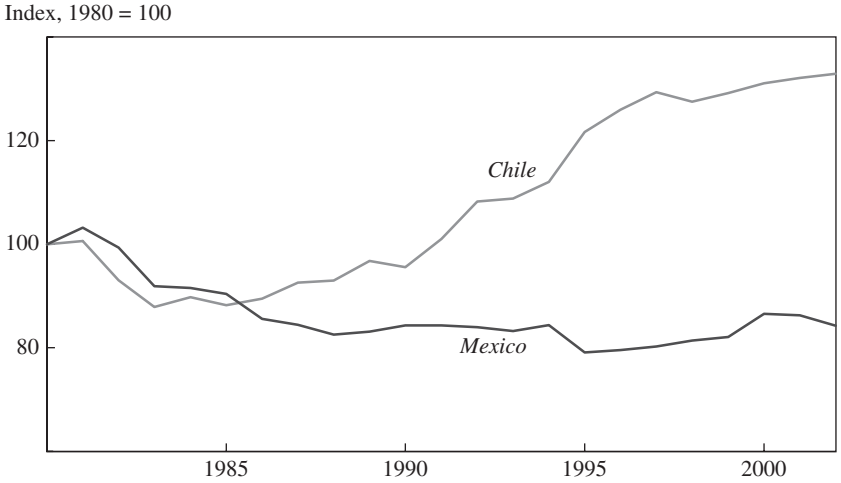
Source: Author's calculations using data from the International Monetary Fund's International Financial Statistics and the World Bank's World Development Indicators.

a. Trend growth of 2 percent a year in real GDP per person aged sixteen to sixty-four is subtracted from actual growth.

Chile and Mexico, like most Latin American countries, experienced severe economic crises in the early 1980s. Their recovery paths after the crisis differed markedly, however. In Chile, output per working-age person has grown at an annual average rate of 4.0 percent during 1983–2002. In Mexico, in contrast, output per working-age person has grown at an annual average rate of 0.6 percent during 1988–2002. Figure 2 shows that Mexico has lost more than 30 percent of output per working-age person with respect to the 2 percent growth trend since the early 1980s.

BKKS's striking finding is that the main determinants of the depressions in Chile and Mexico were not the drops in inputs of capital and labor that traditional theories of depressions stress, but rather drops in the efficiency with which these inputs are used, measured as total factor productivity (TFP). Figure 3 presents data on TFP in Chile and Mexico over the period 1980–2002. Exogenous shocks like the deteriorations in the terms of trade and the increases in foreign interest rates that buffeted Chile and Mexico in the early 1980s can cause a decline in economic activity of the magnitude usually observed over a business cycle. BKKS argue that it was mistaken government policy that turned this sort of a

Figure 3. Total Factor Productivity in Mexico and in Chile, 1980–2002



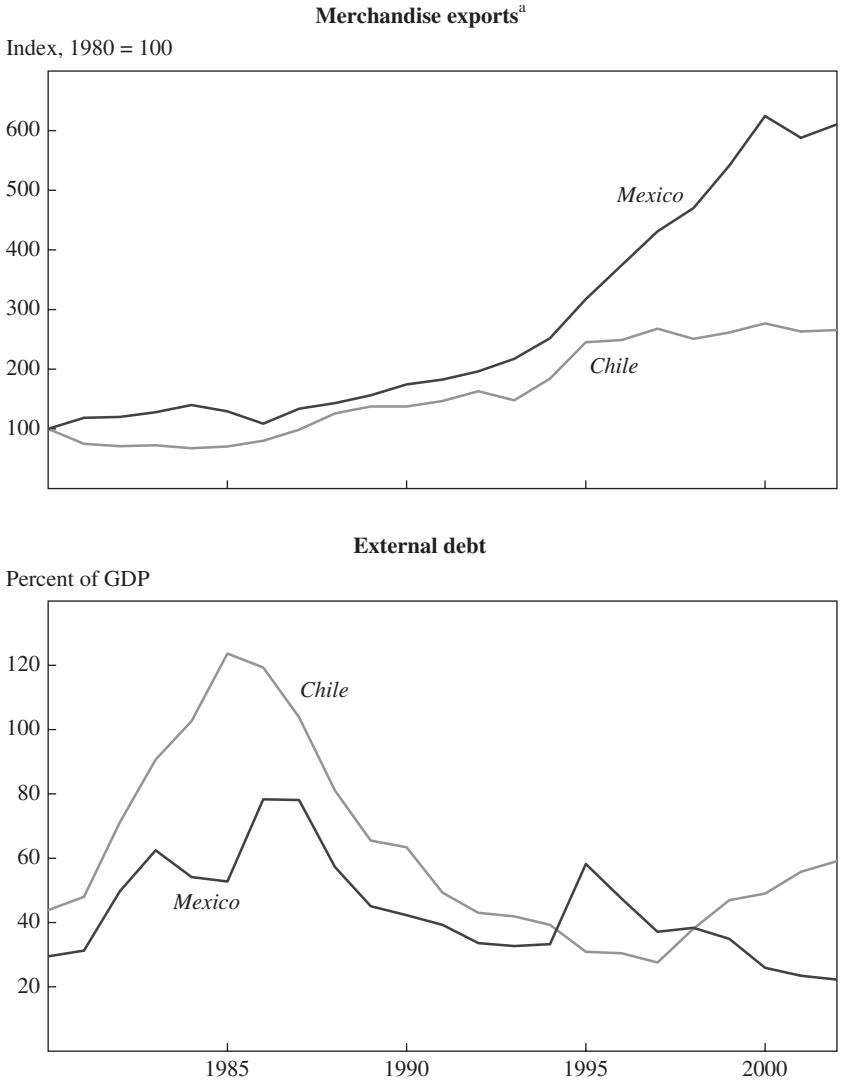
Source: Author's calculations using data from the International Monetary Fund's International Financial Statistics, the Organization for Economic Cooperation and Development's Main Economic Indicators; Penn World Table 5.6, the Universidad de Chile's Encuesta de Ocupación y Desocupación, and the World Bank's World Development Indicators. See Bergoeing and others (2002) for details.

decline into the severe and prolonged drop in economic activity below trend that constitutes a depression. In both Chile and Mexico the mistaken government policy involved the domestic banking system. Rather than focus on the causes of the depressions in Chile and Mexico, however, BKKS concentrate their attention on why the subsequent growth experiences in these two countries were so different.

