Financial and Monetary Policies in an Economy with Balance Sheet Effects

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1 Introduction

The old balance of payments crises, in which government deficits took center stage, have been replaced by new twin currency and banking crises, in which bank lending has taken center stage.

In this paper we present a conceptual framework that can help us analyze the effects of some of the financial and monetary policies that have been implemented in emerging markets during the last decade. The central theme of the paper is that the policies implemented in countries that have experienced crises reflect neither sheer incompetence nor outright corruption. Moreover, we will argue that some of the policies adopted can be considered as second-best-optimal given the environment faced by emerging economies. Crises were simply bad draws that did not have to happen. They were the price that had to be paid in order to attain faster growth. We would like to emphasize that we will not defendsome policy measures that simply mask corruption.

Bailout Guarantees have been considered the main villain in the recent crises. They have been attacked as the cause of excessive risk taking and overinvestment that have rendered economies fragile to crises. In this paper we will question this view. Throughout the paper we will make a distinction between systemic bailout guarantees and unconditional guarantees. The former are granted only if a critical mass of agents defaults. The latter are granted whenever there is an individual default, like in a deposit insurance scheme. As we shall see, this distinction is quite important.

We will analyze two sets of issues that have been hotly debated in recent years. The first set of issues relate to the transition path along which emerging markets evolve:

1. What is the role of systemic bailout guarantees?

2. Why is it that banks tend to choose risky foreign exchange denominated debt? Does this play a useful social role?

3. Do lending booms play a socially beneficial role? And how about asset price inflation inflation?

4. Is privatization and other reforms that improve the contractual environment always socially beneficial?

5. What is the role of foreign banks in promoting the development of emerging economies?

6. Does the exchange rate regime matter in determining the likelihood of crises and the generosity of bailouts?

The second set of issues refer to the aftermath of crises:

1. Do interest rate and exchange rate responses to a crisis have different effects?

2. Why do credit crunches develop? Bailing out lenders vs. bailing out borrowers.

3. What are the dynamic effects of piecemeal bailouts and all-at-once bailouts?

In order to evaluate these issues, it is necessary to understand the context in which policy rules were designed, and the underlying imperfections they were supposed to counteract. In order to do this one needs a conceptual framework that can explain the basic features of the boom-bust cycles experienced by emerging economies during the 1990s. In this paper we will use the model developed by Schneider and Tornell (2000) to make such an evaluation.

We start with a description of the stylized facts. Typically, during the 1990s crises have been preceded by real exchange rate appreciation and by lending booms, during which bank lending grew unusually fast.[1] During these lending booms emerging economies became fragile because a significant amount of short-term banks' liabilities were denominated in foreign currency on an unhedged basis. Meanwhile, banks lend mainly to small firms in the nontradables sector. Much of this lending was guaranteed by governments — at least implicitly.

Twin banking and currency crises often occurred in the absence of any major external shock, and came as a surprise to financial markets. In these episodes, a small incipient reduction in capital inflows has been followed by

[1]Real appreciation has been particularly severe in Latin America. See Corsetti, Pesenti and Roubini (1998), Glick and Rose (1998), Gorinchas, et. al. (1999), Kaminsky and Reinhart (1999), Sachs, Tornell and Velasco (1995) and Tornell (1999).

a significant real exchange rate depreciation. Since debt was largely denominated in foreign currency, the depreciation has induced widespread bankruptcies and a collapse of new lending. In most countries, rescue packages were designed to support the banking system and to bail out foreign lenders. Nevertheless, these countries still experienced a sharp and long-lasting credit crunches.

A puzzling regularity is that the contraction in the growth rate of bank credit that typically develops in the aftermath of crises is quite pronounced and persistent. In contrast, although aggregate GDP and deposits' growth decline initially, they recuperate rather fast. This puzzle can be explained by two additional stylized facts, that we will emphasize throughout this paper. On the one hand, the milder decline and faster recovery of aggregate activity in the aftermath of a crisis masks an asymmetric performance. While tradable (T) sectors suffer a very mild decline, nontradables (N) sectors suffer a very deep a persistent recession. On the other hand, the banking system is typically strongly exposed to the N-sector. Since the debt burden increases sharply relative to revenues, entrepreneurial wealth is drastically reduced. This in turn keeps the growth rate of bank credit depressed despite the fast resumption of deposits' growth.

These stylized facts are illustrated in Figures 1 through 4. These figures depict the evolution of the real exchange rate, bank credit and deposits, GDP and the ratio of nontradables to tradables production for six emerging economies: Argentina and Mexico which suffered a crisis in 1995; Korea, Malaysia and Thailand which experienced a crisis in 1997; and Chile which did not experience any severe crisis during the 1990s, and so can be considered as a benchmark. Furthermore, as a concrete example of a boom-bust episode we describe below the Mexican experience around the December 1994 Tequila crisis.

To explain some of the stylized facts 'third generation' crises models have looked to financial market imperfections as key 'fundamentals'. The models are typically based on *one of two* distortions: either "bad policy", in the form of bailout guarantees, or "bad markets", in the form of an imperfection that induces balance sheet effects, such as asymmetric information, or the imperfect enforceability of contracts. Schneider and Tornell (2000) consider an economy that is *simultaneously* subject to these two distortions: systemic bailout guarantees and the imperfect enforceability of contracts. It also stresses *the role of the nontradables sector*, which is often overlooked in the debate about the causes of recent crises. They show that *the interaction*

of the two distortions generates a coherent account of a *complete* boom-bust episode, and explains the stylized facts described above. In this paper we use this framework to address the policy issues we have raised.

We make five main points. First, systemic bailout guarantees are a second best instrument to promote investment in emerging economies. Severe enforceability problems make bank credit practically the only source of external finance for firms in the nontradables sector. In this environment many profitable investment project cannot be undertaken because agents are credit-constrained. Guarantees promote investment because they ease borrowing constraints and provide an implicit subsidy. In contrast to deposit insurance schemes, systemic bailout guarantees are only granted if a critical mass of agents goes bust. Thus, they do not eliminate the monitoring role of banks.

Second, risky debt plays a useful role in promoting investment. The subsidy implicit in systemic bailout guarantees can be cashed-in only if there exist some states of the world in which there is a systemic crisis. In the absence of exogenous shocks that bankrupt many agents, there must be endogenous expected volatility. Lending booms and risky dollar debt can generate this endogenous volatility by making the economy fragile against self-fulfilling crises. Clearly, an economy might evolve along the transition path without experiencing any crisis. In fact, the likelihood of crisis must be small. Otherwise, systemic bailout guarantees might have the unintended effect of drastically reducing productive investment.

Third, a consequence of the previous point is that if prudential regulation tries to minimize risk in the banking system, it might block the investment enhancing effect of systemic bailout guarantees. In contrast, a very important role of prudential regulation is to prevent fraudulent activities. If not accompanied by a concurrent improvement in prudential regulation, banks' privatization, and other reforms that improve the contracting environment among private agents might not improve social welfare. This raises the issue of why is it that many emerging countries have failed to improve their regulatory framework. We suggest that in some cases this has been due to political causes.

Fourth, the effects that generate boom-bust cycles are independent of the exchange rate regime. In particular, systemic bailout guarantees can induce the adoption of risky debt structures in fixed as well as in flexible exchange rate regimes. Guarantees may appear under different guises and need not be explicit. The precise form the bailout takes will depend on the regime. For instance, under fixed rates the bailout rate is mostly determined

by the amount of reserves authorities are willing to use in order to defend the currency. In contrast, in a pure floating regime the bailout may take the form of direct transfers to agents.

Fifth, in the event of a crisis the amount of non-performing loans increases dramatically. If they are recognized, the most likely outcome is that the government will have to take over the banking system, make a once-and-for-all bailout payment and incur a huge fiscal cost up-front. This will increase government debt and probably interest rates. On the other hand, if just a small share of non-performing loans is recognized the up-front bailout and fiscal cost will be low. However, this strategy might lead to evergreening and generate perverse incentives. Over time the problem might grow and the credit crunch might last longer, as the experience of Japan and Mexico has shown.

In the next section we present a short description of the Mexican experience. In Section 3 we present the conceptual framework. Section 4, which is the main part of the paper, analyzes the issues we raised above. Section 5 presents a simplified version of the model in Schneider and Tornell (2000).

The Mexican Experience

The experience of Mexico during the 1990s illustrates, in a rather sharp way, the facts described in the Introduction. In the late 1980s, Mexico implemented radical trade and financial liberalization as well as deregulation and privatization programs. These policy measures generated the expectation of an extraordinary growth in exports after a short transition period. After decades of statism, the private sector was too small and so the relevant policy question was how to promote its rapid growth (as well as the investment in the infrastructure that would provide the services and inputs that the T-sector would need once the extraordinary future would arrive). The decision was made to privatize the banks and allow them to be the means through which resources would be channeled to the nascent private sector.

The expectation of an extraordinary growth in exports, as well as implicit bailout guarantees, generated privatization prices for the banks way above standard multiples-to-book value. As is well known, Mexico experienced a pronounced lending boom and a severe real appreciation. Between 1992 and 1994, lending from banks to the private sector increased by more than 50% in real terms and the real exchange rate appreciated around 15%.

In December 1994, the new administration of President Zedillo announced

a change in the exchange rate regime and engineered a small depreciation. Although the pre-crisis estimates of the real appreciation did not exceed 20%, Mexico experienced a massive real depreciation of nearly 100%. As a result, many firms were unable to repay their dollar denominated debts and the government had to implement a bailout program, known as the Fobaproa. Current estimates of the Fobaproa's costs are around 20% of GDP.

In the aftermath of the Tequila crisis, real credit from banks to the private sector collapsed and has remained at a depressed level since then. This stands in sharp contrast with the fast recovery of both, bank deposits and aggregate real GDP. After a short recession, real GDP started to increase as early as 1996.

Aggregate GDP performance masks an asymmetric sectorial response to the crisis. While the T-sector experienced an acceleration of growth throughout the period, the N-sector experienced a sharp fall and a sluggish recuperation. This asymmetric response was caused by the fact that the credit crunch affected mainly small and medium firms in the N-sector, while firms in the T-sector could obtain finance from international capital markets. As a result, non-oil exports were not affected by the Tequila crisis. In fact, they increased at a faster rate thanks to the real depreciation and to the booming US economy.

The contrasting pattern displayed by the T- and N-sectors is consistent with the view that the real depreciation had a 'balance sheet' effect mainly in the N-sector. The destruction of entrepreneurial wealth, in turn, lead to the protracted recession in that sector and the credit crunch.

2 Conceptual Framework

In this section we present a brief overview of the model of Schneider and Tornell (2000). A simplified version of this model is presented in Section 4. In the next section we will use this model to address the policy issues we raised in the Introduction. Consider an economy with a tradable (T) and a nontradables (N) sectors. Agents in he T-sector can be financed in international capital markets. In contrast, bank credit is the only source of external finance for agents in the N-sector. Agents in the N-sector demand T-goods for consumption, and produce nontradables using only nontradables as inputs according to a linear production technology: $q_t = \theta I_t$.T-sector agents

are endowed with T goods, and consume both T and N goods.

N-sector agents can issue either 'risky debt' or 'safe debt'. Risky debt is denominated in foreign currency (T goods) on an unhedged basis, while safe debt has no real exchange rate risk.

N-sector financing is subject to two distortions: enforceability problems and bailout guarantees. High enforceability problems imply that lenders will limit the amount they lend regardless of what the interest rate is. As a result, N-sector agents might face borrowing constraints in equilibrium. In our model, similar to several financial accelerator type models, the amount of credit available to a firm is determined by the level of internal funds. If bailout guarantees are introduced, their interaction with enforceability problems will induce agents to issue risky debt, generating endogenous real exchange rate risk.

Consider an economy in which only enforceability problems are present, as in standard financial accelerator models. If investment has a sufficiently high rate of return, agents will borrow as much as they can. As a result the credit multiplier becomes an investment multiplier. We show in Section 4 that

$$p_t I_t^s = m^s(h) \cdot w_t \tag{1}$$

where w_t is internal funds (denominated in T goods) of a representative N-sector firm; $p_t = \frac{p_t^N}{p_t^T}$ is the inverse of the real exchange rate; $m^s(h)$ is the investment multiplier which is decreasing in the degree of the enforceability problem (indexed by $1/h$); and I_t is physical investment by the N-sector. Although safe debt is more expensive than risky debt, in the presence of bankruptcy costs issuing safe debt is individually optimal. Thus, in the absence of exogenous shocks, the economy will not exhibit fragility to meltdowns. Under no circumstances will firms go bust.