Comparing data from Chile and Mexico allows BKKS to reject two popular explanations of the economic performances of these two countries as explanations for the difference: The first is Vittorio Corbo and Stanley Fischer's hypothesis that Chile's rapid recovery was driven by export growth;[4] the second is Jeffrey Sachs's hypothesis that Mexico's stagnation was due to a large external debt overhang that discouraged new investment.[5] On the one hand, the top panel of figure 4 shows that, during the late 1980s and early 1990s, exports actually grew much faster in Mexico than in Chile, yet Chile grew while Mexico stagnated. On the other

4. Corbo and Fischer (1994).
5. Sachs (1989).

Figure 4. Exports and External Debt in Chile and Mexico, 1980–2002



Sources: Author's calculations using data from the International Monetary Fund's International Financial Statistics, the U.S. Bureau of Labor Statistics, the World Bank's World Development Indicators, and the World Trade Organization's International Trade Statistics 2000.

a. Deflated by the U.S. producer price index.

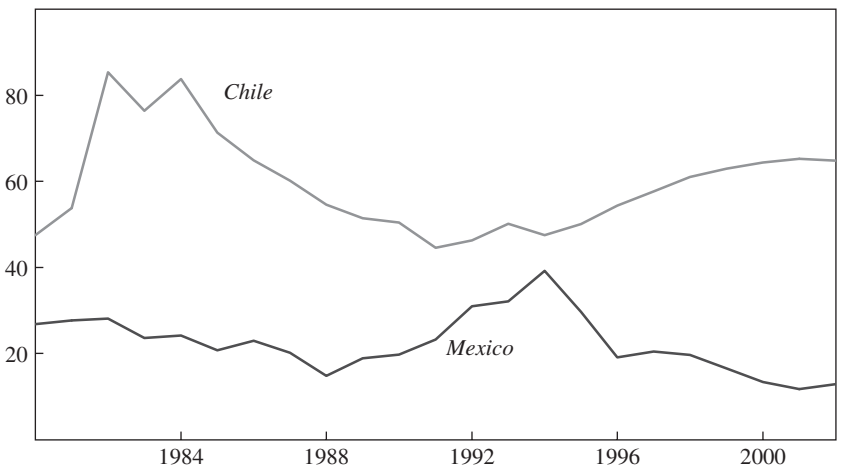
hand, the bottom panel of figure 4 shows that Chile's ratio of external debt to GDP was much higher than Mexico's through the 1980s, and growth accounting shows that Mexico's stagnation was not caused by the lack of new investment.

BKKS's alternative explanation for the difference in economic performance between Chile and Mexico is based on the different timing of structural reforms in the two countries. In the 1970s and early 1980s, Chile privatized extensively and undertook reforms in trade policy, fiscal policy, banking, and bankruptcy law, thus setting the stage for the country's successful performance of the late 1980s and 1990s. Mexico, in contrast, postponed these reforms and stagnated. BKKS use numerical experiments with a calibrated dynamic general equilibrium model to argue that the only reforms that can explain the difference in economic performance are those whose effects show up primarily as differences in productivity, not those that show up as differences in factor inputs. This result rules out fiscal reforms, which primarily affect the incentives to accumulate capital and to work. Moreover, the timing is not right for fiscal reforms as an explanation: both Chile and Mexico reformed their tax systems in the mid-1980s, and these reforms had similar impacts on investment; hence these reforms cannot account for the different paths. Like the present authors, BKKS identify the lack of reform in the domestic financial system as the likely culprit in Mexico's lack of growth. Figure 5 shows that the trajectory of private credit was substantially lower in Mexico than in Chile.

The matter of timing is crucial. BKKS argue that reforms in trade policy and privatization were less important than those in banking and bankruptcy law, precisely because Chile had already reaped most of the benefits of these reforms, whereas Mexico was starting to reap them precisely when Mexico was stagnating and Chile was growing. BKKS conclude that the crucial difference between Chile and Mexico is that Chile was willing to pay the costs of reforming its banking system and of letting inefficient firms go bankrupt, and Mexico was not.

How does BKKS's analysis compare with that of Tornell, Westermann, and Martínez? Much of the relationship is complementary. BKKS's growth accounting shows that any successful theory of Mexico's lack of growth needs to work through low TFP growth, not through low levels of investment or employment. The explanation of Tornell and coauthors would be that it is not that levels of investment were low after

Figure 5. Private Credit in Chile and Mexico, 1980–2002



Source: Author's calculations using data from the International Monetary Fund's International Financial Statistics and the World Bank's World Development Indicators.

the crisis in 1995, but that lack of reform in the domestic banking system led to this investment being misallocated to the tradables sector rather than to the nontradables sector. Furthermore, in their model, the lack of output of nontradables starved the tradables sector of intermediate inputs, resulting in lower productivity there as well.

BKKS also conclude, as do the present authors, that problems with contract enforcement in Mexico have contributed to low productivity. Once again it is important to remember that growth accounting indicates that Mexico's problem is not lack of aggregate investment: it is not that lack of enforcement has led to lower investment, but rather that lack of enforcement has led to investment being allocated inefficiently. A problem with this sort of hypothesis is the lack of data to prove or disprove it. The present authors do the best they can with data on imputed tax evasion and criminal arrests for theft. Studying Chile and Mexico, BKKS use data on business bankruptcies in Chile from that country's Fiscalía Nacional de Quiebras (National Attorney's Office for Bankruptcies) in the Ministry of Justice. It is telling that no such agency existed in Mexico before the bankruptcy reform in 2000, so that no such data existed. The impact of contract enforcement problems on economic growth and industrial orga-

nization is a topic that merits more study. Erwan Quintin, for example, shows that inadequacies in contract enforcement can account for most of the differences in the distribution of firm size, and a large part of the difference in incomes, among Mexico, the United States, and Argentina.[6]

SOME DOUBTS. The data depicted in the bottom panel of figure 1 highlight the contrast between Mexican growth during 1950–81 and growth since then. The authors' analysis, in contrast, stresses the comparison before and after Mexico's opening in the late 1980s. Over the period 1988–2002, growth in real GDP per working-age person averaged 0.6 percent a year, a substantial improvement over the 3.0 percent average annual decline over the period 1981–88. Notice, however, that growth by this measure since 1988 comes nowhere near the average of 3.5 percent a year recorded over the period 1950–81. The sort of import substitution policy that Mexico followed during that period has fallen into such disrepute among both academic economists and policymakers that we often forget that Mexico did extraordinarily well as a closed economy up until 1981. One can argue (as I would) that the crisis of 1982–88 demonstrated that import substitution in Mexico was ultimately doomed to fail. Nonetheless, figure 1 suggests that the authors' decision to use data from 1980–99 is crucial in obtaining the favorable effects for openness in their growth regressions. Had their data included observations from the 1950s, 1960s, and 1970s, when such closed economies as Brazil and Mexico grew spectacularly, I suspect that their results would have been significantly different.

Concentrating on the authors' contrast of the period 1988–94 with the period 1995–2002, I find that my doubts revolve around timing. According to the authors, nontradables-producing firms were financially constrained during 1995–2002, but not during 1988–94. Notice, however, that the data in my figures 1 and 2 show that Mexico grew much faster during the period when firms were financially constrained than it did during the period when they were not. Real GDP per working-age person grew by only 0.9 percent a year from 1988 to 1994. From 1995 to 2002 it grew by 1.8 percent a year, and it grew at an even faster rate—3.3 percent a year—if 2001 and 2002 are omitted. The authors suggest that "fire sales" on the part of financially constrained Mexican firms can account for the initially rapid growth after the 1995 crisis, and that the 2001–02

6. Quintin (2003).

experience is what Mexico should expect in the future. They may be right, but I have my doubts. For example, my figure 5 shows that private credit in Chile fell sharply over the period 1984–91, yet figure 2 shows that Chile grew spectacularly during this period and afterward. Furthermore, the authors' story cannot account for Mexico's disappointing growth experience over the period 1988–94, when firms were not financially constrained.

To be convinced by the authors' hypothesis on why growth was disappointing in Mexico, I would want to see a calibrated version of their model that gets right not only the magnitudes of the changes in the important variables, but also the timing of these changes. Can the authors construct a model in which the problems in the banking system show up primarily as a misallocation of investment rather than as an underprovision of investment? Can the observed drop in TFP be driven by a misallocation of resources across the tradables and nontradables sectors that is consistent with the observed changes in relative prices? Can their model reconcile the lack of correlation of movements in TFP (figure 3) with the movements in private credit (figure 5)?

A conclusive confirmation or refutation of the authors' hypothesis will ultimately require more research based on microlevel data. I have some doubts about the mechanism that the authors posit as leading from lack of financing in the nontradables sector to lower productivity in the tradables sector: Mexican input-output data show that the nontradables sector is even more dependent on the tradables sector for intermediate inputs than vice versa. If tradables sector firms had free access to financing, why did they not develop in-house ways of obtaining the sorts of maintenance, repair, and transportation services cited by the authors as essential nontradable inputs into tradables production?

The authors' pessimistic view of Mexico's prospects depends crucially on data since 2000. The drop in Mexico's exports in 2001 and 2002 depicted in figure 4 is indeed alarming after a decade and a half of explosive growth. It is also undoubtedly true that Mexico still has a way to go in reforming and modernizing its economy. The political gridlock that is occurring during President Vicente Fox's term of office (2000–2006) is not helping to advance reform. Nonetheless, the authors' analysis leaves a lot unanswered: Why has the entry of foreign banks into the Mexican financial system not led to more efficient financing of domestic firms? Why has the bankruptcy reform of 2000 not solved the sorts of contract

enforcement problems that they discuss? If the rapid real exchange rate appreciation in Mexico over 1995–2000 accounts for the later slowdown in growth and drop in exports, why does the real depreciation over the period 2001–02 (and 2003) not presage a resurgence in growth?

The data in figure 1 are a reminder of how minor a part of Mexico's growth experience is the experience of 2001–02. The question is whether the 2001–02 downturn signals a longer-term trend, or whether it will be quickly reversed. It may be that the drop in growth and in exports over the period 2001–02 is more a reflection of the collapse of manufacturing in the United States and of increased competition from countries like China than it is of the financial problems that are the authors' focus. Things could turn around sharply going forward. Only time, and more analysis, will tell.

Alejandro Werner: Tornell, Westermann, and Martínez have produced an important paper on the relationship among financial liberalization, financial crises, and economic growth. It is a significant contribution to the literature on this topic. One of its principal conclusions is that financial liberalization has been good for developing countries. This result holds despite the negative effects of financial crisis on growth and is very well established in the paper.

The paper explores the effects of financial liberalization on growth, paying special attention to two issues. The first is the impact of liberalization on the likelihood of a financial crisis occurring, and the second is the asymmetric response of the nontradables and the tradables sectors as a fundamental transmission mechanism from financial liberalization to growth and crises.

The authors propose an interesting model for studying the mechanisms through which financial crises develop after financial liberalization and the problems these economies face after such crises. Some of these problems are related to the negative effects of a crisis on the growth of the nontradables sector. Although I think these arguments are plausible, the evidence presented for them in the paper is not as strong as that regarding the effect of financial liberalization on growth.

When the paper discusses the case of Mexico, the exercise becomes more difficult as the authors try to fit their specific theory to the case of only one country. The narrower focus makes it clear that the crisis-recovery cycle has many angles and that a single model is not enough to

explain what happened. Therefore my views here differ significantly from those of the authors.