Let us introduce the second distortion: bailout guarantees. We should distinguish two types of bailout guarantees: unconditional and systemic. The former are granted whenever there is a default by an individual borrower (e.g., deposit insurance), while the latter are granted only if a critical mass of borrowers goes bust. Clearly, if all debt were covered by unconditional bailout guarantees, then the enforceability problem would become irrelevant and borrowing constraints would not arise in equilibrium. Since a lender would be bailed out in the case of an idiosyncratic default, he does not have incentives to limit the amount of credit he extends to an individual borrower. Hence, in order for bailout guarantees not to neutralize the effects of enforce-

ability problems, and for borrowing constraints to arise in equilibrium, it is necessary that some part of banks' liabilities be only covered by systemic bailout guarantees.

Systemic bailout guarantees provide an implicit subsidy that eases borrowing constraints. However this subsidy can be cashed in only if there are some states of nature in which a critical mass of borrowers goes bust. In the absence of exogenous shocks that bankrupt a critical mass of borrowers, the introduction of systemic bailout guarantees will have an effect only if there is aggregate endogenous risk.

Endogenous Real Exchange Rate Volatility

The first main result is that the *interaction* of systemic bailout guarantees and enforceability problems might generate an aggregate endogenous risk. This is because there is a self-reinforcing mechanism at work. On the one hand, if there is sufficient real exchange rate risk, it is individually optimal for an N-sector agent to issue risky T-debt (i.e., borrow in foreign currency on a short-term and unhedged basis). On the other hand, if *many* N-sector agents gamble by denominating their debt in T goods, exchange rate risk might be endogenously created, as the economy becomes vulnerable to *self-fulfilling meltdowns* of the banking system. If the amount of T denominated debt is high, a real depreciation can severely squeeze cash flow, or even bankrupt banks altogether. Since they face binding borrowing constraints, they then have to curtail lending to the N-sector. Weak investment demand from the N-sector for its own products in turn validates the real depreciation. The systemic credit risk created by the banking system thus induces endogenous exchange rate risk.[2]

Real exchange rate variability can make risky T-debt cheaper than safe debt. To illustrate this suppose that tomorrow's real exchange rate can take on two values: an appreciated one that leaves every firm solvent, and a depreciated one that makes a majority of N-sector firms go bust. In the presence of full bailout guarantees, risk neutral lenders are willing to fund T-debt at world interest rates because it will be repaid in full in both states of nature. Either by the borrowers in the good state, or by the bailout agency in the crisis state. Second, if the probability of crisis is small and real appreciation in the good state is large, it clearly pays N-sector agents to

[2]There are several ways in which agents can adopt risky projects. However, risky debt denomination (borrowing in dollars to finance nontradables activities) is a wonderful 'coordinating device'. Since debt denomination is easily observed, agents can implicitly collude to cash in the subsidy implicit in the bailout guarantee.

issue T-debt and gamble with the bailout agency's money. This is because the greater the real appreciation, the greater the debt burden, measured in terms of nontradables, which is inflated away.

To see under which circumstances the existence of T-debt generates fragility we turn to the determination of the equilibrium real exchange rate $(1/p_t)$. This price equalizes aggregate demand and the (predetermined) supply of nontradables: $D(p_t) = \theta I_{t-1}$. The aggregate demand for N goods has two components: the demand by the T-sector, and the demand by the N-sector for its own goods. Since at a given point in time supply is given, the key to having multiple equilibria is a backward bending aggregate demand curve. This is impossible if N-sector firms have only N-debt. In this case, price changes lead to variations in both firms' revenues and their debt payments. In fact, profits (measured in nontradables) are completely insulated against price movements. The upshot is that as long as firms are solvent,, demand slopes downward and there is a *unique* equilibrium real exchange rate.

Multiple equilibria are possible only if N-sector agents have T-debt. In this case real exchange rate movements affect revenues, but keep the debt burden unchanged. Thus, it becomes important to distinguish between insolvent and solvent firms. For real exchange rates more depreciated than a cutoff level $1/p_t^c$, all N-firms go bankrupt because revenues do not cover the debt burden. As a result, internal funds collapse. Total demand in this range is downward sloping. In contrast, for real exchange rates more appreciated than $1/p_t^c$, a further real appreciation is accompanied by a *more than proportional* increase in internal funds. The reason is that revenues increase while the debt burden remains the same. Equivalently, part of the debt burden measured in terms of nontradables is 'inflated away'. Consequently, investment demand *increases.*

It is apparent that if the balance sheet effect is strong enough to make aggregate demand 'bend backward', as in Figure XXX, multiple market clearing real exchange rates, and hence self fulfilling 'twin crises' can exist. With identical fundamentals, in terms of supply and debt, the market may clear in one of two equilibria. In a 'solvent' equilibrium (point B in Figure XXX), the price [the reciprocal of the real exchange] is high, inflating away enough of firms' debt (measured in nontradables) to allow them to bid away a large share of output from consumers. In contrast, in the 'crisis' equilibrium of point A, the price is low to allow the T-sector and bankrupt N-sector agents with little internal funds to absorb the supply of nontradables. Whichever of these two points is reached depends on expectations. Fundamentals deter-

mine only whether the environment is fragile enough to allow two equilibria.

Equilibrium Dynamics

The second main point is that the *interaction* between systemic bailout guarantees and enforceability problems not only induces endogenous volatility, but also fuels the lending and investment booms as well as the real appreciation. This explains the other stylized facts described in the Introduction.

Systemic bailout guarantees alleviate the 'underinvestment' problem usually associated with constrained banks. They permit high leverage with debt denominated in T goods, and faster credit growth. As we have seen, the presence of bailout guarantees induces N-sector agents to issue T-debt. This allows agents to reduce the expected value of debt repayments. This reduction, in turn, permits agents to borrow more at each level of internal funds. Therefore, at a given point in time, the 'investment multiplier' is greater than that of an economy that features only enforceability problems (m^s). We show in Section 4 that the value of investment by the N-sector is

$$p_t I_t = m^r(h, F) \cdot w_t, \qquad m^s(h) < m^r(h, F) \text{ if } F > 0 \tag{2}$$

where F stand for the generosity of the bailout guarantee.

As a result, the N-sector grows faster than if guarantees were absent.

Consider now the interplay between the real appreciation and the lending boom. Since N goods are demanded for investment by the N-sector itself, both output and the relative price of nontradables increase during the boom. Furthermore, since debt is denominated in T goods, a real appreciation (a relative price increase) reduces the debt burden measured in terms of nontradables. This increases N-sector agents' cash flow. For constrained agents, this translates into more lending through a 'balance sheet effect'. More lending, in turn, permits more investment in N goods. In order to close the circle, note that if the investment increase is greater than the higher output, the real exchange rate must appreciate in order to eliminate the excess demand for nontradables.

An economy can follow a risky or safe equilibrium path depending on whether or not firms investment plans lead them to go bust in some states. Figure XXX depicts the paths that an economy follows along both equilibria. Along the lucky path of a risky equilibrium credit and investment in the N-sector rise over time while the real exchange rate appreciates. At the same time, demand of N goods by the T-sector *falls*. Thus, we have a drastic

version of the transfer of resources and the asymmetric sectorial pattern that actually takes place during lending booms. A risky lending boom equilibrium features two key observed characteristics of credit: debt denomination is used to take on real exchange rate risk and leverage is unusually high. The benchmark is the leverage achieved in a safe equilibrium (see Proposition 1). The lending boom develops gradually over time. Since the production technology is linear, the relevant 'adjustment costs' here are due to the contract enforceability problem. The N-sector can grow only gradually since it must wait for internal funds to accumulate.

Self-fulfilling Crises

A crisis occurs when the bad state of the sunspot is realized for the first time. The result is a real depreciation and widespread bankruptcies in the N-sector. This depletes the internal funds of the N-sector. Thus, its investment drops and can only gradually recover (due to the financial 'adjustment costs' mentioned above). At the same time, demand by the T-sector jumps up. Again, this highlights the asymmetric patterns followed by the N-sector and the T-sector.

We would like to emphasize that a key point of Schneider and Tornell (2000) is that *the interaction* of contract enforceability problems and bailout guarantees creates the fragility required for self-fulfilling crises. If there were no guarantees, firms would not be willing to take on price risk to claim a subsidy. Costly enforceability of contracts would still imply that the N-sector can grow only gradually and balance sheet effects would play a role during the lending boom. However, there would be no force that makes a boom end in a crisis. Alternatively, if there were only guarantees but no enforceability problems, then there would not be any balance sheet effects that make demand backward-bending, a necessary condition for a sunspot to matter.

Lending booms that feature fragility cannot occur in just any economy with bailout guarantees and enforceability problems. It is also necessary to have a future increase in the demand of the T-sector for nontradables. Otherwise, the N-sector would not be able to repay the accumulated deficits it runs during the lending boom. Backward induction then indicates that the sequence of returns that supports the lending boom would collapse. This suggests that the boom-bust episodes are more likely to occur during a transition period (for instance, following a far reaching reform or a natural resource discovery).

Even during a transitional period *the likelihood of a self-fulling crisis is not a free parameter*. If crises were not rare events, either borrowing constraints would not arise, or would not be binding in equilibrium if they did arise. In either case, credit would not be constrained by internal funds and balance sheet effects would not exist in equilibrium. Clearly, if this was the case, crises could not occur. If the probability of crises is not small enough, enforceability problems do not generate borrowing constraints.

In conclusion, the introduction of systemic bailout guarantees into an otherwise riskless economy can increase the credit and investment multiplier. However, this occurs only if the economy becomes fragile to self-fulfilling meltdowns. The systemic bailout guarantees induce agents in the N-sector to switch from safe to risky debt, generating aggregate real exchange rate risk.

3 Policy Evaluation

An emerging economy is one where the future is much brighter than the present, but where profitable investment projects cannot be undertaken because: (i) the private sector is small (i.e., entrepreneurial wealth is low), and (ii) the amount of external financing is severely limited. The reforms of the late 1980s liberalized trade and financial markets in many emerging markets. These reforms also brought a significant reduction in the role of the state in the economy. Suddenly, the future looked much brighter than before, and the private sector much smaller than what was desirable. Unfortunately legal and judicial reform could not be implemented as easily as the other reforms. As a result, many of the institutions that support the provision of external finance in developed economies did not flourish in emerging markets.

The policy problem then became how to better promote the fast development of the private sector in an environment where external finance to the domestic sector is constrained by internal funds of firms, and where credit and investment are too low relative to investment opportunities. One is tempted to say that if a government had the appropriate information and correct incentives, the optimal policy would have been to transfer resources to those in the population with better entrepreneurial skills, and to let them make the investing decisions. Of course, we now know that this is wishful thinking. After many failed experiments of this sort carried out during the last

century, we now know that either governments do not posses the appropriate information, or crony capitalism and rampant corruption take over.

Since direct made-to-measure government transfers are not feasible, during the 1990s governments had to design second-best policies to foster the development of the private sector. In many countries the decision was made to privatize the banks and allow them to be the means through which resources would be channeled to the nascent private sector. The issues described in the Introduction should be analyzed from this perspective.

We will analyze these issues by using the framework developed by Schneider and Tornell (2000), described in Sections 2 and 4. Since this model explains many of the stylized facts that characterize the boom-bust cycles experienced by emerging markets during the 1990s, it is an appropriate framework to evaluate the policies implemented by emerging markets. We will argue that when taking into consideration the distortions that exist in emerging markets, there is a sense in which these policies are second-best-optimal instruments to foster the private sector's growth. We would like to emphasize that we are not defending some policy measures that simply mask corruption. Those are clearly undefendable.