THE MODEL. I have three points to make regarding the model. First, the model is based on a contract enforceability problem in local credit markets that drives investment in the nontradables sector below the optimal level. The implicit assumption is that tradable goods producers can borrow in foreign countries and therefore are not subject to this distortion. However, it is not clear in the model how these firms can bypass the contract enforceability problem. If a foreign lender must go to the creditor's domestic courts to oblige the creditor to pay, the lender faces the same contract enforceability problem that the local financial system faces. The authors should have good arguments to sustain this assumption, through either reputational effects, the existence of international pledgeable collateral, or legally binding provisions in free trade agreements. Many free trade agreements in fact contain clauses that allow the interested parties in a contract to bypass domestic courts.

The second point is that, in the model, financial liberalization brings about bailouts and the possibility of risk-enhancing foreign currency borrowing. Borrowing in foreign currency is the mechanism through which financing costs are brought down. Therefore the mechanism for lowering financing costs is a bailout that is conditional on a crisis happening and having borrowed in foreign currency. This is a very narrow view of financial liberalization. If this were the only effect of financial liberalization, any rational government would prefer to give firms a direct subsidy and maintain restrictions on borrowing in foreign currency. This would correct the undesirable effects of the enforceability problem on investment without generating the problem of excessive risk. Implicitly, then, there must be additional reasons, not incorporated in the model, that drive a government to allow foreign currency borrowing from the rest of the world.

My final point about the model is that although it generates the result that, even with the occurrence of crises, growth is more rapid with financial liberalization, it would be nice to see some welfare implications of that conclusion. The effect of financial liberalization on welfare for the representative agent is not clear. Although growth is increasing, thus improving welfare, the variance of that growth is also on the rise, thus decreasing welfare. One can take this a bit further: crises generate significant problems that are subject to hysteresis effects, driving some eco-

nomies to a very bad self-fulfilling equilibrium. For example, the effects that crises have on poverty and crime, and eventually on politics, could seriously threaten future macroeconomic outcomes. The authors' figure 16 shows that tax evasion and crime remained at very high levels in Mexico, even after the 1994–95 crisis had passed and the economy started growing again. These are issues that might be explored in future research.

EMPIRICAL RESULTS. One of the paper's empirical results is that financial liberalization creates financial crises and that financial fragility, or "bumpiness," as the authors call it, is associated with faster growth only through its positive correlation with financial liberalization. The measure of fragility they use—the skewness of real credit growth—is a bit confusing, however: it does not, as the reader might think, capture the probability of a crisis developing, but rather identifies the occurrence of a crisis.

Another point is that skewness could be capturing any nonlinear effect of all the other moments of the credit growth distribution. To some extent, we do not know whether skewness may be capturing a nonlinear effect of credit growth, because those countries that have had the highest rate of growth of credit may have exhibited skewness. Therefore some robustness test of the effect of skewness on growth should be tried in the regression.

A third point is that the endogeneity of the credit moments and their covariance with the error term in the equation could be biasing the results. The model presented to justify why skewness was exogenous fails the simplicity criteria outlined by Jeffrey Frankel, in his comment on the paper by Bosworth and Collins in this volume, in the sense that the more complicated the arguments get, the harder it is to sustain the claim that these are two exogenous variables. Also, given that the authors are taking ten-year averages, it seems hard to believe that this problem can be solved simply by lagging these variables.

In addition, the paper presents the result that financial liberalization and credit are positively correlated with the ratio of nontradable to tradable output and that crises are negatively correlated with this ratio. This is interpreted as evidence in favor of the transmission mechanism in which the relaxation of credit constraints in the nontradables sector is the driving force of the model. However, I think all three of these variables—financial liberalization, credit, and the timing of the crisis—are basically constructed from capital flows into the country. Therefore this correlation could also be explained by several theories in which, when large capital

inflows occur, the nontradables sector expands more than the tradables sector. This could happen, for example, because the investment equation (or the demand for investment) is more elastic in the nontradables than in the tradables sector, or by the additional expansion of the nontradables sector due to a real appreciation. One could come up with many more stories that produce the same results.

Using only the macroeconomic evidence to sustain the mechanism in which there are credit constraints in the nontradables but not in the tradables sector is not enough. The results from the authors' microlevel data could be used to show that it was actually the credit-constrained firms in the nontradables sector that saw the greatest relaxation of their credit constraints after financial liberalization.

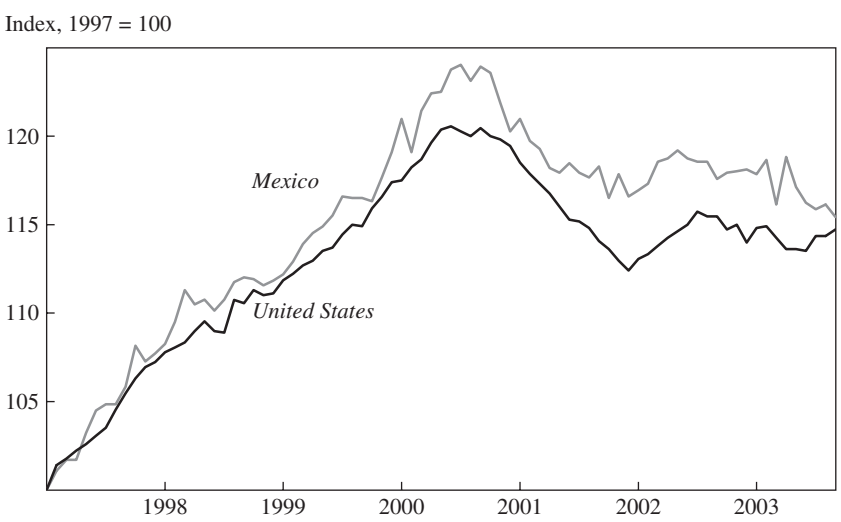
THE MEXICAN EXPERIENCE. Turning to the case of Mexico, the authors argue that Mexico is a bumpy underperformer. This means both that Mexico is a highly bumpy economy and that, even controlling for its bumpiness, the country has grown less than it should have.

I think that when one looks at the scatterplots in the authors' figure 5 and tries to imagine how a regression would fit that set of data points, it is clear that the error for Mexico in that regression should be relatively small. Therefore the authors' result showing that Mexico is growing more slowly than it should might not be statistically significant, given the large standard errors that those regressions have.