Consider the two-sector economy described in Section 2. Firms in the T-sector can easily obtain financing in international capital markets either because they can pledge their export receivables as collateral, or because they are closely linked to firms that can secure their debt. In contrast, firms in the N-sector must rely more heavily on domestic bank credit. Furthermore, since emerging markets face acute enforceability problems, firms in the N-sector face severe borrowing constraints that limit their ability to undertake profitable projects. As a result, the growth rate of the economy is kept below its potential. It follows that a policymaker, whose objective is to maximize social welfare, must design second best policies that will ease borrowing constraints and increase investment in the N-sector. Since the N-sector and the T-sector compete for productive resources and since any policies to support the N-sector have implicit fiscal costs, the optimal support level for the N-sector cannot be arbitrarily large.

3.0.1 Policies During a Boom

Systemic versus Unconditional bailout guarantees

We have seen that in the presence of severe enforceability problems in fi-

nancial markets credit is constrained by internal funds. As a result profitable investment projects will not be undertaken, and growth will be significantly lower than what it could be. This indicates that systemic bailout guarantees might actually play a socially beneficial role. Systemic bailout guarantees provide an implicit subsidy that reduces the cost at which firms can fund themselves, and increases the credit multiplier. This increases investment and growth at each level of internal funds. In the absence of better instruments to promote investment and growth of the private sector, systemic bailout guarantees are a second best instrument to make transfers to the nascent private sector. We would like to emphasize that this mechanism uses the information and monitoring capacity of banks.

Consider the generosity of bailout guarantees (F) as a policy instrument. An increase in F induces an increase in the investment multiplier in (2), which in turn leads to a higher growth rate of the N-sector. Therefore, in an emerging economy it is optimal to set F higher than zero in order to reduce the under-investment problem. However, there are trade-offs: first, the greater F the greater the contingent fiscal cost; second, the greater F, the greater the share of resources allocated to the N-sector at the expense of the T-sector. Therefore, F should not be set at a 'level too high'. There is an interior optimum. As we shall discuss below, there are several ways in which systemic bailout guarantees can be implemented.

We would like to emphasize three points. First, if in a given country banks play no monitoring role and are prone to fraud, systemic bailout guarantees will not be socially beneficial. Second, systemic bailout guarantees do not curtail the discipline faced by either individual banks or firms because they are granted only if a critical mass of agents defaults. At the same time, systemic bailout guarantees generate an investment subsidy only if the banks' portfolios are risky. That is, only if there exist states of nature in which there is systemic crisis. In the absence of large exogenous shocks, this means that some risk must de endogenously generated by the banking system in order for guarantees to be effective in promoting investment (we address this issue below). Third, systemic bailout guarantees imply that the government can credibly commit not to bailout individual agents in the case of idiosyncratic default.

The experience of Mexico during the 1990s illustrates, in a rather sharp manner, the policy dilemma faced by reformers. The reforms of the late 1980s generated the expectation of an extraordinary growth in exports after a short transition period. After decades of statism, the private sector was too small

and so the relevant policy question was how to promote the investment in infrastructure that would provide the services and inputs that the T-sector would need once the extraordinary future would arrive. The decision was made to privatize the banks and allow them to be the means through which resources would be channeled to the nascent private sector. The expectation of an extraordinary growth in exports, as well as implicit bailout guarantees, generated privatization prices for the banks way above standard multiples-to-book value. Several critics have pointed to the 'false rosy expectations' generated by the government, and the promises of bailout guarantees, as the culprits for the Tequila crisis. Certainly, ex-post this is true, a policymaker would say. However, at that time it seemed a correct policy. The alternative was that the N-sector would experience low growth and bottlenecks that would limit the overall future growth of the economy. Politically, it was necessary to promote the development of the private sector in order to create new power bases that would block attempts by statist groups to go back to the old ways. It was a way to ensure the continuity of the reforms.

An important issue that we have not discussed yet is unconditional bailout guarantees, which are granted whenever an individual debtor defaults. Deposit insurance is a prime example. If all guarantees were unconditional, the discipline in the banking system would disappear and guarantees would not play the investment promoting role we described above. Moreover, we would not be able to explain the boom-bust cycles experienced by emerging economies.

However, if unconditional bailout guarantees are granted to small bank depositors, they might play a socially beneficial role. This policy avoids bank-runs generated by cascading rumors, but does not impinge negatively on the market discipline faced by an individual bank because small depositors have typically very little information regarding the bank's portfolio. As it is the case in the U.S., market discipline should be imposed by non-insured bank debt, whose interest rate should serve as an indicator of a bank's health.

The role of risky 'dollar' debt

In the absence of large exogenous shocks, outlawing risky dollar debt will undo the investment-enhancing effects of systemic bailout guarantees. Thus, if the conditions of a country call for bailouts as a second best policy to promote the growth of the private sector, then risky debt (or another way to generate endogenous volatility) must also be allowed. Of course, this does not mean that banks should be allowed to have outrageously risky portfolios.

It just means that a naive policy of outlawing risky dollar debt is not correct from a normative perspective.

Since systemic bailout guarantees can only be cashed in states of the world in which there is a systemic crisis, Systemic bailout guarantees are effective in increasing investment only if a significant part of the economy is vulnerable to systemic crises. It is only during a systemic meltdown that the bailout agency makes payments to lenders. Thus, the expected value of the subsidy is determined by the likelihood of a crisis and by the generosity of the bailout. The greater the expected value of the subsidy, the lower interest rates that lenders are willing to accept. Clearly, banks portfolios cannot be outrageously risky, as the likelihood of crisis must be quite small in order for the mechanism identified in this paper to be operative. Otherwise, firms would not find it profitable to borrow and invest in the first place! Note however, that small is not the same as zero. In the absence of major exogenous shocks, fragility must be endogenously generated. This is precisely the role of risky debt denomination. As we explained above, if a majority of borrowers has unhedged debt, the economy as a whole can become fragile to self-fulfilling crises. Furthermore, dollar debt is a wonderful coordinating device, as it can be observed by others. It plays the same role as the real-estate buildup on an uninsured basis in catastrophe prone areas. The principle that 'if everyone else does it, then I am safe' reigns.

From a positive perspective it is also impossible to outlaw dollar short-term debt. Many firms need such debt in order to carry out their international transactions. Since it is impossible to distinguish what part of dollar debt is used by a given firm to finance international transactions, it is not feasible to enforce a law that outlaws dollar debt for uses other that international trade. This lesson has been painfully learned by many countries that have tried to implement dual exchange rates, and then were faced with rampant mis-invoicing of imports and exports.

In conclusion, the degree of banks' and firms' portfolio riskiness should be strictly regulated. However, risky debt should not be outlawed altogether. It is neither socially optimal nor practically implementable.

The role of lending booms and asset price inflation

During a lending boom credit grows unusually fast and, as many observers have pointed out, monitoring effectiveness declines. Thus, it is less likely that unprofitable and white elephant projects will be detected and stopped. At the same time, firms in emerging markets have a very low level of external

finance, and a lending boom is a mechanism by which faster growth can be attained. In fact, the lending boom is a transitional phase that is ignited by deep economic reforms that make the future much brighter than the present.

Stopping a lending boom, for example by increasing reserve requirements, would interrupt the policy of promoting the growth of the private sector. On the contrary, allowing the lending boom to continue unchecked, increases the debt burden of the economy which makes it more vulnerable to crises. Hence, from an ex-ante perspective it is not clear at which point should a lending boom be stopped.

It is interesting to note that although crises typically are preceded by lending booms (Tornell (1999)), the converse is not true. Gourinchas et. al. (1999) find that for a large panel of countries the probability that a lending boom ends in a crisis is quite small. That is, in the majority of cases, lending booms end with soft landings. Furthermore, theoretic lending booms can only develop if the probability of crisis is small and they are expected to end with a soft landing if they last long enough (see Schneider and Tornell (1999), (2000)).

Clearly, India has not experienced lending booms of such magnitude as the ones experienced by Korea. Moreover, India has not suffered currency crises as deep as Korea. Certainly, this does not mean that over the last half century India has performed better than Korea. Of course, with hindsight Korean performance could have been improved on the margin. However, we should beware of fine tuning policies that look great after the fact.

Prior to several crises it has been observed that some assets, such as real estate, experience a steep price inflation which is followed by a price collapse at the time of crisis. Since real estate is used as collateral, there is a close link between lending and asset price inflation during a boom. Thus, implementing policies that would stop asset price inflation will also reduce the growth of credit. Clearly, it might be dangerous to leave asset price inflation unchecked. However, some degree of inflation might be desirable as a tool to ease borrowing constraints. Schneider and Tornell (1999) study the interplay between asset prices and lending along a boom.

What are the effects of reforms that improve the contracting technology in financial markets?

During the last decade several countries privatized their banks, liberalized their financial markets, and implemented legal reforms that facilitated contracts between private agents. Unfortunately, in several cases these reforms

have lead to an increase in fraud instead of economic growth (see Tornell (2000)). The lack of a concurrent improvement in prudential regulation is often cited as responsible for this lackluster outcome. Given that the regulatory framework cannot be improved by decree, the question arises as to whether such reforms should be implemented regardless of the regulatory framework.

To address this issue it is important to note than there is a *nonlinearity* in the relationship between the degree of contract enforceability and the desirability of financial sector reforms. We will argue that such reforms are socially beneficial only if either contract enforceability is very low, or the reforms are radical enough so as to eliminate balance sheet effects.

An improvement in the financial markets' contracting technology has the effect of increasing credit at each level of internal funds. In terms of equations (1) and (2), it means a reduction in the parameter h, and an increase in the investment multipliers m^s and m^r. In the extreme, if contracts are not enforceable and the legal system is non-functional, it will be almost impossible for creditors and lenders to establish a bilateral debt agreement. With certainty borrowers would divert funds and default. As a result, credit to the N-sector will be almost nil, and the economy will not be fragile to crises. In this environment the introduction of systemic bailout guarantees would obviously not induce greater investment as suggested in the previous section. Thus, in these extreme circumstances privatization of the banking system and reforms that improve the contractual environment are clearly socially beneficial.

Consider now the other extreme in which it is possible to implement legal reforms that reduce the enforceability problem to such a level that it is possible for even small firms in the N-sector to enter into bilateral agreements with foreign lenders. Clearly, in this extreme case borrowing constraints will not be an issue. As a result, firms could borrow up the level determined by profitability and technological conditions. Therefore, it is socially beneficial to bring the enforceability of contracts to a level where the majority of domestic firms and banks do not face borrowing constraints. Moreover, if this were the case, there would be no role for systemic bailout guarantees. Even if they were put in place, they would be irrelevant!

But, what if contract enforceability (h) is at an intermediate level? Would privatization and financial reforms that improve private contracting unambiguously be socially beneficial? The answer is no. A concurrent improvement in prudential regulation is essential. Recall that it is not socially op-

timal to increase credit to the N-sector indefinitely at the expense of the T-sector. There is an interior maximum. Taking as given the generosity of bailouts (F), an improvement in contract enforceability ($1/h$) eases borrowing constraints and increases the credit multiplier. However, it does not eliminate borrowing constraints and balance sheet effects altogether. As a result, such an improvement in private contracting might induce more fragility than what is socially desirable. Clearly, if one could fine-tune the generosity of bailout guarantees, one could envision some trade-off. Unfortunately, systemic bailout guarantees are more often than not determined by political forces. Either you have them or you do not!

Another way of stating this argument is that, after some point, a further improvement in contract enforcement will only serve to permit borrowers and lenders to better collude in ripping off the bailout agency and tax payers. Instead of enhancing the rate of growth of the economy, it will simply facilitate the adoption of white elephant investment projects that mask theft, or might make it easier to design fraudulent lending schemes. If not accompanied by improvements in the regulatory framework, reforms that simply improve contractual arrangements marginally might have the unintended effect of fostering crony capitalism.

The role of prudential regulation

Our previous discussion highlights the need to improve prudential regulation concurrently with privatization and financial reforms. There are two levels at which the regulatory body should act. First, it should ensure that the banking system does not undertake more risk than what is socially desirable. As we discussed in the previous section, a risky debt profile might be necessary for the subsidy implicit in systemic bailout guarantees to have the desired effect of increasing credit and investment. However, this does not mean that anything goes. Appropriate regulation must determine the financial ratios in accordance with the situation of a given country. Blindly applying the Basle accord requirements does not make sense, as the level of riskiness induced might be greater than the one appropriate for the country in question.

The second level at which the regulatory body should act is in minimizing the extent of fraudulent schemes and adoption of white elephants. The more efficient the regulatory agency is in blocking these manifestations of crony capitalism, the more likely that systemic bailout guarantees will induce fast and sustainable economic growth, and the greater the social payoff associated

with reforms that improve contractual enforceability. In the absence of a strong and independent regulatory agency, it becomes important to consider whether the ownership of banks should be strictly separated from ownership of industrial corporations. We will discuss this below.

Reforms that permit better bilateral private contracting should go hand in hand with improvements in regulatory capacity. However, it seems that here lies one of the greatest bottlenecks faced by emerging markets. More often than not regulatory agencies fall prey to those they regulate. We now know that this is a political distortion which cannot be eliminated by decree.

In the case of banks, at the time of privatization a significant part of de facto non-performing loans are passed on to the new owners. These invisible non-performing loans reflect typically past hidden fiscal deficits or political payoffs. At the time of privatization it is politically expedient not to recognize them, and pass them on to the new owners. This has two implications. First, the true capitalization of the newly privatized banks is lower than what the standard ratios indicate. Second, if the privatizers are also the regulators, there is a strong reason for regulators to oversee some future malpractices of the banks: bankers help regulators hide some non-performing loans to begin with. Both implications make it more likely that the recently privatized banking system will engage in excessively risky lending and even in fraudulent activities.

Even if capture of regulatory agencies is not a issue, one still needs to worry about regulatory forbearance and evergreening. Regulators have incentives to consider as more transitory than what they actually are the negative shocks that hit banks' balance sheets. Doing so, avoids forcing banks to recapitalize or, if they fail to do so, to seek fiscal resources to cover the gap. Since such actions are politically costly, it is always better to ignore the problem at least for the time being. Thus, with the acquiescence of regulators, banks capitalize the past due interest of de facto non-performing loans. These loans now become evergreen accounts. Obviously, this is an explosive situation, where in the future the capitalization of banks will have to be confronted. There are more perverse situations where evergreen accounts reflect political favors to specific powerful groups.

The FDICIA Law implemented in the U.S. in 1991 has several elements that might be effective ways to improve the regulatory framework in emerging markets (see Kaufman (1997)). This Law makes sanctions to banks mandatory and thus lessens political pressure on regulators. This Law includes a prompt corrective action clause according to which a bank's problems must

be solved before effective capital becomes negative. Sanctions are applied in stages depending on the level of effective capital. These sanctions include restrictions on dividends payouts, limits on assets' growth and losing management rights. Furthermore, new capital must be injected by owners before effective capital becomes negative. With this, the resolution of a bank does not imply fiscal costs. International organizations could pay much attention to this area.

The role of foreign banks

During the last decade the share of the domestic banking system owned by foreigners has increased spectacularly. The accepted wisdom is that foreign ownership of banks brings three main benefits to an emerging market. First, foreign banks improve the banking practice and know-how. Second, since the size of the private sector in emerging markets is too small, the existence of foreign banks makes it easier to separate ownership of banks from ownership of industrial corporations. As we discussed earlier, in the presence of a weak regulatory framework this separation might reduce the likelihood of fraudulent schemes between lenders and borrowers.

Third, in case of a systemic crisis, parents of foreign subsidiaries will inject the resources necessary to withstand a run. Note however that, in general, foreign subsidiaries are legally separate entities from the parents. Thus, subsidiaries can declare themselves in bankruptcy during a crisis, without affecting the parent company. Reputation considerations are frequently invoked to defend the notion that resources would be transferred by the parent in case of a crisis. This argument is far from obvious because in case of a systemic crisis all parent banks can refuse to support their subsidiaries (by invoking some sort of force majeure clause), without loosing reputational capital, vis a vis the other major international banks.

Bailout Guarantees and the exchange rate regime

There are several ways in which systemic bailout guarantees can be implemented. The particulars will of course depend on the exchange rate regime. A nice feature of Schneider and Tornell's framework is that the effects of guarantees and the forces that generate boom-bust cycles are independent of the exchange rate regime or monetary policy rule. This permits us to study how guarantees affect the economy under different regimes.

With fully flexible exchange rates the mechanism is literally the same as the one we consider in Sections 2 and 4. If agents are highly leveraged and

have risky dollar debt, the economy is vulnerable to self-fulfilling crises in which there is a severe real depreciation and several agents in the N-sector suffer from balance sheet effects and are unable to repay their debts. As a result, creditors get paid a proportion F of the contracted payment. This bailout payment can be financed by an international organization and/or by an increase in future taxes to the rest of the economy. The real depreciation can arise by either a nominal depreciation, a change in nominal prices or a combination of both.

Consider the other extreme of a fixed exchange rate regime. In the case of an attack the central bank can defend the currency by either running down reserves or increasing the interest rate. If the attack is successful, the reduction in reserves constitutes a bail out payment to bank creditors that withdraw their funds and convert them into foreign currency. Thus, any defense policy has associated with it a bailout rate F. Clearly, the bailout rate need not be 100%, as reserves might not suffice to cover all the liabilities of the banking system. We should add that the bailout can be complemented by an explicit transfer, like in Mexico during the Tequila crisis. Again, the real depreciation can come about through a combination of a nominal depreciation and a change in nominal prices.

In the real world we observe a mixture of both regimes. However, it should be clear that the mechanism at work are essentially the same.

3.1 Policy in the Aftermath of Crisis

Bailing out borrowers versus bailing out lenders

Once a crisis has erupted and a severe real depreciation has taken place, the main objective should be to contain the meltdown and to minimize the number of bankruptcies. This is because inefficient bankruptcy procedures generate deadweight losses. Productive assets are inefficiently liquidated and human capital networks are destroyed. Furthermore, reputational capital in credit markets, which takes a long time to build, is destroyed (Wyne 2000).

Typically, bailouts are granted to lenders not to borrowers. However, bailing out lenders does not save borrowers from being decapitalized and suffering bankruptcy. Therefore, despite the occurrence of generous bailouts, credit crunches have developed in the aftermath of crises during the 1990s. This has been reflected in three regularities. First, depositors' bank runs have seldom been observed in the crises of the 1990s. Second, in the aftermath

of crises the growth rate of bank loans has typically remained below the growth rate of deposits. Since the value of collateral collapses, banks shift their portfolios towards others assets such as government securities. Third, the interest rate spread typically has remained above its pre-crisis level after GDP growth has returned to its trend.

Ex-post, extending some type of bailout to borrowers might avoid bankruptcies and ameliorate the credit crunch. This policy, however, might not be possible to implement because the fiscal cost might be enormous. Furthermore, it has perverse incentives effects. First, many borrowers that have the ability to pay might simply refuse to do so. Since it is extremely difficult to distinguish liquid and illiquid borrowers during a generalized crises, it is basically impossible to implement a borrowers' bailout policy that discriminates among different types of borrowers. Second, market mechanisms might be blocked as borrowers and lenders might delay the resolution of certain loans.

Piecemeal versus all-at-once bailouts

In the aftermath of a crisis the share of non-performing loans increases spectacularly. Both regulators and banks have incentives to under-report the true share of non-performing loans This way bank owners need to inject less capital, and the government needs to spend less fiscal resources at present. In contrast, reporting the true non-performing loans might force a takeover of several banks by either the government or other banks. As a result, bank owners will loose their franchise, and government officials will face political criticism for their failure to appropriately regulate the banking system.

Thus, bankers and regulators have incentives to 'believe' that negative news is more transitory than what it actually is, and to make predictions about the banks' portfolios which are more optimistic than what is warranted by the facts. The effect of this misperception is an 'evergreening' of banks balance sheets. That is, there is a tendency for banks to classify as performing those loans that are actually never going to be repaid, and for regulators to turn a blind eye to this mistake. The problem with evergreening is that it generally leads to an increase in the share of non-performing loans over time. This is because interest is not repaid, and because banks have incentives to undertake very risky projects that might have negative expected net present value. Banks might even have incentives to extend outright fraudulent loans.

Evergreening has two negative effects on the economy as a whole. First, the fiscal cost of the bailout grows over time, and it might even grow faster than GDP. Second, the credit crunch suffered by small nontradables firms will

be deeper and more persistent, as banks will have more incentives to engage in risky activities than to lend to firms with low internal funds (Krueger and Tornell (2000) analyze the Mexican case).

The alternative policy is to recognize at once all non-performing loans. Since it is unlikely that bank shareholders will be able to come up with the necessary capital, the government will have to take over all the liabilities of the banking system. This policy implies that government debt must increase by several percentage points of GDP in a single year. This is politically very costly. However, the evergreening alternative is likely to socially be more costly, as the experience of Japan and Mexico has shown.

Interest rate and exchange rate responses to crises

In the standard Mundell-Fleming model, when there is a capital outflow the needed improvement in the current account can be attained with a real depreciation and with no output costs. According to this view, a depreciation induces a shift of resources from the nontradables to the tradable sector, and makes the economy more competitive in world markets. As a result, growth resumes quite fast after the depreciation.

The Mundell-Fleming framework and traditional BoP crisis models are not appropriate for explaining these new boom-bust episodes because the banking system plays no essential role in these models. Once we move into a world in which bank lending is essential, and debt is denominated in foreign currency, the traditional policy recommendation becomes invalid. As we have seen, allowing the real exchange rate to depreciate in order to close the external gap has perverse effects. Since domestic firms have dollar denominated debt but their revenues are denominated in domestic currency, a real depreciation will make some domestic firms unable to repay their debts, and bankrupt them. This in turn, will make the problem even worse. Capital flight will increase, the real exchange rate will depreciate even further, and more firms will go bust. This vicious circle will generate a meltdown of the domestic sector of the economy.

In this situation an increase in interest rates might not be such a bad idea. But does it actually work? It is not clear, both, from an empirical as well as a conceptual perspective. In a sample of 75 countries over the period 1960-97 Kraay (2000) finds no evidence that interest rates systematically increase during failed speculative attacks, nor that raising interest rates increases the probability that an attack fails.

From a conceptual perspective, an interest rate hike is effective in stem-

ming a crisis only if such an increase does not bankrupt a critical mass of firms. If a critical mass of firms goes bust because they are unable to meet their debt service, then the investment demand will collapse and the real exchange rate will have to depreciate in order to clear the market for nontradables. The end result will be the same as the one in the previous paragraph.

In contrast, if an interest rate hike simply generates a recession but does not induce generalized bankruptcies, then an immediate crisis might be avoided. The question then arises as to whether the time of reckoning will not simply be pushed forward. Will higher domestic interest rates simply induce foreign investors to exploit arbitrage opportunities during a short period until central bank reserves are depleted? Will higher domestic interest rates make several firms insolvent, and lead them to bankruptcy in the near future. It is necessary that the answers to these questions are in the negative in order for an interest rate increase to avoid a crisis.

Clearly, the specific situation of a country will determine what is the correct mix of exchange rate depreciation and interest rate increase.