Turning to the recession that the Mexican economy has experienced since 2001, the authors argue that their theory, particularly its invocation of bottlenecks in the nontradables sector, explains the negative growth. However, the main driver of this recession has been the slowdown in the U.S. manufacturing sector. Mexico today is basically another manufacturing region within North America. And, as my figure 1 shows, the correlation between manufacturing (or industrial) production in the United States and that in Mexico is close to 0.9. Given that the U.S. industrial sector has been the driver of the current recession and the sector that has suffered the most, it is not surprising that the Mexican economy has suffered as well. This suggests that the vector autoregression estimated in the paper may not give an accurate explanation for this period.

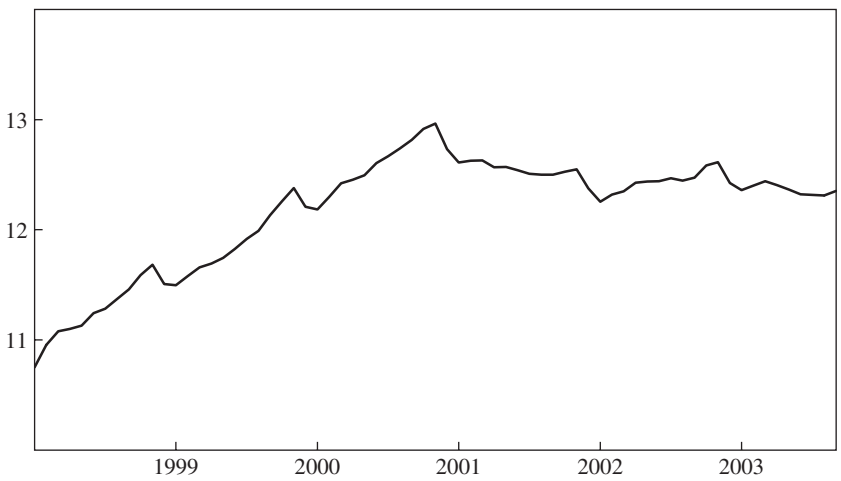
In addition, the stagnation experienced in formal employment in Mexico in the last three years suggests that there are no bottlenecks in the economy (see my figure 2). Rather than the nontradables sector acting as a bottleneck, holding back the tradables sector as the authors suggest, the

Figure 1. Industrial Production in Mexico and the United States, 1997–2003[a]



Source: National Institute of Statistics, Geography, and Informatics and U.S. Census Bureau.
a. Seasonally adjusted monthly data.

Figure 2. Formal Employment in Mexico, 1998–2003[a]



Source: Instituto Mexicano del Seguro Social.
a. Three-month moving average of monthly data.

reverse appears to be the case. As can be seen in the authors' figure 10, the slowdown in the tradables sector is affecting growth in the nontradables sector. Tradables output turned down in 2001, before nontradables output, and therefore the nontradables-to-tradables output ratio increased in that year. This is difficult to reconcile with the argument that it was the slowdown in the nontradables sector that affected the tradables sector. It is more likely that this slowdown in the tradables sector has generated a significant underemployment problem that has affected consumption, investment, and the development of the nontradables sector. In short, I think the main story is the opposite of that presented in the paper.

A closer look at the Mexican recession suggests that it is an almost exact copy of the recent recession in the United States. Private investment and industrial production in Mexico fell in tandem with those in the United States. What has been different is that the authorities in Mexico lack the capability to follow effective countercyclical policies.

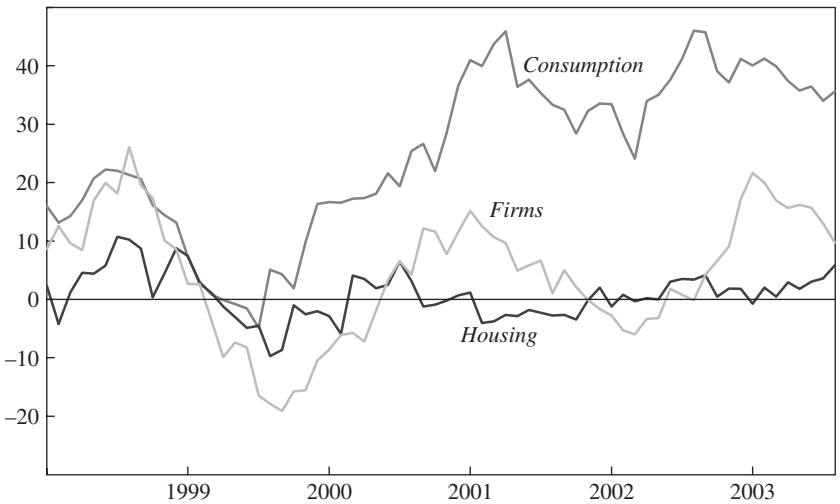
Although, in Mexico, credit has not been as useful as it has in the United States as a mechanism for smoothing the business cycle, credit to the private sector has begun to grow once again, but from very low levels (see my figure 3). The growth in credit was at first largely for consumption, but in 2002 credit to firms also started to increase. Therefore, although the banking sector is starting to lend, it took too long for this to happen, as the paper stresses.

What were the reasons behind this credit crunch? First of all, I agree with the authors that the bank restructuring process was slow. However, this comment should be put in perspective, by comparing the speed of restructuring after Mexico's banking crisis with that in other bank bailout and restructuring processes in Latin America over the last twenty years. It is hard to judge whether Mexico's restructuring was unduly fast or unduly slow if one lacks a benchmark.

A second point is that, throughout this period, banks were building up capital. Eventually this process accelerated, as all remaining restrictions on foreign capital coming into the domestic financial industry were lifted in 1998. Today several important mergers are taking place in the financial sector, and this is diverting attention from lending to the private sector. It might also be the case that the recession began just as banks were ready to restart their lending. Obviously, a situation in which private investment is falling at an annual rate of 5 percent is not the best time to lend. The legal problems that the paper mentions are another element that affected this

Figure 3. Growth in Credit to the Private Sector by Use, 1998–2003

Percent a year



Source: Banco de México.

process. Therefore, one has to wait and see whether, as the economy and investment start to pick up, banks once again start lending aggressively in Mexico.

The final question that stands out is why we do not see a market solution to the credit constraint problem in the nontradables sector. In such a situation one would expect to see some kind of vertical integration, in which large firms in the tradables sector incorporate their nontradable goods suppliers into their corporate structure, so as to bypass the credit problem. In the medium run, if this situation continues, one would tend to see more vertical integration in countries with severe financing constraints.

To sum up, this paper is a comprehensive empirical analysis of the work that these authors have been developing over the last three or four years relating financial liberalization, crises, and growth. It presents several new results, some of which prove some of the linkages that their theoretical work has suggested are important, whereas others will stimulate further research on the topic.

General discussion: Aaron Tornell responded to some points in Alejandro Werner's comment. The paper recognized that developments in the U.S. economy were important to Mexican exports, but it identified credit effects leading to bottlenecks as an additional important factor in the most recent period of recession. He noted that it was not appropriate to cite the high correlation between levels of industrial production in the two countries as evidence that they explain almost everything about Mexican output, because both series are nonstationary. He also observed that the growth in consumption credit cited by Werner accounts for less than 5 percent of total credit in Mexico, whereas the other two credit components fluctuate around zero.

Participants discussed the way financial liberalization was modeled in the paper. Susan Collins criticized the use of capital flows, a de facto measure, as a proxy for financial liberalization, a policy variable. She pointed out that measures of policy and measures of actual flows behave very differently. Therefore inferring the effects of liberalization from a study based on actual flows could lead to misleading interpretations of the effect of policy changes. Carmen Reinhart echoed Collins's comments. She added that de jure measures of financial liberalization may be endogenous, because countries usually introduce capital controls in times of stress and liberalize when international and domestic conditions are favorable.

The roles assigned to the tradables (T) and nontradables (N) sectors in the authors' model were also discussed. Ricardo Caballero argued that the key role assigned to currency mismatches in squeezing the N-sector through the impoverishment of the banking system may be overstated. He suggested that "T-collateral" be thought of as something that allowed some domestic firms direct access to international financial markets, and "N-collateral" as something that allowed the allocation of excess international collateral to those domestic firms that lacked direct access. The more fundamental problem is the collapse in T-collateral, rather than the balance sheets of domestic banks. He noted that Chile, despite having a well-developed financial system, went into crisis when large firms could not borrow abroad and turned instead to the domestic banks and nonbank financial firms, crowding out smaller borrowers. In Argentina it was the government that squeezed out the private sector. But in both cases the reasons for the contraction of credit to the domestic private sector were unrelated to any currency mismatch.

Richard Cooper noted that assigning industries to the tradables and nontradables sectors is not straightforward, especially because major changes have occurred in Mexican trade policy. To illustrate the difficulties, he cited the examples of some agricultural goods that are still effectively nontraded, and of gas, which because of a policy decision by Pemex (the state petroleum company) is not exported. Cooper added that although the paper assumes the dependence of the tradables sector on the nontradables sector, the opposite could occur as well, for example in the case of transportation services, which depend importantly on tradable goods.

Caballero addressed the issue of private sector overborrowing arising from the likelihood of bailouts. He pointed out that a complete model would need to address where the bailout money is expected to come from, and that the implications and policy recommendations would depend importantly on that question. If consumers are expected to pay for the bailout, consumption should be falling rather than rising before the crisis, which is not typically what happens. If the international community is expected to provide the bailout resources, it may be optimal to overborrow, and attention should be directed to transferring the resources to the private sector efficiently. Cooper added that if the money is expected to come from the government, the demand for government funds to bail out firms would compete with other needs and create a bottleneck in the fiscal system, which a complete model should take into account.

Miguel Savastano suggested that certain institutional features of the Mexican banking sector were important, and he argued that treating credit availability as a homogeneous input to emerging markets production was too strong an assumption. He noted that the role of banks differs widely across Europe, the United States, Japan, Latin America, and Asia, and he conjectured that the recovery of output with no recovery of credit in Mexico should not be viewed as a major aberration. Such a pattern may well be repeated in Argentina, for example. The present period in Mexico may come to be seen as one in which other sources of credit developed.

Carol Graham suggested an alternative mechanism to explain why countries with deeper crises grow faster: Instead of credit expansion leading to growth and crises, it could be that countries with deeper crises make more and deeper economic reforms. She suggested that the institutional reforms pending in Mexico may be an important part of the story there.

References

Aghion, Philippe, Philippe Bacchetta, and Abhijit Banerjee. 2000. "Capital Markets and the Instability of Open Economies." Working Paper 99.01 (updated). Study Center Gerzensee (November).

Aspe, Pedro. 1993. *Economic Transition the Mexican Way.* MIT Press.

Babatz, Guillermo, and Andrés Conesa. 1997. "The Effect of Financial Liberalization on the Capital Structure and Investment Decisions of Firms: Evidence from Mexican Panel Data." Ph.D. dissertation, Harvard University.

Bekaert, Geert, Campbell R. Harvey, and Christian Lundblad. 2001. "Does Financial Liberalization Spur Growth?" Working Paper 8245. Cambridge, Mass.: National Bureau of Economic Research (April).

Bergoeing, Raphael, and others. 2002. "A Decade Lost and Found: Mexico and Chile in the 1980s." *Review of Economic Dynamics* 5(1): 166–205.

Bernanke, Ben S., Mark Gertler, and Simon Gilchrist. 2000. "The Financial Accelerator in a Quantitative Business Cycle Framework." In *Handbook of Macroeconomics,* edited by John B. Taylor and Michael Woodford. New York: Elsevier North Holland.

Betts, Caroline M., and Timothy J. Kehoe. 2002. "Real Exchange Rate Movements and the Relative Price of Nontraded Goods." University of Minnesota.

Bordo, Michael D., and Barry Eichengreen. 2002. "Crises Now and Then: What Lessons from the Last Era of Financial Globalization?" Working Paper 8716. Cambridge, Mass.: National Bureau of Economic Research (January).

Brown, R. L., J. Durbin, and J. Evans. 1975. "Technique for Testing the Constancy of Regression Relationships over Time." *Journal of the Royal Statistical Society, Series B (Methodological)* 37(2): 149–92.

Burnside, Craig, Martin Eichenbaum, and Sergio Rebelo. 2001. "Prospective Deficits and the Asian Currency Crisis." *Journal of Political Economy* 109(6): 1155–97.

Caballero, Ricardo J., and Arvind Krishnamurthy. 2001. "International and Domestic Collateral Constraints in a Model of Emerging Market Crises." *Journal of Monetary Economics* 48(3): 513–48.

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

Chang, Roberto, and Andrés Velasco. 1998. "Financial Crises in Emerging Markets: A Canonical Model." Working Paper 6606. Cambridge, Mass.: National Bureau of Economic Research (June).

Chari, Anusha, and Peter Blair Henry. 2002. "Capital Account Liberalization: Allocative Efficiency or Animal Spirits?" Working Paper 8908. Cambridge, Mass.: National Bureau of Economic Research (April).

Cheung, Yin-Wong, and Kon S. Lai. 1993. "Finite Sample Sizes of Johansen's Likelihood Ratio Tests for Cointegration." *Oxford Bulletin of Economics and Statistics* 55(3): 313–28.

Chinn, Menzie D., and Kenneth M. Kletzter. 2000. "International Capital Inflows, Domestic Financial Intermediation and Financial Crises under Imperfect Information." Working Paper 7902. Cambridge, Mass.: National Bureau of Economic Research (September).

Cole, Harold L., and Timothy J. Kehoe. 2000. "Self-Fulfilling Debt Crises." *Review of Economic Studies* 67(1): 91–116.

Cole, Harold L., and Lee R. Ohanian. 1999. "The Great Depression in the United States from a Neoclassical Perspective." *Federal Reserve Bank of Minneapolis Quarterly Review* 23(1): 2–24.

Corbo, Vittorio, and Stanley Fischer. 1994. "Lessons from the Chilean Stabilization and Recovery." In *The Chilean Economy: Policy Lessons and Challenges,* edited by Barry P. Bosworth, Rudiger Dornbusch, and Raul Labán. Brookings.

Corsetti, Giancarlo, Paolo Pesenti, and Nouriel Roubini. 1999. "Paper Tigers? A Model of the Asian Crisis." *European Economic Review* 43(4): 1211–36.

Cuevas, Alfredo, Miguel Messmacher, and Alejandro Werner. 2003. "Macroeconomic Synchronization between Mexico and Its NAFTA Partners." Banco de México.

Demirgüç-Kunt, Asli, and Ross Levine, eds. 2001. *Financial Structure and Economic Growth: A Cross-Country Comparison of Banks, Markets, and Development*. MIT Press.

Dollar, David, and Aart Kraay. 2003. "Institutions, Trade and Growth." *Journal of Monetary Economics* 50(1): 133–62.

Dornbusch, Rudiger, and Alejandro Werner. 1994. "Mexico: Stabilization, Reform, and No Growth." *BPEA 1:1994,* 253–97.

Edison, Hali J., and others. 2002. "International Financial Integration and Growth." *Journal of International Money and Finance* 21(6): 749–76.

Edwards, Sebastian. 1998. "Openness, Productivity, and Growth: What Do We Really Know?" *Economic Journal* 108: 383–98.

Edwards, Sebastian, and Carlos A. Végh. 1997. "Banks and Macroeconomic Disturbances under Predetermined Exchange Rates." *Journal of Monetary Economics* 40(2): 239–78.

Engel, Charles. 1999. "Accounting for U.S. Real Exchange Rates." *Journal of Political Economy* 107(3): 507–38.

Esquivel, Gerardo, and Aaron Tornell. 1998. "The Political Economy of Mexico's Entry into NAFTA." In *Regionalism versus Multilateral Trade Arrangements: The Annual NBER East Asia Seminar on Economics,* Vol. 6, edited by Takatoshi Ito and Anne O. Krueger. University of Chicago Press.

Fatas, Antonio, and Ilian Mihov. 2002. "The Case for Restricting Fiscal Policy Discretion." CEPR Discussion Paper 3277. London: Centre for Economic Policy Research.

Fazzari, Steven M., R. Glenn Hubbard, and Bruce C. Petersen. 1988. "Financing Constraints and Corporate Investment." *BPEA 1:1988,* 141–95.

Frankel, Jeffrey A., and David Romer. 1999. "Does Trade Cause Growth?" *American Economic Review* 89(3): 379–99.

Gelos, Gaston R., and Alejandro Werner. 2002. "Financial Liberalization, Credit Constraints, and Collateral: Investment in the Mexican Manufacturing Sector." *Journal of Development Economics* 67(1): 1–27.

Gourinchas, Pierre-Olivier, and Olivier Jeanne. 2003. "The Elusive Gains from International Financial Integration." Working Paper 9684. Cambridge, Mass.: National Bureau of Economic Research (May).

Gourinchas, Pierre-Olivier, Oscar Landerretche, and Rodrigo Valdés. 2001. "Lending Booms: Latin America and the World." Working Paper 8249. Cambridge, Mass.: National Bureau of Economic Research (April).

Helpman, Elhanan, Marc J. Melitz, and Stephen R. Yeaple. 2003. "Export versus FDI with Heterogeneous Firms." Harvard University (July).

Hutchison, Michael, and Kathleen McDill. 1999. "Are All Banking Crises Alike? The Japanese Experience in International Comparison." *Journal of the Japanese and International Economies* 13(3): 155–80.

Imbs, Jean. 2002. "Why the Link between Volatility and Growth Is Both Positive and Negative." CEPR Discussion Paper 3361. London: Centre for Economic Policy Research (September).

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

Kaminsky, Graciela L., and Sergio L. Schmukler. 2002. "Short-Run Pain, Long-Run Gain: The Effects of Financial Liberalization." World Bank Working Paper 2912. Washington (October).

Kaufmann, Daniel, Aart Kraay, and Pablo Zoido-Lobaton. 1999. "Governance Matters." World Bank Policy Research Working Paper 2196. Washington.

Kehoe, Timothy J., and Edward C. Prescott. 2002. "Great Depressions of the 20th Century." *Review of Economic Dynamics* 5(1): 1–18.

Konrad, Kai A. 1992. "Risikoproduktivität." Contemporary Studies in Economics. Heidelberg: Springer.

Kraay, Aart. 1999. "In Search of the Macroeconomic Effects of Capital Account Liberalization." World Bank (October).

Krueger, Anne O., and Aaron Tornell. 1999. "The Role of Bank Restructuring in Recovering from Crisis: Mexico 1995–98." Working Paper 7042. Cambridge, Mass.: National Bureau of Economic Research (March).

Krugman, Paul. 1999. "Balance Sheets, The Transfer Problem, and Financial Crises." Working Paper. Massachusetts Institute of Technology.

La Porta, Rafael, and others. 1999. "The Quality of Government." *Journal of Law, Economics and Organization* 15(1): 222–79.

Lane, Philip R., and Gian-Maria Milesi-Ferretti. 2002. "External Wealth, the Trade Balance, and the Real Exchange Rate." *European Economic Review* 46(6): 1049–71.

Levine, Ross, Norman Loayza, and Torsten Beck. 2000. "Financial Intermediation and Growth: Causality and Causes." *Journal of Monetary Economics* 46(1): 31–77.

Loayza, Norman, and Romain Ranciere. 2001. "Financial Development, Financial Fragility and Growth." New York University.

Lustig, Nora. 2001. "Life Is Not Easy: Mexico's Quest for Stability and Growth." *Journal of Economic Perspectives* 15(1): 85–106.

Maddison, Angus. 1995. *Monitoring the World Economy, 1820–1992.* Paris: Organization for Economic Cooperation and Development.

Markusen, James R. 2002. *Multinational Firms and the Theory of International Trade*. MIT Press.

Martínez, Lorenza, and Alejandro Werner. 2002a. "Capital Markets in Mexico: Recent Developments and Future Challenges." Working Paper. Banco de México (November).

———. 2002b. "The Exchange Rate Regime and the Currency Composition of Corporate Debt: The Mexican Experience." *Journal of Development Economics* 69(2): 315–34.

McKinnon, Ronald I. 1973. *Money and Capital in Economic Development*. Brookings.

McKinnon, Ronald I., and Huw Pill. 1999. "Exchange-Rate Regimes for Emerging Markets: Moral Hazard and International Overborrowing." *Oxford Review of Economic Policy* 15(3): 19–38.

Mody, Ashoka, Assaf Razin, and Efraim Sadka. 2003. "The Role of Information in Driving FDI Flows: Host-Country Transparency and Source Country Specialization." Working Paper 9662. Cambridge, Mass.: National Bureau of Economic Research (April).

Newey, Whitney K., and Kenneth D. West. 1987. "A Simple, Positive Semi-Definite, Heteroskedasticity and Autocorrelation Consistent Covariance Matrix." *Econometrica* 55: 703–08.

Obstfeld, Maurice. 1986. "Rational and Self-Fulfilling Balance of Payments Crises." *American Economic Review* 76(1): 72–81.

Perry, Guillermo, and others. 2003. "Lessons from NAFTA for Latin American and Caribbean Countries." World Bank.

Prasad, Eswar S., and others. 2003. "Effect of Financial Globalization on Developing Countries: Some Empirical Evidence." IMF Occasional Paper 220. International Monetary Fund.

Quintin, Erwan. 2003. "Limited Enforcement and Organization of Production." Federal Reserve Bank of Dallas.

Rajan, Raghuram G., and Luigi Zingales. 1998. "Financial Dependence and Growth." *American Economic Review* 88(3): 559–86.

Ramey, Garey, and Valerie A. Ramey. 1995. "Cross Country Evidence on the Link Between Volatility and Growth." *American Economic Review* 85(5): 1138–51.

Ranciere, Romain, Aaron Tornell, and Frank Westermann. 2003. "Crises and Growth: A Re-evaluation." University of California, Los Angeles.

Sachs, Jeffrey D. 1989. "The Debt Overhang of Developing Countries." In *Debt, Stabilization and Development: Essays in Memory of Carlos Diaz-Alejandro,* edited by Guillermo Calvo and others. Oxford, U.K.: Blackwell, and Helsinki: United Nations University, World Institute for Development Economics Research.

Sachs, Jeffrey D., and Andrew Warner. 1995. "Economic Reform and the Process of Global Integration." *BPEA 1:1995,* 1–118.

Sachs, Jeffrey D., Aaron Tornell, and Andrés Velasco. 1996a. "Financial Crises in Emerging Markets: The Lessons from 1995." *BPEA 1:1996,* 147–98.

———. 1996b. "The Collapse of the Mexican Peso: What Have We Learned?" *Economic Policy* 0(22): 13–63.

Schneider, Martin, and Aaron Tornell. Forthcoming. "Balance Sheet Effects, Bailout Guarantees and Financial Crises." *Review of Economic Studies*.

Silverman, B. W. 1986. *Density Estimation for Statistics and Data Analysis*. New York: Chapman & Hall/CRC Publishing.

Sinn, Hans-Werner. 1986. "Risiko als Produktionsfaktor." *Jahrbücher für Nationalökonomie and Statistik* 201: 557–71.

Stiglitz, Joseph. 2002. *Globalization and Its Discontents*. W. W. Norton.

Tirole, Jean. 2002. "Financial Crises, Liquidity, and the International Monetary System." Princeton University Press.

Tornell, Aaron, and Andrés Velasco. 1992. "The Tragedy of the Commons and Economic Growth: Why Does Capital Flow from Poor to Rich Countries?" *Journal of Political Economy* 100(6): 1208–31.

Tornell, Aaron, and Frank Westermann. 2002. "Boom-Bust Cycles: Facts and Explanation." International Monetary Fund *Staff Papers* 49(special issue): 111–55.

———. 2003. "Credit Market Imperfections in Middle Income Countries." Working Paper 9737. Cambridge, Mass.: National Bureau of Economic Research (June).

Veldkamp, Laura. 2002. "Slow Boom, Sudden Crash." Paris: INSEAD.