4 The Model

In this section we present a simplified version of Schneider and Tornell (2000). Consider a small open economy which exists for T periods. There are two goods: an internationally tradable (T) good, which is the numeraire, and a non-tradeable (N) good. The only source of uncertainty is a sunspot variable σ_t which is i.i.d. and takes values in $\{good, bad\}$ with α probability of the 'good' state.[3] Riskless bonds are issued by foreigners or consumers. They can be denominated in T-goods or in N-goods. A T-denominated bond pays one unit of tradables next period and trades today at the price $\beta := \frac{1}{1+r}$, where r is the constant world interest rate. An N-denominated bond pays p_{t+1} units of tradables next period, where p is the inverse of the real exchange

[3]Two comments are in order. First, considering a two-sector economy is essential because the transfer of resources from the N- to the T-sector has played a leading role in recent crises, and because two sectors are needed to analyze the real exchange rate appreciation observed prior to the onset of crises and the asymmetric recovery in the aftermath of crises. Second, considering an economy with no fundamental uncertainty rules out explanations of crises based on the premise that emerging markets suffer from more and bigger exogenous shocks than developed countries.

rate, i.e. $p = \frac{p_N}{p_T}$. The N-bond trades today at the price $\frac{1}{1+r_t^n}$.[4]

Here $p_{t+1}^e := \alpha \overline{p}_{t+1} + (1-\alpha)\underline{p}_{t+1}$, where $\overline{p}_{t+1}$ and $\underline{p}_{t+1}$ denote the values that the price p_{t+1} is expected to take on in period $t+1$ in the good and bad state, respectively.[5]

N-goods are produced with nontradables as the only input using a linear production technology

$$q_{t+1} = \theta\, I_t \tag{3}$$

These technologies are operated by successive cohorts of large numbers of *managers.* We can think of a manager as a banker who lends to the N sector. A manager of the period t cohort is a risk neutral agent who cares for consumption of tradables in period $t+1$ only.[6] Each 'generation' consists of a continuum of firms of measure one. Since we will impose symmetry throughout, we state everything in terms of a representative firm. The manager in period t begins with internal funds w_t. He raises an amount b_t by issuing one-period bonds that pay off in T-goods, and an amount b_t^n by issuing one-period bonds that pay off in N-goods. Since the promised interest rates on these bonds are ρ_t and ρ_t^n, respectively, the total repayment promised by the entrepreneur is $p_{t+1}(1+\rho_t^n)b_t^n + (1+\rho_t)b_t$.[7]

Since b_t and b_t^n are measured in T-goods, the budget constraint is

$$p_t I_t + s_t + s_t^n = w_t + b_t + b_t^n, \tag{4}$$

where s_t and s_t^n are the amounts invested in international bonds that pay off in tradables and non-tradables, respectively. Here I_t, b_t, b_t^n, s_t and s_t^n must be non-negative. In the following period, a manager sells the output of N-goods. He then pays out a fixed fraction c of the profits as dividends to himself and passes on the remainder to the next manager. The goal of every manager is to maximize expected profits in the following period.

Consumers

[4]Managers also issue bonds, but cannot commit to repay. Thus, in general, their debt will be risky, as will be described below.

[5]These values will depend on the information available at t, $\mathcal{I}_t$: $\overline{p}_{t+1} = E\left[p_{t+1}|\mathcal{I}_t, \{\sigma_{t+1} = good\}\right]$, and $\underline{p}_{t+1} = E\left[p_{t+1}|\mathcal{I}_t, \{\sigma_{t+1} = bad\}\right]$.

[6]Managers incur a utility cost if they engage in 'diversion activities'. We will complete the description of their preferences below.

[7]The actual repayment may differ from the promised repayment. This is described below when we discuss the 'credit market game'.

There is a representative consumer that consumes tradable (c_t^{tr}) and non-tradables goods (c_t^{nt}). His utility is

$$\sum\nolimits_{t=0}^{T} \beta^t [c_t^{tr} + d_t \log(c_t^{nt})] \tag{5}$$

Consumers are endowed with ε units of the T-good in every period. In light of (**??**) and complete markets, their budget constraint is

$$E\left[\sum\nolimits_{t=0}^{T} \beta^t \left(c_t^{tr} + p_t c_t^{nt} - \varepsilon\right)\right] \leq 0$$

As long as ε is large enough (which we assume is the case), consumers' demand for N-goods will be

$$D_t(p_t) = \frac{d_t}{p_t} \tag{6}$$

Reform (such as trade liberalization) or discovery of a natural resource (oil) induces a future outward shift in the demand for N-goods by the T-sector (offices, services, etc.). Typically, the expectation of future good-times is what drives lending booms. We capture this fact through a shift in the preference parameter d_t:

$$d_t = \begin{cases} d & \text{if } t < T \\ \hat{d} \ \geq d & \text{if } t = T \end{cases} \tag{7}$$

The focus in this paper is on the N-sector. The 'consumer' is to be broadly interpreted as a stand-in for the T-sector. Our assumptions on preferences and absence of borrowing constraints is perhaps most natural if we imagine that the consumer is the owner of an exporting sector business, and the endowment ε can be easily collateralized because it is tradable. What is important for our overall story is that there is a downward-sloping component of the demand for N-goods and that this demand shifts up in period T. Both features could be derived from alternative more complicated structures. The current formulation is adopted for tractability.[8]

[8] An alternative it to consider a T-production sector which uses N-goods as inputs, and which experiences a movement in the terms of trade or a productivity improvement in some future period. One could also extend the analysis to stochastic d_t, as long as there is an expected increase in the need for N-goods. We do not pursue this here as we concentrate on sunspot uncertainty.

4.1 Institutions

The financing decision is subject to two distortions: an enforceability problem and systemic bailout guarantees. We consider each in turn.

Enforceability of Contracts

A firm is called *insolvent* if cash flow, defined by

$$\hat{\pi}(p_{t+1}) := p_{t+1}\theta I_t - (1+\rho_t^n)p_{t+1}b_t^n - (1+\rho_t)b_t \tag{8}$$

is negative. We will use the random variable ζ_{t+1} to indicate solvency. A *solvent* entrepreneur ($\zeta_{t+1} = 1$) can default strategically even though he would in principle be able to repay. We assume that he can divert all returns from investment to himself at time $t+1$, provided that he has incurred a non-pecuniary diversion cost hp_tI_t at time t. In this case, lenders are left with nothing. 'Diversion' can be interpreted as an activity that reflects 'crony capitalism.'

In case of insolvency ($\zeta_{t+1} = 0$), the manager's payoff is zero. In addition, the gross returns from investment are dissipated in bargaining among the large number of creditors (so creditors also get a zero payoff).[9]

It follows that there is *no diversion* if and only if the expected repayment is less than the diversion cost:

$$(1+\rho_t^n)E_t\left[\zeta_{t+1}p_{t+1}\right]\, b_t^n + (1+\rho_t)E_t\left[\zeta_{t+1}\right]\, b_t \leq h\, p_t I_t \tag{9}$$

We will refer to this condition as the firm's *borrowing constraint.* This label is natural since we will show below that there cannot be an equilibrium in which managers divert. In fact (9) will be binding in all equilibria we consider. Importantly, we do not impose this borrowing constraint, but it arises endogenously as a result of the contract enforceability problem. In what follows we will use the random variable δ_t to indicate whether a managerial strategy entails diversion (i.e. $\delta_t = 1$ if (9) holds).

The parameter h can be interpreted as a measure of the severity of the enforceability problem. We would expect countries with lax contract enforcement, or industries with little collateral requirements to have relatively low values of h. If h increases beyond $1 + r := \beta^{-1}$, it is always cheaper to repay

[9] Assuming 100% bankruptcy costs is not necessary for the results. The role of bankruptcy costs is only to make insolvency undesirable in the absence of bailouts. Any (possibly small) positive percentage would be sufficient.

debt rather than to divert, so that there is no enforceability problem. Since we are interested in firms that face financing constraints, we assume

Assumption 1 (Financing Constraints)

$$\beta h < 1 \tag{10}$$

Bailout Guarantees

In a *bailout*, lenders receive a fraction F of the outstanding debts of all defaulting entrepreneurs, regardless of debt-denomination (N- or T-goods). The bailout policy is contingent on the number of defaults, in that the agency grants bailouts only if it faces a critical mass of defaults. For concreteness we assume that a bailout occurs if and only if more than 50% of firms default in a given period. The bailout is granted by an international organization.[10]

The contingent rule for bailouts captures the fact that bailouts typically occur when a large number of banks gets in trouble.[11] It is also crucial for financing constraints to bite: if there was a basic 'deposit insurance' scheme (i.e. if a bailout was granted whenever a single entrepreneur defaulted), then guarantees would neutralize the enforceability problem.

This completes the description of the economy. We have considered a minimal setup in which we have assumed neither borrowing constraints nor risky debt denomination. Furthermore, since the production function is linear, the gradual character of the dynamics and the vulnerability to meltdowns that will emerge in equilibrium will derive from the interaction of the two distortions we emphasize in this paper.

[10]It thus represents a 'windfall' gain for the country. Alternatively, one could assume that a lump sum tax is levied on consumers. Since consumers are not subject to wealth effects, this does not affect the rest of the equilibrium as long as their endowment is large enough. In a previous version of this paper we considered the case in which the bailout agency has limited reserves and the bailout rate is a decreasing function of the liabilities-to-reserves ratio. Although the algebra is a bit more involved, the same qualitative results hold.

[11]The Mexican experience fits this assumption well. In the aftermath of the 1994 crisis, the entire financial system became insolvent. In order to ensure that all debt obligations were met, the US Treasury and international organizations provided Mexico a generous bailout. In 1999, however, a big Mexican firm, GAN, announced the suspension of the service of its debt (which stood at more than one billion US dollars). The Mexican government did not provide a bailout (The Wall Street Journal, June 16, 1999).

4.2 Investment and Debt Denomination

In order to rationalize the facts mentioned in the Introduction it is essential that borrowing constraints arise in equilibrium, and that entrepreneurs find it profitable to invest in the production technology, and to issue T-debt. In order to determine the circumstance under which this occurs it is useful to classify plans according to whether they might lead to insolvency and/or diversion of funds. We will refer to *risky plans* as those that keep the firm solvent in the good state, but lead to insolvency in the bad state ($\hat{\pi}(\bar{p}_{t+1}) \geq 0 > \hat{\pi}(\underline{p}_{t+1})$). In contrast, *safe plans* never lead to insolvency ($\hat{\pi}(\bar{p}_{t+1}) \geq 0$, $\hat{\pi}(\underline{p}_{t+1}) \geq 0$).

In this section we discuss the investment and financing decisions of an individual firm at a given point in time. Current prices (p) and expected future prices ($\bar{p}, \underline{p}$) are taken as given. In order for borrowing constraints to be binding in equilibrium and all debt to be denominated in T-goods there must be sufficient real exchange rate risk. As we shall see, returns must satisfy the following condition:

$$\frac{\overline{p}\theta}{p} > 1 + r > h > \frac{\underline{p}\theta}{p} \tag{11}$$

In this subsection we will assume (11) holds. Then, in the next subsection we will determine the circumstances under which it holds along the equilibrium path. The first inequality ensures that if crises are rare events (α close or equal to one), investment in N-goods is a positive NPV activity. This must clearly hold in any interesting equilibrium of the model. The third inequality says the crisis return is lower than the opportunity cost of diversion. It implies that firms will go bankrupt in a crisis state. Since in our model price risk is present if and only if bankruptcy risk is present, this must be true in any equilibrium in which $\alpha < 1$. The second inequality follows from Assumption 1. In the next section we will derive the conditions under which (11) holds along the equilibrium path.

Throughout this paper we will consider only cases in which investment plans that do not lead to diversion are funded by lenders. Schneider and Tornell (2000) show that if (11) holds and α is large, then plans that lead to diversion are not be funded. Since lenders are risk neutral, the interest rates that managers must pay depend on whether the investment plan is risky (i..e., it leads to bankruptcy if the low price realizes next period), or it is safe (i.e., it never leads to bankruptcy). Let the international interest rate be r,

an denote by ρ and ρ^n the interest rates that a manager that chooses a risky plan must offer on T-debt and N-debt, respectively. In the high price state there debt is repaid in full and there is no bailout, while in the bad state there is bankruptcy and each lender receives a proportion F of what he was promised. Since the probability of a good state is α, interest rates satisfy:

$$\begin{aligned} (1+\rho_t)\left[\alpha+(1-\alpha)F\right] &= 1+r \\ (1+\rho_t^n)\left[\alpha\bar{p}_{t+1}+(1-\alpha)\underline{p}_{t+1}F\right] &= 1+r \end{aligned} \tag{12}$$

If the managers chooses a safe plan, it will always be able to repay. Thus, interest rates satisfy

$$\begin{aligned} \rho_t &= r \\ (1+\rho_t^n)\left[\alpha\bar{p}_{t+1}+(1-\alpha)\underline{p}_{t+1}\right] &= 1+r \end{aligned} \tag{13}$$

Since $\bar{p}_{t+1} > \underline{p}_{t+1}$, we can see from (12) that if a risky plan is chosen, T-debt is cheaper than N-debt. In contrast, if a safe plan is chosen, T-debt is more expensive than N-debt. Thus, the choice of risky plans goes hand in hand with T-debt.

The representative manager solves the following problem. Given prices, choose a plan $(I, s^n, s, b^n, b, \rho^n, \rho, \zeta)$ that maximizes expected profit subject to the budget constraint (4) and interest rates (12)-(13).

When there are no guarantees ($F = 0$) it is optimal to choose safe plans, while if $F = 1$, it is optimal to choose a risky plan. We have already seen that, in this case, the limit on leverage is the same for risky and safe plans. If there were no bankruptcy costs, then we would have a 'Modigliani-Miller theorem for external finance': the limit on leverage would act like a technological bound on investment and the denomination of debt would be irrelevant. Bankruptcy costs induce a preference for N-debt. If a risky plan were undertaken, then revenues would be dissipated in the bad state. Thus, the total expected surplus to be divided between lenders and the entrepreneur is only $[\alpha\theta\overline{p} - (1+r)p]I^s + [1+r]w$. For a safe plan, the surplus is $[p^e\theta - (1+r)p]I^r + [1+r]w$. Since lenders always break even, the entrepreneur bears all bankruptcy costs in the form of higher interest rates. Also, there is no gain from choosing a risky plan because I^r cannot be larger than I^s. Entrepreneurs are therefore always willing to avoid costly bankruptcy by denominating debt in non-tradables.

What changes if bailout guarantees are in place (say $F = 1$)? There are two effects. First, if a risky plan is chosen, total expected surplus is increased by the bailout subsidy because the cost of capital is artificially lowered to $\alpha(1 + r)$. The entrepreneur and the lenders now have $(\alpha\theta\overline{p} - \alpha(1+r)p)I^r + \alpha(1+r)w$ to divide. The subsidy thus partly compensates for the deadweight costs of bankruptcy. Second, this effect is reinforced by the ability to have higher leverage and investment, which further increases the overall expected surplus. For sufficiently generous bailout guarantees, these two effects outweigh the bankruptcy costs and risky plans are preferred to safe plans.

The following Proposition describes how a cohort of managers as a whole invests and denominates debt under different scenarios. We have seen that if there are no bailout guarantees, managers hedge any real exchange rate risk perfectly by denominating debt in nontradables. Recall that bailouts are granted only during a 'systemic' crisis. Thus, as long as nobody expects a bailout, everybody hedges, and a crisis – and hence a bailout – cannot occur. In other words, a 'safe' equilibrium of the credit market game always exists. This is independent of whether the exchange rate is variable or not.

However, in a world with bailout guarantees this is not the only equilibrium. Indeed, suppose that a manager believes that all other managers will undertake risky plans. He will conclude that a bailout will occur in the bad state. Thus, he will refrain from hedging and take on real exchange rate risk. He will in fact go bankrupt in the bad state, along with all the other managers, triggering a bailout. Formally, we have:

Proposition 1 *(Credit Market Equilibria) Suppose crises are rare events (α is close to or equal to one).*

1. *In a safe symmetric equilibrium a safe plan is funded and firms' borrowing constraints bind. Defaults and bailouts do not occur. The value of investment is*

$$pI = m^s w := \frac{1}{1 - \beta h} w \tag{14}$$

   It is optimal to denominate all debt in nontradables. The total debt burden, in terms of tradables, during the following period is $L = hp'[p^e]^{-1} m^s w$.

2. *If $\alpha < 1$, a risky symmetric equilibrium exists if and only if bailout guarantees are present ($F = 1$). In this equilibrium, a risky plan is*

funded and firms' borrowing constraints bind. All firms default in the bad state (where a bailout occurs), but not in the good state. The value of investment is

$$pI = m^r w =: \frac{1}{1 - \beta h[1 + \frac{1-\alpha}{\alpha} F]} w \tag{15}$$

It is optimal to denominate all debt in nontradables. The total debt burden, in terms of tradables, during the following period is $L = \alpha^{-1} hpI = \alpha^{-1} h m^r w$.

This proposition makes three points. First, it shows that bailout guarantees need not neutralize the effect of the enforceability problem. Under the condition on returns (11), lenders do not finance diversion plans. This gives rise (via (9)) to a borrowing constraint which, in turn, generates the familiar *credit multiplier* result: the amount of credit is proportional to the borrower's internal funds. Furthermore, if the production technology has positive NPV ($\frac{\bar{p}\theta}{p} > 1 + r$), firms prefer investment to 'speculation' in bonds and the credit multiplier m^r translates into an investment multiplier.

Second, the amount of leverage that a firm can achieve with a risky strategy ($\frac{b}{w} = m^r - 1$) depends on how generous the bailout policy is.[12] When an entrepreneur makes the diversion decision, he compares the diversion cost to the *debt burden* (principal plus interest) that can be avoided in the following period. In other words, the firm has a limited 'debt burden capacity'. Now, from the lender's break-even constraint, the more generous the bailout guarantee, the lower an interest rate can be promised while still keeping a plan fundable. In turn, a reduction in the interest rate lowers the debt burden, making room for more leverage. Here α^{-1} and h work in the same direction as F. The easier it is to enforce contracts and the more likely are crises, the higher is the multiplier.

Third, undertaking risky plans goes hand in hand with a preference for T-debt. If there is enough exchange rate risk there will be bankruptcy in the bad state. Furthermore, if $F > 0$, the bailout agency will pay part of the promise in the bad state. It is thus desirable for the firm to shift as much of the payment as possible into the bad state. This is achieved

[12] When $F = 0$, the multiplier equals that in the safe case. If there are no bailout guarantees, the limit on leverage is independent of whether the chosen plan is risky or safe.

precisely by denominating all debt in tradables. Since lenders must break even, switching from non-tradable to tradable debt always shifts some of the debt burden from the good to the bad state, making the firm better off.[13]

4.3 Twin Crises

We now turn to the determination of the real exchange rate by characterizing a 'temporary equilibrium' for a typical period $t < T$. We assume that one of the equilibria from Proposition 1 was played in the previous period. The incumbent managers enter the current period with a supply of nontradables q_t, no bond holdings and a debt burden, $L_t + p_t L_t^n$.[14] The new cohort chooses its plans taking as given future prices and the value of the internal funds they get from incumbents' sales.

In order to characterize equilibria we need to specify the market clearing condition for nontradables:

$$\frac{d_t}{p_t} + I_t = \theta\, I_{t-1}. \tag{16}$$

where consumers' demand for non-tradables is equal to d/p_t. We also need to specify the evolution of internal funds: $w_0 = e_0$, and for $t \geq 1$,

$$w_t = \begin{cases} [1-c]\hat{\pi}(p_t) & \text{if } \delta_t \hat{\pi}(p_t) > 0 \\ e & \text{otherwise} \end{cases} \tag{17}$$

We assume that whenever there is default, new managers in cohort t receive an 'aid payment' e to jump start their firms. In period 0, there is both a cohort of initial 'incumbent' managers who have an amount q_0 of nontradables to sell and a cohort of 'new' managers who have an endowment e in terms of tradables.

As usual, investment of a borrowing constrained firm depends not only the rate of return, but also on cash flow. With our linear structure, the

[13] Under a risky plan the expected repayments per unit debt are $\frac{\alpha[1+r]}{\alpha+(1-\alpha)F}$ for T-debt and $\frac{\alpha[1+r]}{\alpha+(1-\alpha)F\frac{\underline{p}}{\bar{p}}}$ for N-debt. Since $\bar{p} > \underline{p}$, T-debt is strictly cheaper than N-debt for all $F > 0$.

[14] L_t (L_t^n) is the burden induced by T-debt(N-debt). From Proposition 1 we know that, if plans were in symmetric equilibrium last period, then managers will have exclusively one or the other. We use $L_t + p_t L_t^n$ because it is notationally convenient.

rate of return enters only through the positive NPV condition (**??**): a high enough return is necessary for investment to be positive. If this is the case, investment expenditure will simply be proportional to internal funds. The size of the multiplier in period t, m_t, depends on whether safe ($m_t = m^s$) or risky ($m_t = m^r$) plans are undertaken: $p_t I_t = m_t w_t$.

As long as incumbents are solvent, internal funds are $w_t = (1-c)\hat{\pi}_t$, where $\hat{\pi}_t = p_t \theta I_t - L_t - p_t L_t^n$. In contrast, if the bad state is realized, firms become insolvent and the new cohort starts out with an endowment of T goods e. Investment expenditure is thus

$$p_t I_t = \begin{cases} \eta_t [p_t q_t - L_t - p_t L_t^n] & \text{if } p_t q_t \geq L_t + p_t L_t^n \\ m_t e & \text{otherwise} \end{cases} \tag{18}$$

where the *cash flow multiplier* η_t is defined by $\eta_t := (1-c)m_t$. It depends negatively on the 'dividend payout rate' c (if profits are not reinvested, then balance sheet effects are weak) and positively on leverage (we have $\frac{b_t}{w_t} = m^r - 1$). High leverage is possible if the enforceability problem is not very severe (high diversion cost h) and if the probability of a crisis $(1-\alpha)$ is large. The latter effect arises because a larger probability of crisis increases the implicit subsidy from the bailout guarantee and hence increases debt capacity.

In a temporary equilibrium, the real exchange rate equalizes aggregate demand and the (predetermined) supply of nontradables: $D(p_t) = q_t$, where

$$D(p_t) = \begin{cases} \frac{d}{p_t} + \eta_t \left[q_t - \frac{L_t}{p_t} - L_t^n \right] & \text{if } p_t q_t > L_t + p_t L_t^n \\ \frac{d + m_t e}{p_t} & \text{otherwise} \end{cases} \tag{19}$$

Since supply is given, the key to having multiple equilibria is a backward bending aggregate demand curve. This is impossible if incumbent managers have only nontradables debt ($L_t = 0$). In this case, price changes lead to variations in both incumbents' revenues and their debt payments. In fact, incumbent profits (measured in nontradables) are completely insulated against price movements. This implies that, for solvent firms, investment demand from the N-sector is price inelastic. From the point of view of a manager in the new cohort, any increase in price (that might hurt investment demand) is matched by an increase in internal funds. Of course, this effect works both ways: a drop in the price that might encourage investment demand is always accompanied by an offsetting drop in internal funds. The upshot is that as

long as incumbent plans satisfy $q_t > L_t^n$, demand slopes downward and there is a *unique* equilibrium price. From Proposition 1, the latter condition is always satisfied in a safe equilibrium.

However, multiple equilibria are possible if incumbents have T-debt on the books (and $L_t^n = 0$). In this case price movements affect revenues, but keep the debt burden unchanged. It thus becomes important to distinguish between insolvent and solvent firms. For prices below the cutoff price $p_t^c = \frac{L_t}{q_t}$, all N-firms go bankrupt because revenues do not cover the debt burden. As a result, internal funds are only e. Total demand in this range is downward sloping. In contrast, for prices above p_t^c, an increase in the price is accompanied by a *more than proportional* increase in internal funds. The reason is that revenues increase while the debt burden remains the same. Equivalently, part of the debt burden measured in terms of nontradables is 'inflated away'. Consequently, investment demand is *increasing* in price.

It is apparent that if the balance sheet effect is strong enough to make aggregate demand 'bend backward', as in Figure XXX, multiple market clearing prices, and hence self fulfilling 'twin crises' can exist.[15] The strength of the balance sheet effect depends on two factors. Obviously, the liabilities of the old (L_t) have to be large enough for them to matter. But it is also important that the investment capacity of the young be sufficiently sensitive to the liabilities of the old (i.e., that the cash flow multiplier η be high). From (19), multiple market clearing prices arise if and only if

$$L_t > d + m_t e \qquad \text{and} \qquad \eta_t > 1 \tag{20}$$

With identical fundamentals, in terms of supply and debt, the market may clear in one of two equilibria. In a 'solvent' equilibrium (point B in Figure 3), the price is high, inflating away enough of firms' debt (measured in nontradables) to allow them to bid away a large share of output from consumers. In contrast, in the 'crisis' equilibrium of point A, the price is low to allow consumers and bankrupt firms with little internal funds to absorb the supply of nontradables.

Which of these two points is reached depends on expectations. Fundamentals determine only whether the environment is fragile enough to allow two equilibria. In view of (20), the relevant factors are a strong balance sheet

[15] More specifically, the balance sheet effect must outweigh the counteracting effect of consumption demand (which is downward sloping) and it must also make investment demand large enough relative to supply.

effect and a high enough level of *tradables* debt. The former is facilitated by a low dividend payout rate and easy enforceability of contracts. The latter has been taken as given in this section.

In subsection .... we will show that *anticipated* endogenous price risk can induce managers to take on enough T-debt for such risk to *actually* arise. For this to happen, bailout guarantees have to be generous. To carry out this analysis, however, we must turn to an explicitly dynamic analysis.

4.4 Equilibrium Dynamics

In this section we study the dynamic behavior of the economy. We begin in subsection 5.1 with an environment without bailout guarantees. We show that the existence of balance sheet effects together with growth expectations for the N-sector can lead to 'lending boom equilibria', characterized by fast growth of the N-sector, accumulation of debt and real appreciation. In subsection 5.2 we show how a lending boom can end in self-fulfilling twin crises, *provided that bailout guarantees are present.*

We have seen in the previous section that, in the absence of bailout guarantees, managers will not be inclined to issue T-debt. In our model, the only source of uncertainty is the sunspot. Furthermore, multiple market clearing prices, which are crucial for a sunspot to matter, exist only if debt is denominated in tradables. It follows that, in the absence of bailout guarantees, there cannot be an equilibrium in which prices depend on the sunspot. Instead, in economies without bailout guarantees, equilibria must be 'safe': the 'safe' credit market equilibria of Proposition 1 are played every period and firms are always solvent.

Market clearing for nontradables requires that consumption and investment expenditure sum to the value of output: $d_t + m_t w_t = p_t q_t$. From Lemma **??**, we have that $m_t = m^s$. Thus, internal funds evolve according to

$$\begin{aligned} w_t &= (1-c)\left(p_t q_t - p_t L_t^n\right) \\ &= (1-c)\left(p_t q_t - h m^s w_{t-1}\right) \end{aligned}$$

Output is proportional to internal funds in the previous period: $q_t = \frac{\theta m^s w_{t-1}}{p_{t-1}}$. Combining these equations it follows that any equilibrium path of output and

internal funds (q_t, w_t) must be a solution to

$$q_t = \theta \frac{m^s w_{t-1}}{m^s w_{t-1} + d} q_{t-1}, \qquad t \leq T \tag{21}$$

$$\frac{1-\eta^s}{1-c} w_t = d - h m^s w_{t-1}, \qquad t < T \tag{22}$$

$$w_T = \hat{d} - h m^s w_{T-1} \tag{23}$$

with initial conditions q_0 and $w_0 = e_0$, and where $\eta^s = (1-c)m^s$ is the 'safe' cash flow multiplier. A solution to (21)-(23) is an equilibrium if the implied price path given by

$$p_t = \begin{cases} \frac{d + m^s w_t}{q_t} & t < T \\ \frac{d}{q_T} & t = T \end{cases} \tag{24}$$

is steep enough to make the technology a positive NPV undertaking (i.e., $p_{t+1}\theta > (1+r)p_t$ for all $t < T$).

Equation (21) states that the fraction of nontradables production that is invested in every period depends on the financial strength of the N-sector. If internal funds are low, nontradables firms can borrow very little. Holding supply fixed, weak investment demand implies that the price is low and consumers absorb a larger fraction of supply. On the other hand, a strong N-sector (high w_t) will try to expand and bid resources away from consumers. This increases the price.

Equation (22) provides a 'flow of funds' account for the 'consolidated' N-sector, putting both cohorts of managers together. The right hand side is consolidated cash flow: sales to the household sector minus repayment of debt to foreigners. The left hand side may be called 'net new funds raised': it consists of new debt issued minus dividends paid out.

Whether consolidated cash flow is positive or negative in equilibrium now depends on the expansion strategy of the N-sector, via the cash flow multiplier η^s. If $\eta^s < 1$, the N-sector makes a profit throughout. If the dividend payout rate c is high enough, its size (measured, for example, by the value of investment $p_t I_t = m^s w_t$) gradually moves towards a steady state value. In this type of equilibrium, firms' behavior is independent of the preference shift occurring at date T. It would be the natural case to consider if we were interested in long run issues.

In contrast, if the dividend payout rate is low enough to allow the N-sector to grow, the existence of 'growth expectations' for the N-sector allows another equilibrium. The N-sector can expand, in fact running a deficit over

time, in anticipation of strong demand in the future. Since we are interested in characterizing the transition phase of an economy in the aftermath of reform, we focus on this second case. We thus assume that

Assumption 2 (Expanding N-sector)

$$c < \beta h \tag{25}$$

This assumption is necessary, but not sufficient to guarantee growth of the N-sector over time. First, it is apparent from the flow-of-funds equation (22) that the N-sector must be above a 'critical size' in period zero. If this is the case, debt and investment expenditure will rise over time as N-sector firms issue new debt to cover the sequence of deficits. Second, in the final period, the accumulated debt must be repaid. A lending boom equilibrium thus also requires a large enough preference shift at time T.

The previous discussion focused on the financial side of the N-sector and, implicitly, on the *value* of output ($p_t q_t$). The technology parameter θ determines how this rise in value translates into changes in prices and quantities. If θ were very high, supply would outpace demand. As a result the price would fall over time, while investment would rise. At the other extreme, if θ were small, we could have an equilibrium along which nontradables become more and more scarce while firms would be chasing the returns offered by rising prices but could afford to invest less and less. To match the observations that N-sector growth coincides with a real *appreciation*, we fix θ at an intermediate value.

Assumption 3 (Technology Bounds)

$$\theta \in \left(1,\ \frac{\eta^s h}{\eta^s - 1}\right) \tag{26}$$

We are ready to establish the existence of lending boom safe equilibria.

Proposition 2 (Safe Equilibria) *Suppose Assumptions 1 and 2 hold.*

1. *There is a region* $E = \left\{(e_0, d) : e_0 > \underline{e} \text{ and } \hat{d} > \underline{d}(e_0)\right\}$ *for the N-sector's initial funds and the demand parameter, such that for all economies with* $(e_0, d) \in E$*, a safe symmetric equilibrium exists in which debt and investment expenditure increase over time.*

2. *If, in addition, Assumption 3 holds, then for large enough T there is a $\tau < T$, such that (i) the output of nontradables increases over time from τ on, and (ii) the real exchange rate appreciates between τ and $T-1$.*

Sunspot Equilibria We now consider an economy in which systemic bailout guarantees are present. The main point is that economies which would otherwise exhibit safe lending booms can now exhibit risky lending booms, which allow faster growth (financed by 'cheap' T-debt), but which may end in self-fulfilling twin crises. We begin with a preliminary question: the possibility of *unanticipated* self-fulfilling crises in the safe lending boom equilibria of Section 5.1. We then establish the existence of *sunspot equilibria*, in which the risky credit market equilibria of Section 4 are played during the boom.

Safe Equilibria and Unanticipated Crises

The safe lending boom equilibria derived in the previous subsection will continue to be equilibria in an economy with bailout guarantees. Suppose every manager believes that the safe equilibrium price will be realized for sure one period ahead. Since the existence of bailout guarantees is irrelevant, managers will simply play the best safe plan. As a result, the price evolves exactly as in a safe equilibrium.

To think about unanticipated crises, we use the fact that managers are *indifferent* between T and N debt if prices are *deterministic* (by Lemma **??**). Suppose that debt is actually denominated in tradables. Unanticipated crises can now occur during *sufficiently long* safe lending booms. Indeed, we know from section 4 that multiple market clearing prices exist, provided the amount of T-debt to be repaid in period t is large enough:

$$hm^s w_{t-1} > d_t + m^s e \tag{27}$$

We call a state (q_{t-1}, w_{t-1}) *fragile* if (27) holds. If the economy is in a fragile state, then outstanding debt is so large that it cannot be repaid by selling output only to consumers and new managers that start with e. It follows that there is a price which clears the market by defaulting all firms.

Fragility need not be present at all times in a safe lending boom equilibrium. In particular, if contract enforceability is not easy (low h), and e is large relative to e_0, the initial phase of a boom (w_{t-1} close to e_0) need not be fragile. However, by Proposition 2, in any lending boom equilibrium the

debt burden $L_t = hm^s w_{t-1}$ is increasing over time. The economy must thus enter into a 'fragile region' if the boom continues long enough. Of course, the economy cannot be in a fragile state in period $T-1$: there can never be a crisis in the final period because firms do not reinvest.

Anticipated Crises

It is technically simple to focus on unanticipated crises, but it is conceptually unsatisfactory for several reasons. First, from Lemma **??**, firms are indifferent between T and N debt in a safe equilibrium. We would thus be *assuming* fragility. Only if crises are anticipated can we rationalize this fragility as a result of risky debt denomination. Second, the economy with anticipated crises will behave differently while no crises occur: only if crises are anticipated can we make the point that growth is faster with bailout guarantees.

We are thus led to tackle the more difficult question of whether crises can actually occur with positive probability along the equilibrium path. We know from Section 4 that under exchange rate risk and bailout guarantees, managers may create credit risk from real exchange rate risk by financing investment with T debt. They will do so in particular if they expect (*i*) a sufficiently high return on investment in the absence of a depreciation, (*ii*) a sufficiently low return after a depreciation, so that it is possible to claim the bailout subsidy by defaulting; and (*iii*) a sufficiently low probability of a crisis, which ensures that the ex-ante expected return is high enough and borrowing constraints bind. Section 4 has also shown that if there is enough T debt, there are two market clearing prices, where the lower price bankrupts firms, and hence triggers a bailout. The question is whether these two effects can be elements of one consistent story.

Formally, can we construct an equilibrium price process, by making the sunspot variable σ_t select among market clearing prices, such that the resulting return distribution encourages firms to issue enough T debt to validate the price process? In other words, we need to construct *a set of beliefs about future prices* that is consistent with a rationally anticipated self-fulfilling crisis. We thus need to find a range of probabilities α for the 'sunspot process', so that the sunspot 'matters' over a number of periods before the next to last one.

Consider a typical period $t-1$. Suppose agents believe that there will be a crisis with probability $1-\alpha$ in period t, and that this risk induces them

to issue T-debt. In the good state in period t, firms are solvent, and the transition is similar to the safe case:

$$\begin{aligned} \overline{w}_t &= (1-c)\left(\overline{p}_t q_t - L_t\right) \\ &= (1-c)\left(\overline{p}_t q_t - \alpha^{-1} h m^r w_{t-1}\right) \end{aligned}$$

Still conditioning on the good state, the market clearing and flow of funds equations are also essentially the same as in the safe case:

$$d + m^r \overline{w}_t = \overline{p}_t q_t \tag{28}$$

$$q_t = \frac{\theta m^r w_{t-1}}{p_{t-1}} \tag{29}$$

It follows that for α close to 1, i.e. if crises are a relatively 'rare event', the evolution of the economy along the 'lucky path', along which no crisis occurs, is essentially the same as in the safe lending boom equilibria. Moreover, for α close to one, we have $p_t^e \approx \overline{p}_t$ and the expected return is close to the one that would prevail in a safe equilibrium with the same initial conditions. This suggests that there is a range of crisis probabilities, $(1-\alpha) \in (0, 1-\overline{\alpha})$, for which internal funds increase over time and returns are sufficiently high to allow positive investment.

Condition (ii) is satisfied when firms go bankrupt in the bad state. If a crisis actually occurs in the bad state, internal funds of the new cohort are $\underline{w}_t = e$. The equilibrium price must be low enough to bankrupt the incumbent cohort ($\hat{\pi}(\underline{p}_t) < 0$):

$$\underline{p}_t q_t = d + m^r e < \alpha^{-1} h m^r w_{t-1} \tag{30}$$

Clearly, for α close to one, this is implied by the condition for a fragile state (27). It follows that if the economy is in a fragile state in period $t-1$, a crisis can occur in period t with conditional probability $1-\alpha$. It remains to characterize the third stage of the equilibrium path. Since the economy cannot be in a fragile state at $T-1$, there must be a switch to a safe path no latter than $T-2$. Clearly the demand shift at terminal time T (i.e., $\hat{d}$) must be large enough to ensure that the N-sector can repay its accumulated deficits. We conclude that *if the N-sector has enough time to grow*, the sunspot can eventually matter and self-fulfilling crises can be anticipated. We now formally describe one particular sunspot equilibrium, which we will use below to interpret recent stylized facts about lending booms and crises.

Proposition 3 (Sunspot Equilibria) *Suppose Assumptions 1-2 hold and lenders are fully bailed out ($F = 1$) in the event of a meltdown.*

1. *There exists a region*

$$S = \left\{ (e_0, \alpha, T, d) : e_0 > \underline{e},\ \alpha > \underline{\alpha}(e_0),\ T > \underline{T}(e_0, \alpha),\ \hat{d} > \underline{d}(e_0, \alpha, T) \right\}$$

   for the N-sector's initial funds, the probability of no *crisis, the terminal time, and the demand parameter, such that for all economies with* $\left(e_0, \alpha, T, \hat{d}\right) \in S$, *a sunspot equilibrium exists.*

2. *In the equilibrium there is an interval* $[\underline{\tau}, \overline{\tau}]$, *with* $\overline{\tau} \leq T - 1$, *during which a crisis occurs with conditional probability* $1 - \alpha$, *provided that there has not been a crisis up to* $t - 1$. *The probability of two crises in the interval* $[0, T]$ *is zero.*

3. *If, in addition, Assumption 3 holds, then there is a* $\tau \in [\underline{\tau}, T)$ *such that, along the 'lucky path' on which no crisis occurs,* (i) *the output of nontradables increases over time from* τ *on, and* (ii) *the real exchange rate appreciates between* τ *and* $T - 1$.

4. *If a crisis occurs at* t, *investment and credit are lower in* t *than in* $t-1$. *The real exchange rate depreciates from* $t - 1$ *to* t. *If* $\underline{e} < e < \frac{d}{(\theta-1)m^s}$, *output falls between* t *and* $t + 1$.

It should be emphasized that the *likelihood of self-fulfilling crises is not a free parameter*. First, SE exist only if crises are relatively rare events. If the probability of a crisis was too high, low ex ante returns would discourage managers from investing in the first place. We take this feature of the model as a check of the plausibility of our particular sunspot story. Second, crises are more likely to happen toward the end of a boom, as the anticipated event that triggered the boom draws near. Note that even though prosperity is near for the N-sector, fragility and the size of a possible downturn become more severe.

4.4.1 Pareto Optimal versus Equilibrium Nontradables' Production

To highlight the role of bailout guarantees, we compare safe and risky equilibria in the following result:

Corollary 4 (Effects of Bailout Guarantees) *Consider two economies A and B with parameters in S. The only difference between these economies is that A has systemic bailout guarantees. Then, there is an SE where A and B behave identically up to time $\underline{\tau}-2$, after which the N-sector in economy A grows faster and exhibits higher leverage along the lucky path, as long as a crisis does not occur. However, A experiences a crisis and subsequent recession with positive probability while B does not.*

This Corollary implies that systemic bailout guarantees might induce faster economic growth by easing borrowing constraints. Thus, it is not obvious that eliminating them is desirable under all circumstances. To illustrate this point, it is useful to characterize the set of Pareto optima. The allocation problem that has to be solved in our economy is (i) to distribute the available endowment of tradables among consumers and managers and (ii) to efficiently accumulate nontradables to equate the marginal rates of substitution and transformation: $\frac{d_t}{v_t} = \beta\theta\frac{d_{t+1}}{v_{t+1}}$. It follows that the Pareto optimal production of N-goods can be characterized by the following law of motion:[16]

$$q_t = \left(1 - \frac{1-\beta}{1+\beta^{T-t}\left(\frac{\hat{d}(1-\beta)}{d} - 1\right)}\right)\theta q_{t-1}; \qquad t = 1, ..., T \tag{31}$$

The fraction of output that should be devoted to investment is thus increasing over time, and depends positively on the anticipated preference shift $\frac{\hat{d}}{d}$. Comparing (31) and (21), there is no reason that the use of nontradables in a no-bailout regime should be Pareto optimal. Investment could be too large or too small, depending on the financial position of the N-sector. In fact, if the future looks sufficiently brighter than the present, the presence of bailout guarantees might bring the path of N-goods output nearer to the Pareto optimal path, as shown in Figure 4. This is because bailout guarantees might induce a faster growth rate of output (see (21) and (29)).

[16]The key here is that only nontradables are used to produce nontradables, and only the consumer enjoys nontradables. This means that the Pareto optimal law of motion for nontradables can be derived independently of managerial preferences and welfare weights of different agents.

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Ratio of Nontradables (Construction) to Tradables (Manufacturing).

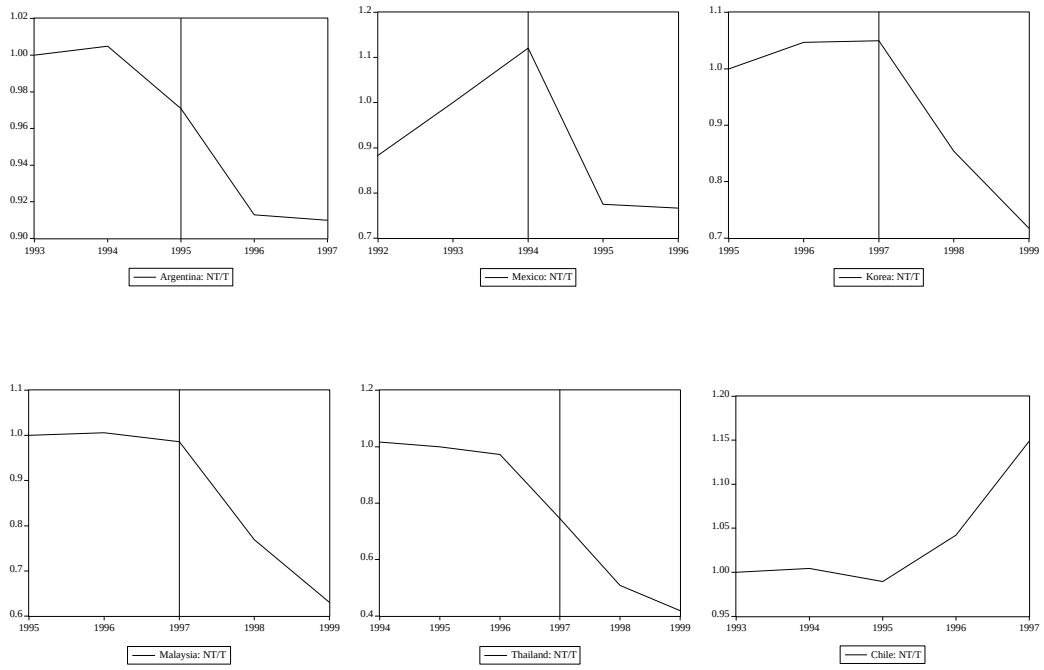


Figure 1:

Banks' loans (22d) and deposits (24+25). Percent of GDP

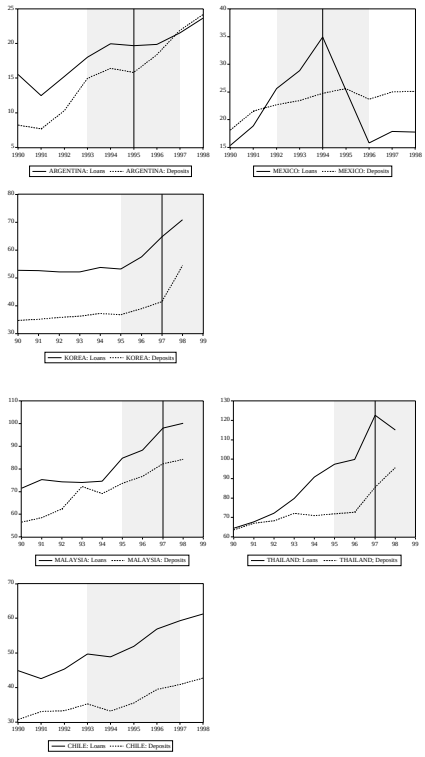


Figure 2:

Real GDP, units of domestic currency.

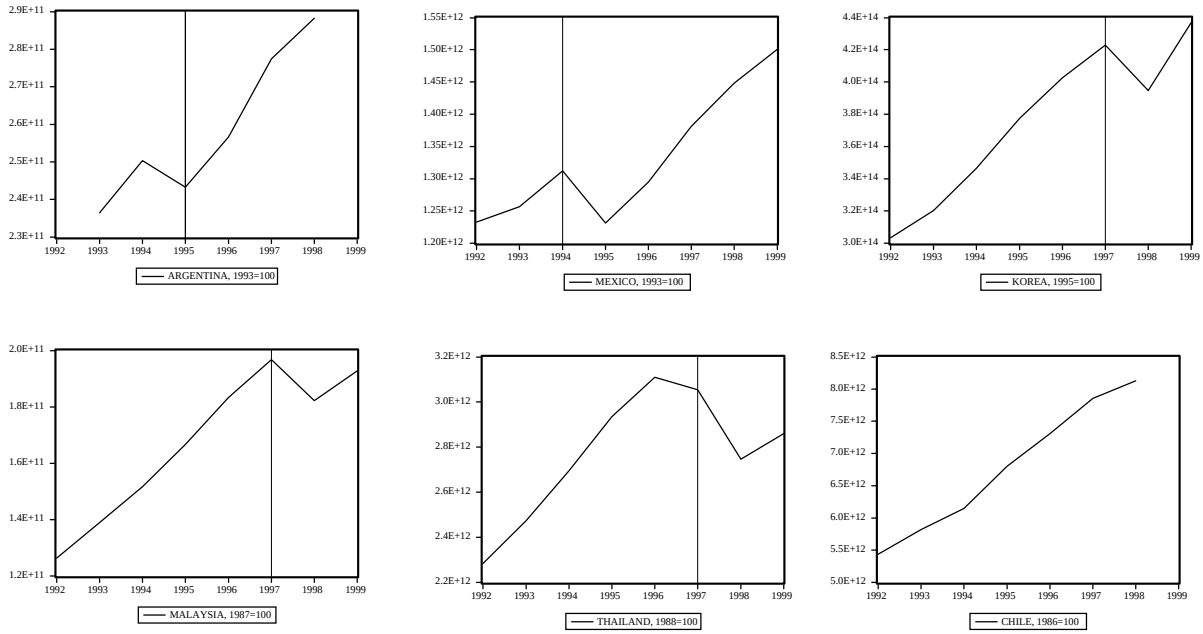
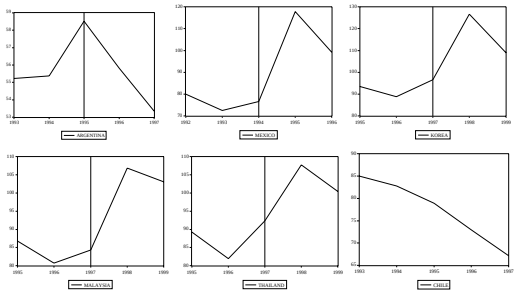


Figure 3:

RER (SDRWPI), 1990=100



"The real exchange rate is defined as the real price of the real dollar (RER = E P* / P)[1]. Where E is the nominal exchange rate, P is the domestic price (measured by the consumer price index), and P* refers to the world price. The SDR-WPI index[2] is used to measure the international price level, which is a measure of the cost, in U.S. dollars of a basket of wholesale price index baskets, and attempts to measure the "world" purchasing power of a dollar by taking the wholesale price indices of the five countries (the United States, Germany, Japan, the United Kingdom, and France) whose currencies are part of the International Monetary Fund's currency unit, SDR (Special Drawing Right). To obtain the SDR-WPI the WPI of each of the reference countries is multiplied by the dollar price of the country's currency, then a weighted average of all five baskets is taken, with fixed weights equal to the ones IMF uses in its construction of the SDR (.40 for the U.S. dollar, .21 for the German mark, .17 for the Japanese yen, and .11 each for the British pound and the French franc) [3]." (Wong, 2000)

[1] Thus, in this paper a real exchange rate appreciation means a reduction in the measure of the RER.
[2] As in Harberger (1989).
[3] These were the weights the IMF used from January 1991 to January 1996.

Figure 4: