High Real Interest Rates, Guarantor Risk, and Bank Recapitalizations

Philip L. Brock

A methodology for analyzing episodes of high real interest rates in emerging market economies.

Summary findings

Brock sets out a methodology for analyzing episodes of high real interest rates in emerging market economies. He reviews the literature on what determines spreads in deposit rates and loan rates. Then he links the causes of interest rate spreads by explicitly modeling the incentive effects of a government deposit guarantee on the behavior of depositors, banks, and firms.

His basic premise: One should begin with accounting identities that decompose the deposit spread and loan spread into several components. One can measure the relative importance of those components to get some idea of the sources of the high real rates.

The stylized facts that emerge suggest that expected depreciation of the exchange rate and the credit quality of borrowers are among the most important, but not the only, determinants of high real rates. In any given country the relative importance of the determinants must be established.

When a government guarantee exists on deposits, the guarantee affects both the deposit and the loan spread by altering the marginal incentives of depositors, bank owners, and firms. Although high real rates may signal financial distress and risky lending by banks, standard recapitalization mechanisms pursued by governments may not improve the situation if the government's tax base is not large enough to eliminate guarantor risk (the

risk that the government will default on its bonds or its guarantee commitment).

The behavior of real interest rates depends on the unit of account that has been chosen for financial transactions. Guarantor risk, in particular, may vary between financial systems that have only nominal contracts denominated in domestic currency and those that have contracts denominated in dollars or contracts whose nominal value is linked to the consumer price index.

High real interest rates often occur when an economy is close to widespread debtor default on privately contracted loans or to government default on government debt or deposit guarantees. These high real rates are contracted at a time when the financial sector operates within the formal legal rules governing bankruptcy proceedings. But expectations about the government's possible departure from enforcement of standard bankruptcy procedures will affect the level of real interest rates.

If high real interest rates are a symptom of distress in the financial sector, as is often true, then high real rates will incorporate expectations of a breakdown in the government's enforcement of financial contracts, in addition to other factors Brock addresses.

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1. Introduction

In the past decade the financial systems of many developing and transitional economies have come under stress. The stress has manifested itself in the form of high real interest rates, high ratios of non-performing loans to total loans, banking crises, and attempts to recapitalize banking systems, sometimes with foreign aid. The observed *ex-post* real lending rates of twenty percent to forty percent (and higher) have occurred in other times, such as in Chile in the mid-1970s and in Korea in the late 1960s. But in any one country such an episode is rare, and policy responses to the high real rates range from denial of their importance to active intervention by the central bank to force the real rates down, without a firm understanding of the possible factors leading to the high real rates.

When governments confront measured *ex-post* real lending rates (that is nominal rates minus actual inflation or actual exchange rate depreciation) of twenty percent over a two-year period, there is a strong and usually correct presumption that borrowers are in distress and that banks, too, may be in trouble. Because any one episode appears to be unique, there are many interpretations of the causes of the high real rates, most of which are plausible although not necessarily correct. A government, consequently, will receive conflicting advice regarding policy. Some will argue that it should devalue to eliminate an overvalued exchange rate, while others will argue that devaluation will destroy policy credibility and lead to even higher real interest rates. Some will argue for the imposition of reserve requirements and special restrictions on capital flows, while others will argue for an even greater relaxation of capital controls. Some will blame external factors, such as a decline in the country's terms of trade, for the high real rates, while others will blame domestic speculators or greedy bankers. Some may argue in favor of a general debt restructuring using public funds, while others will claim that strict enforcement of bankruptcy laws will, in the long run, help the economy by raising respect for the "rule of law".

If a country's government does attempt to recapitalize the banking system following an extended period of high real rates, are there any assurances that the recapitalization will work? Hungary's banking system has been recapitalized three times since 1991, without a long-run solution yet in sight. Mexico is currently attempting to recapitalize its banking system, although a number of observers believe that the funds committed to the recapitalization are too small to restore the solvency of borrowers and banks. On the other hand, recapitalizations in Chile in the mid-1980s and in the Czech Republic in the early 1990s appear to have largely resolved the problems of high real rates and financial fragility of those economies.¹

This paper sets out a methodology for thinking about high real interest rates in developing and transitional economies. In Section 2 I organize a review of relevant macroeconomic and microeconomic literature so that one can use the literature review to make a checklist of possible causes of high real interest rates in any given situation. Section 3 links the microeconomic and macroeconomic causes of high real rates by explicitly modeling the incentive effects on bankers and firms of a government deposit guarantee. Section 4 discusses high real interest rates in connection with the choice of a unit of account for financial transactions. Section 5 concludes.

2. Literature Review

In a small open economy, there are two basic interest rate spreads that one needs to explain in order to understand why interest rates may be high in a given country. The first spread is between the domestic nominal deposit rate (i_d), adjusted by the observed rate of exchange rate depreciation $\hat{E}$, and a relevant nominal foreign interest rate (i^*) such as the three-month Treasury Bill Rate. This spread ($i_d - \hat{E} - i^*$) is generally considered to be

¹See Ramírez and Rosende (1992) and Valdés (1994) for a discussion of Chile's recapitalization program and Borish, Long, and Noël (1995) for a discussion of the Czech Republic and other programs in transition countries.

determined by macroeconomic considerations, such as devaluation expectations, country risk, and factors permitting sterilized intervention by the central bank.

The second basic spread is that between the banking system's average nominal lending rate (i_t) and the deposit rate. This spread ($i_t - i_d$) is generally considered to be determined by microeconomic factors, such as credit risk of borrowers, required reserves, costs of intermediation related to scale economies, and industry structure (such as conglomerates of firms and banks).

Most of the empirical work in this area involves accounting for the spreads by the use of other measurable variables. Two recent papers provide good illustrations of the way in which these accounting exercises can provide insights into the causes of high interest rates in developing countries. The first study, by Carlos Rodríguez (1994), examines interest rate spreads for seven Latin American countries in 1992. Because a number of these countries offer dollar-denominated deposits ($i_d^{\$}$), it is possible to decompose the deposit spread as follows:

$$i_d - \hat{E} - i^* \equiv \text{deposit rate spread}$$

$$(i_d - \hat{E} - i_d^{\$}) \quad \text{exchange rate credibility} \quad (1a)$$

$$+ (i_d^{\$} - i^*) \quad \text{country risk/guarantor risk} \quad (1b)$$

where Rodríguez (p. 11) defines exchange rate credibility as "the difference between expected and actual devaluation" and country risk is the difference between the marginal cost of obtaining foreign funds in the country and the Treasury Bill rate.²

For Argentina and Uruguay information was available on lending rates to prime customers as well as the average lending rate, so that Rodríguez could decompose the spread

²Note that Rodríguez infers the exchange-rate forecast error by implicitly assuming a type of uncovered interest rate parity (i.e., $i_d - i_d^{\$} = \hat{E}^e$, where $\hat{E}^e$ is the expected rate of change of the exchange rate). See Hanna (1994) for a similar study using Indonesian data and Lächler (1995) for a study using Nicaraguan data.

between the loan rate and deposit rate into the basic spread for prime customers as well as the additional spread for lower quality borrowers:

$$\begin{aligned}
 i_\ell - i_d &\equiv && \text{loan rate spread} \\
 (i_\ell^{prime} - i_d) &&& \text{prime rate spread} && (2a) \\
 + (i_\ell - i_\ell^{prime}) &&& \text{credit risk spread.} && (2b)
 \end{aligned}$$

As shown in Table 1 Rodríguez found that of the 22.8 percentage point spread between the peso lending rate and the U.S. treasury bill rate in Argentina (1993.3), 15 percentage points was due to the higher cost of credit for riskier borrowers, 0.24 percentage points was due to the spread for prime customers over the deposit rate, 2.93 points was due to lack of exchange rate credibility, and 4.61 points was due to country risk (the difference between the interest rate on dollar-denominated deposits in Argentina and the T-bill rate). For Uruguay (1992), of the 59.0 percentage point spread between the lending rate and the T-bill rate (adjusted for exchange rate depreciation) Rodríguez found that 32.8 percentage points was due to the higher cost of credit for riskier borrowers, 15.5 points was due to the spread for prime customers over the deposit rate, lack of exchange rate credibility accounted for 10.8 points, and country risk was zero.

Across all seven countries, Rodríguez found an average spread between exchange-rate adjusted lending rates (i.e., lending rates minus actual exchange rate depreciation) and the T-bill rate of about 30 percentage points, of which 25.3 points was due to the spread between the lending rate and deposit rate in local currency terms and 4.6 points was accounted for by the country risk and lack of exchange rate credibility terms. The findings of Rodríguez can be summarized as a stylized fact:

Stylized Fact #1. *In countries with high real lending rates (adjusted for actual exchange rate depreciation), the credit standing of domestic borrowers will generally be a major determinant of the observed spread between deposit and lending rates.*

This stylized fact does not appear to be astounding, but it is a reminder that high real lending rates generally reflect financial distress among non-prime borrowers. As Rodríguez (p. 10) notes, credit operations are short-term in these countries and a firm that is borrowing at a monthly dollar equivalent 23 percent rate for one month does not usually intend to borrow for twelve months at an annual equivalent rate of 1099 percent.

A second recent study by Frankel and Okongwu (1995) looks only at the spreads between deposit rates (or money market rates) and T-bill rates for nine Latin American and East Asian countries during the 1987-1994 period. The authors take issue with Rodríguez's assumption that the difference between dollar-denominated interest rates and the T-bill rate measures country risk, since this assumption implicitly assumes perfect capital mobility. If there is room for sterilization by the central bank, then a divergence between the two rates may reflect lags in capital mobility. This point also implies that the measure of exchange rate credibility employed by Rodríguez may not accurately track forecast errors of the exchange rate (see footnote 2). Frankel and Okongwu (1995) employ survey data of about forty-five multinational firms and forecasting firms or economics departments of banks to develop forecasts of proportional exchange rate changes ($\hat{E}^e$) for the nine developing countries. By combining the approach of Rodríguez (1994) with the forecast information used by Frankel and Okongwu (1995), one can express the deposit interest rate differential as the sum of a forecast error, an exchange rate risk premium, and a country risk premium:

$$\begin{aligned}
 i_d - \hat{E} - i^* &\equiv && \text{deposit rate spread} \\
 &\hat{E}^e - \hat{E} && \text{forecast error} && (3a) \\
 + (i_d - \hat{E}^e - i_d^{\$}) &&& \text{exchange rate risk premium} && (3b) \\
 + (i_d^{\$} - i^*) &&& \text{country risk/guarantor risk premium} && (3c)
 \end{aligned}$$

where the authors (p. 13) define the exchange rate risk premium as "the compensation for holding currencies that are perceived to be riskier than dollars" while the country risk premium

is defined to be "the compensation for holding claims on a country that are perceived to be riskier than claims on the United States."

For all countries, the expected exchange rate change accounted for "a large positive share" of the differential between local and U.S. interest rates. In Chile and the Philippines, in particular, incorporating exchange rate expectations basically eliminated the deposit rate differential. For countries in which the differential was not entirely explained by exchange rate expectations, Frankel and Okongwu show that both the exchange rate premium and the country risk premium were important residual determinants of the spread, but that "a decomposition of interest differentials into country premium and currency premium shows that the latter is generally larger." These considerations lead to a second stylized fact:

Stylized Fact #2. *In countries with high real deposit rates (adjusted for actual exchange rate depreciation), expectations of future exchange rate depreciation that exceed the realized depreciation rate are generally the most important explanation of the high rates, followed in importance by currency risk factors and country risk factors.*

Stylized fact #2 is a reminder that high real deposit rates in developing and transitional economies generally incorporate expectations of exchange rate depreciation that exceed the depreciation rate currently established by the central bank.

Accounting frameworks for large interest rate spreads provide useful information on the proximate sources of the spreads, but they do not resolve why expectations of devaluation develop nor do they explain why borrowers lose their credit standing with banks. The next two sections review the theoretical literature that applies to explanations of the two basic spreads.

2.1 The Deposit Spread

As already noted, the links between high domestic deposit rates and the U.S. T-Bill rate appear to be primarily macroeconomic links, with expected exchange rate depreciation leading

the list of macroeconomic factors explaining the high domestic interest rates. This section will describe a number of analytical models that address the origins of large expected exchange rate depreciations. The deposit spread is frequently measured as the difference in the real *ex post* deposit rate ($r_d \equiv i_d - \pi$) and the real *ex post* international rate ($r^* \equiv i^* - \pi^*$). Equation (3) can be rewritten in terms of the real interest rate spread, expected changes in the real exchange rate, risk premia, and forecast errors:

$$\begin{aligned}
 r_d - r^* &\equiv && \text{real deposit rate differential} \\
 &(\pi^e - \pi) && \text{forecast error for domestic inflation} && (4a) \\
 + \hat{e}^e &&& \text{expected proportional change in the real exchange rate} && (4b) \\
 + (i_d - \hat{E}^e - i_d^s) &&& \text{exchange rate risk premium} && (4c) \\
 + (i_d^s - i^*) &&& \text{country risk premium} && (4d)
 \end{aligned}$$

where $\hat{e}^e \equiv \hat{E}^e + \pi^{*e} - \pi^e$ is the expected real devaluation of the exchange rate.³ Equation (4) states that a real deposit rate that exceeds the real international rate will be the result of a combination of a forecast error resulting from an overestimation of the domestic inflation rate, an expected depreciation in the real exchange rate, and positive exchange rate and country risk premia.

Expectations of Nominal Exchange Rate Depreciation

Most of the theoretical work centered around equation (4a) builds on the work of Krugman (1979) on speculative exchange rate attacks. This literature has been the subject of several surveys, including the one by Garber and Svensson (1995). The essential point of this literature is that a fixed exchange rate will be subject to an attack if the fundamentals of the government's consolidated budget constraint imply that the central bank must eventually expand domestic credit to finance government expenditure. The speculative attack occurs when the remaining amount of international reserves just equals the decline in the real

³I drop a term that measures the forecast error for foreign inflation ($\pi^{*e} - \pi^*$) under the assumption that this error is small.

demand for money balances associated with a switch in policy regime to inflationary finance of the budget deficit.

In the theoretical models, the exchange rate path is continuous (that is, it does not jump) at the time of the attack on the reserves due to the perfect foresight assumption. However, in the empirical literature beginning with Blanco and Garber (1986), it has been common practice to assume that the timing of the attack is uncertain so that an expected jump in the nominal exchange rate can take place, conditional on the central bank's decision to abandon the fixed parity.

The assumption that finite international reserves motivate central banks to abandon fixed exchange rates has recently been questioned by Obstfeld and Rogoff (1995). They point out that many central banks in the 1990s have reserves that nearly cover the monetary base, and sometimes exceed the monetary base. The decision to devalue in the face of a speculative attack, according to Obstfeld and Rogoff, is driven more by a desire to save the banking system than by the exhaustion of reserves backing the monetary base. High interest rates reflect an expected devaluation, but the expected devaluation is driven by lack of credibility that the government will permit a contraction of the monetary base to wreck the banking system.⁴

Models of Real Exchange Rate Depreciation

Holding other things constant, an expected real depreciation that exceeds the actual real depreciation of the exchange rate will lead to high real deposit rates, as shown by

⁴Obstfeld and Rogoff (pp. 10-11) write that "...to fend off a major speculative attack, the monetary authorities typically must be prepared to allow a sharp increase in domestic interest rates, especially short-term rates. Such sharp spikes in interest rates, if sustained for any length of time, can wreak havoc with the banking system, which typically borrows short and lends long. Over the longer term, these unanticipated interest rate rises can also have profound negative effects on investment, unemployment, the government budget deficit, and the domestic distribution of income. A government pledge that it will ignore such side-effects indefinitely to defend the exchange rate is not likely to be credible. Lack of credibility, in turn, makes a fixed exchange rate more vulnerable to speculative attack."

equation (4b) (setting 4a, 4c, and 4d equal to zero). In the stabilization models of Dornbusch (1982), Dornbusch and Werner (1994), and Dornbusch (1995) the real exchange rate becomes overvalued following an exchange rate stabilization program due to inertia in the inflation rate. High real domestic interest rates correspond to the contractionary period of spending that corrects the overvaluation. As Dornbusch and Werner (p. 284) put it, "...a large overvaluation will not go away on its own accord...first, growth will slow; then, interest rates will be raised to defend the currency; then the combination of low growth and high *real* interest rates will cause firms' balance sheets to deteriorate, and hence those of banks."⁵

Most other work on high real deposit interest rates and the real exchange rate emphasizes a perceived temporariness of stabilization policies that leads to a transitory expenditure boom. In these models a high real interest rate will generally correspond to an expected decline in expenditure, so that during the period of high expenditure the real deposit rate will be high, reflecting an expected depreciation of the real exchange rate. In the models of Calvo (1986) and Calvo and Végh (1993), for example, a temporarily low inflation rate lowers the cost of consumption (due to the lower opportunity cost of holding cash) relative to the future. Because the non-traded consumption good is a normal good, the consumption boom raises the relative price of nontradables and the real interest rate.⁶

⁵In an earlier paper Dornbusch (1982) writes, "But even if a government chose to sit through a period of deflation so as to regain competitiveness there is still a major problem. The public, while often assured of the policy, will still entertain doubts. There will be some probability that a discrete depreciation could take place. The possibility of that depreciation will be reflected in home interest rates. Domestic nominal interest rates will be raised by the expectation of depreciation even though domestic inflation is reduced by the deflation policy....The order of magnitude of the problem can be appreciated from a simple calculation: suppose at time T_2 the *real* exchange rate has appreciated by 30%. In case of devaluation the public therefore expects a 30% exchange rate adjustment and the probability of a devaluation during the coming month is placed at 10%. There is accordingly an expected depreciation of 3% per month or 42.6% per year if we annualize the expected depreciation into a risk adjusted interest rate. The expectation of a devaluation of 30% with a 10% probability thus gives us a really enormous real interest rate and cannot fail to discourage demand."

⁶Strictly speaking, the real interest rate declines during the period of the appreciating real exchange rate, due to the assumption of perfect capital mobility and perfect foresight. Only at the instant that expenditure declines will the instantaneous real interest rate be high. But by the same heuristic reasoning as Dornbusch in footnote 4, one can assume that uncertainty

In Brock (1992 a, b) I develop a different mechanism that generates a temporary real appreciation of the exchange rate. In these two models the government has a stabilization fund that is used to stabilize the real exchange rate at a rate that is overvalued relative to the market-clearing level. The overvalued exchange rate is consistent with an increasing rate of nontraded investment and a temporary output expansion that draws down on the stabilization fund prior to a speculative attack at the termination of the stabilization program. When the increase in expenditure is brought to a halt at the time of the speculative attack the real exchange rate depreciates. As in the consumption-driven models of Calvo (1986) and Calvo and Végh (1993), the expenditure boom raises the real interest rate prior to the real depreciation of the exchange rate.⁷

It is useful to look at some empirical evidence on the high real interest rates and real exchange rate movements. Tables 2 and 3 show the reaction of five countries to a common external shock associated with the U.S. recession of 1981-82 and the extremely high world real rates of interest that accompanied the recession. Table 2 shows real exchange rates with the U.S. for five developing countries between 1975 and 1994. Taking 1980 as the base year, the real exchange rates of all five countries began to depreciate within the next two years. Chile's real exchange rate had depreciated by almost 100 percent by 1985 (so that a bundle of Chilean consumption goods cost only half of what it had in 1980 in dollar terms). Colombia's real exchange rate began to depreciate in 1983 and kept depreciating until 1990. Indonesia's

about the timing of the decline in expenditure would lead to an observed high real interest rate prior to the actual depreciation of the real exchange rate. Drazen and Helpman (1987, pp. 851-53) make such an argument in their stabilization model, noting that the interest rate rises prior to the change in policies due the "upward trend in the risk premium." Calvo and Végh (1995) show that high real rates can also be the product of an imperfect substitutability between money and bonds in a setting of a temporary stabilization.

⁷There is another body of literature for the OECD countries that tests to see whether real interest differentials are cointegrated with the *level* of the real exchange rate. These tests assume perfect capital mobility and a stationary long-run level of the real exchange rate, so that the level picks up a transitory deviation away from a long-run value. The papers, some of which are reviewed in Baxter (1994) and Edison and Melick (1995), have only found weak evidence of a link between real interest rate differentials and the level of the real exchange rate among industrialized economies.

real exchange rate closely followed Colombia's after 1980. Turkey's real exchange rate, which began to depreciate in 1979, steadily appreciated from 1985 onward. Finally, Thailand's real exchange rate depreciated by 20 percent between 1980 and 1985 before appreciating.

Were the real depreciations preceded by high real interest rates? Table 3 shows real deposit rates of interest for the five countries plus the real T-Bill rate. Between 1980 and 1981 the real T-Bill rate rose from about zero to ten percent. Chile's real ex-post deposit rate peaked at about 30 percent in 1981, Turkey's peaked at 11 percent in 1982, Colombia's peaked at 13 percent in 1983, Thailand's at 12 percent in 1984, and Indonesia's at 12 percent in 1985.

The figures in Tables 2 and 3 show that high real rates immediately preceded significant real exchange depreciations in Chile (1981), Colombia (1983), and Indonesia (1985). The peak in Turkey's real deposit rate in 1982 preceded a significant real depreciation in 1983 and 1984, but the recent liberalization of interest rates meant that it also followed real depreciation in 1980 and 1981. Thailand's high real rates coincided with a period of real depreciation between 1981 and 1985, and came down significantly as the real exchange rate began to appreciate from 1986 on.

Imperfect Capital Mobility

As Calvo (1991), Frankel and Okongwu (1995), Velasco (1993), and others have emphasized, if capital is not perfectly mobile, tight monetary policy in general and sterilization of capital flows in particular can produce transitorily high real deposit rates. Frankel and Okongwu estimate a sterilization offset coefficient of about .3 per quarter, so that thirty percent of any reduction in domestic credit is offset by increased capital inflows within one quarter.

Different countries will have different degrees of capital mobility, so that for some countries high real interest rates may reflect domestic factors that have little to do with expected exchange rate depreciation, as shown by equation (4c). As an example, if capital is not perfectly mobile a transitory increase in government spending will raise the real level of

domestic interest rates, thereby inducing a capital inflow over time and an appreciation of the real exchange rate as domestic interest rates decline to international levels. Similarly, an expected future increase in output will generally lead to immediate increases in consumption (due to higher permanent income) and investment (due to increased demand for consumer durables and houses as well as increased demand for producers' capital). This increase in expenditure will likewise initially raise real interest rates and, provided that some of the expenditure increase falls on nontraded goods, will lead to an appreciation of the real exchange rate.⁸

In summary, with imperfect capital mobility an economy resembles a closed economy in the short run so that the real interest rate plays a relatively larger role in allocating expenditure than in an economy with perfect capital mobility. Conversely, in an economy with imperfect capital mobility, the real exchange rate and expectations of exchange rate depreciation play a less important role than in an economy with perfect capital mobility.

Guarantor Risk

Equation (3) states that a positive spread of the domestic deposit rate over the international rate is either due to expected depreciation of the exchange rate or to a risk premium. Both the exchange rate risk premium (equations 3b and 4c) and the country risk premium (equations 3c and 4d) can be closely identified with risk that the government may not back up explicit or implicit guarantees for banks' liabilities. This risk may take the form of inconvertibility of dollar-denominated deposits at the official exchange rate, as occurred in Mexico in 1982. Or the risk may take the form of a freeze on deposits and deposit interest rates during a period of high inflation, as in Argentina in 1982. Occasionally the financial system risk involves a unilateral write down of deposits, as occurred in Chile in 1975 with

⁸See Bruno (1993, pp. 121-124) for an explanation of this type for Israel's macroeconomic experience following the implementation of its 1985-86 stabilization program.

deposits of the savings and loan association, or in Argentina in 1991 and Brazil in 1992 with bank deposits.

Where these risks exist, domestic deposit rates will remain high even in the absence of expectations of exchange rate depreciation, as can be illustrated most clearly by the example of banks and savings and loans in Texas in the late 1980s. Table 4, taken from Short and Gunther (1989) shows the cost of deposits for Texas thrifts at the start of 1988. Compared to other U.S. thrifts, Texas thrifts as a whole had to pay 74 basis points more for large CDs (7.70% versus 6.96%) while the gap increased to 132 basis points for the least well-capitalized thrifts. In 1988 there was no exchange rate risk in Texas, so that the so-called "Texas premium" was due entirely to guarantor risk.

In a recent paper Cook and Spellman (1994) estimate the value of guarantor risk on a monthly basis during 1987-1988. They find that guarantor risk reached its peak with the announced insolvency of the Federal Savings and Loan Insurance Corporation in February 1987.⁹ According to estimates made by Cook and Spellman, between February 1987 and August 1988 the level of guarantor risk associated with thrift CDs averaged 3.8 percent (i.e., market participants required a premium of 3.8 cents per dollar to compensate them for perceived default risk by the FSLIC). The premium ranged from 10.3 percent at the start of 1987 to about 0.7 percent by the middle of 1988.¹⁰

2.2 The Loan Spread

This paper concerns the topic of high real interest rates and bank recapitalizations. The existing literature establishes a strong presumption that a persistently high deposit rate spread ($i_d - \hat{E} - i^*$) can lead to financial distress, as emphasized by Dornbusch and Werner

⁹Cook and Spellman (p. 14) note that Texas Governor Bill Clements fueled the uncertainty with a statement, carried on the front page of the *Wall Street Journal*, that the FSLIC would pay depositors "like 30 cents on the dollar and give them a piece of paper like a bond" for the remainder.

¹⁰ In February 1988 the U.S. government announced the Southwest Plan to resolve financial institution insolvencies in Texas and the rest of the Southwest.

(1994) and Obstfeld and Rogoff (1995) in the previous section. The literature also emphasizes that a high deposit rate spread is a *macroeconomic* phenomenon, related to fiscal credibility, price inertia, the real exchange rate, and country and exchange rate risk premia. Given that financial distress can have its origins in macroeconomic policy decisions, this section explores the set of *microeconomic* reasons for the existence of a large loan spread ($i_\ell - i_d$) that may be important additional determinants of financial distress.

Credit Risk

The information presented by Rodríguez (1994) shows that a high proportion of the loan rate spreads in Uruguay in 1992 and in Argentina in 1993 could be explained by the creditworthiness of the borrowers. In Uruguay, for example, prime customers paid 15.5 percentage points above the deposit rate while average borrowers paid an additional 32.8 percentage points (48.3 in total). In Argentina, prime customers paid only 0.24 percentage points above the deposit rate, while average borrowers paid an additional 15 percentage points. Rodríguez offers two explanations for the high average loan rate spread. The first is that it is related to industry structure. The second is that the loan rate spread reflects the riskiness of the loans. According to the second argument, better borrowers have access to dollar-denominated

loans and pay lower real rates in peso-denominated operations than the average borrower. Rodríguez (p. 18) writes, "Clearly, the average of the Latin American creditors is well below a qualification of AAA and should pay higher rates independently of whether they are located in Bolivia or in the US."

The second argument has a great deal of merit and serves as a reminder that borrowers are heterogeneous, so that the loan rates they pay should reflect relevant borrower characteristics. Work on credit risk at the micro level stresses the importance of net worth and collateral to secure the loan, the ability to make restrictive covenants that restrict the ability of the borrower to divert funds away from their intended purpose, the disclosure of accurate

information on the borrower, and the ability to write easily enforceable legal contracts. To the extent that there is imperfect information and imperfect enforcement of contracts, loans become costly to the bank and borrowers will be charged higher interest rates or may be rationed out of the loan market. Collateral and, more generally, a firm's net worth can mitigate these costs as long as the collateral can be legally pledged against the loan.

Rodríguez's point that less creditworthy borrowers are charged a higher lending rate in Argentina (and elsewhere) can be interpreted one of two ways. First, the 15.24 percent spread just reflects the poor average credit quality of borrowers in Argentina. The risk structure of interest rates may be more extreme in Argentina than in the United States, but it is essentially a microeconomic phenomenon. A second interpretation of the large spread is to view it as a reflection of generalized low net worth that reflects broader macroeconomic concerns. Much of the macroeconomic concern regarding the risk structure of interest rates stems from work by Bernanke (1983) on financial factors in the propagation of the Great Depression in the United States. Bernanke showed that between June 1929 and June 1932, the difference between the yields on Baa corporate bonds and long-term U.S. government bonds rose from 2.31 to 7.93 percentage points. This increased spread represented a flight to quality (the U.S. government bonds) brought on by successive waves of bank collapse and a decline in the U.S. price level that raised the real value of outstanding debt.

Other work by Bernanke and Blinder (1988), Bernanke and Gertler (1989, 1990), Gertler and Rose (1995), and Kiyotaki and Moore (1995) has emphasized the importance of the credit supply mechanism (as opposed to just the money supply) in the economy. Disruptions to the supply of credit raise the spread between the loan rate and the deposit rate, and reduce output. A common theme of this work on the macroeconomic consequences of credit risk is the importance of collateralizable net worth in lowering the costs of lending. Negative shocks to net worth restrict the aggregate supply of credit, thereby lowering production. In Kiyotaki and Moore's paper, for example, land is used as collateral for working capital loans (intermediate inputs into production). A negative shock to the economy that

lowers output will also result in a fall in the price of land, thereby reducing the value of collateral and magnifying the initial negative shock as banks restrict their loans for working capital. Bernanke, Gertler, and Gilchrist (1994) find micro-level evidence that flight-to-quality restricts the credit access of smaller firms during U.S. recessions. Furthermore, they find that the magnitude of the restriction in credit access is large enough to have a macroeconomic impact that magnifies the size of the economic downturn. In a similarly motivated paper, Caplin, Freeman, and Tracy (1993) show that between June 1989 and May 1992 the fall in property values in the United States exacerbated regional recessions by lowering the value of collateral against mortgage loans.

At a policy level, Fisher (1933) was the first to suggest that a monetary expansion to raise the price level would lower the real value of outstanding debt, raise borrower net worth, and reduce the high real costs of credit in the Depression. More recent work has emphasized steps to raise the real value of collateral as a way of raising net worth, or making transfers to borrowers. As Bernanke and Gertler (1990) note, making large-scale transfers raises the problem of moral hazard and repeated future bailouts. They suggest that "bailouts be used only in response to large aggregate or systemic shocks, over which individual borrowers could have no control; individual institutions that have made bad decisions should not be bailed out."¹¹

Concern with macroeconomic shocks, credit risk, and bailouts is the topic of Dewatripont and Tirole's (1994) recent theoretical treatment of prudential bank regulation. Dewatripont and Tirole develop their analysis using the idea of control rights over economic activity. In general terms, equity holders have soft control rights that they exercise as long as the firm has a positive net worth. Debt holders have hard control rights that they exercise when the firm cannot pay its debt. In the context of bank regulation, the government acts as the agent for debtholders (either because of an explicit deposit guarantee, a lender-of-last-

¹¹They go on to note that "it must be admitted though that, in practice, it is not always so easy to distinguish 'systemic' from 'idiosyncratic' shocks."

resort commitment, or a too-big-to-fail policy), and must therefore act as the agent with the hard control rights.

Banks are generally expected to bear idiosyncratic risk (individual banks that have made bad decisions should not be bailed out), but macroeconomic risk which jeopardizes the solvency of many banks will not necessarily reflect bad ownership and management. A government that has hard control rights must decide when to exert those rights to change the banks' organizational structure and when to bailout the banks, leaving the existing owners and managers in control. Dewatripont and Tirole emphasize the existence of a "double moral hazard" problem, where regulators have an incentive to practice forbearance following a macro shock while bankers (owners and management) have the incentive to take on riskier activities. This double moral hazard problem could result in an increasing loan spread during the period in which control rights over the banks are contestable. As long as the agent with the hard control rights (the government) refrains from exercising those rights in a situation of bank insolvency, the agents with the soft control rights have the incentives to manipulate interest rates and cash flows, possibly in ways that Akerlof and Romer (1993) have described as "looting."

Fiscal Taxes and Quasi-Taxes

Fiscal quasi-taxes, such as deposit rate ceilings, and taxes, such as non-interest-bearing reserve requirements, also create a wedge between the deposit rate and lending rate. Forced investments in government-mandated sectors of the economy and forced purchases of government debt also increase the size of the wedge between the deposit rate and the lending rate for the bank's freely-allocable funds. There is a large literature, including McKinnon and Mathieson (1981), Calvo and Fernandez (1984), Brock (1989), and Espinosa (1995), that provides models of the inflation tax on financial intermediation.

The following simple model taken from Brock (1992c) demonstrates the wedges created by the interaction of reserve requirements and the inflation rate. Let the real monetary

base (h) be composed of real currency balances (m), non-interest-bearing required reserves on demand deposits ($k_{dd}dd$), and non-interest-bearing required reserves on time deposit ($k_{td}td$), where k_{dd} is the required reserve ratio on demand deposits and k_{td} is the required reserve ratio on time deposits. The inflation tax is the opportunity cost of holding non-interest-bearing base money:

$$\text{Inflation Tax} = ih \equiv i(m + k_{dd}dd + k_{td}td) \quad (6a)$$

where i is the nominal interest rate on time deposits. By assuming that banks hold no excess reserves or other investments, loanable funds (ℓ) will equal free deposit resources:

$$\ell = (1 - k_{dd})dd + (1 - k_{td})td \quad (6b)$$

Assuming that the supply of demand deposits is upward sloping, that the demand for loans is downward sloping, and that the supply of time deposits is perfectly elastic at the real interest rate r , revenue from the inflation tax can be rewritten as follows:¹²

$$ih = im + (r - r_{dd})dd + (r_\ell - r)\ell \quad (6c)$$

where $r_{dd} \equiv i_{dd} - \pi$ is the real demand deposit rate and $r_\ell \equiv i_\ell - \pi$ is the real lending rate.

Figure 1 graphs the three components of the inflation tax as the shaded areas A, B, and C.

The experience of Chile in the mid-1970s can be used to illustrate the importance of required bank reserves for the imposition of the inflation tax. In Chile the cumulative effects of the oil price shock and the halving of the price of copper caused a deterioration in the savings and loan system (SINAP). The system was partially bailed out by the government in May 1975 (see de la Cuadra and Valdés, 1992). The cost of the 1975 savings and loan bailout in Chile was borne by the Central Bank. Domestic credit to SINAP represented about 25 percent of total domestic credit of the central bank and about 8.5 percent of GDP by 1977. The cost of

¹²The derivation makes use of the no-arbitrage conditions $i = (1 - k_{td})i_\ell$ and $i_{dd} = (1 - k_{dd})i_\ell$, where i_d is the nominal demand deposit rate and i_ℓ is the nominal loan rate.

the partial rescue of SINAP's depositors was largely monetized, contributing substantially to the large inflation tax of 7 percent of GDP in 1976 and accounting for a substantial proportion of the 57.1 percentage point spread between deposit and lending rates on short-term (30-89 day) operations.

Following the methodology of the inflation tax model of this section, Table 5 calculates the relative size of the components of the inflation tax and shows that the currency and demand deposit components accounted for the majority of the tax. As can be seen in column (2) of Table 5, the contribution of reserve requirements to the loan spread declined swiftly, finally accounting for only 1.8 percentage points in 1980. The figures shown in column (3) of Table 5 indicate a sharp rise in the residual (unexplained) part of the spread from 11.4 percentage points in 1976 to 19.8 percentage points in 1977 before a gradual decline to 5.2 percentage points in 1980. The Chilean experience shows that a bank bailout can produce high real rates if the bailout is monetized with the use of required reserves as part of the base for the inflation tax.

Industry Structure

The last potential candidate for large loan spreads is the structure of the banking industry. At an early stage of development, banks may be smaller than optimal size, so that their unit costs may be high. If there are barriers to entry, then loan spreads may reflect the price leadership of a dominant bank (which could be a state-owned bank).

In developing countries economic conglomerates of banks and firms may also contribute to the high spreads, since the lending rate can act as a transfer price within the conglomerate, without necessarily signaling anything significant about the economy. This use of the lending rate as a transfer price is particularly attractive if there are tax advantages to the conglomerate from loading up its firms with debt. Conglomerates may also result in a concentration of ownership that discriminates against smaller firms that are not associated with a conglomerate. On the other hand, conglomerates may help to solve information problems

that would otherwise result in a very high cost of credit. That appears to be one reason for banking conglomerates in countries such as Germany and Japan (see, e.g., Perotti 1994).

3. A Model of Guarantor Risk

Section 2 showed that the problem of high real interest rates in a developing or transitional economy can be broken down into the real deposit spread relative to the international interest rate ($r_d - r^*$) and the loan spread ($r_\ell - r_d$). The literature treats the deposit spread as determined by macroeconomic factors. The loan spread, on the other hand, is generally regarded as determined by microeconomic factors related to tax rates, credit risk, and industry structure, although some recent papers have begun to examine the loan spread in a macroeconomic setting.

This section of the paper develops a model in which the government insures deposits so that the deposit risk is a macroeconomic risk that the government will not be able to meet its guarantee obligations. In this setting the deposit guarantee will affect the deposit rate set by the banks. The guarantee will also affect the loan rate set by banks and the riskiness of the projects financed by the banks. In terms of the two spreads, the model links the deposit spread ($r_d - r^*$) with the loan spread ($r_\ell - r_d$) by means of the government deposit guarantee. In this way, both spreads are jointly determined by macroeconomic and microeconomic factors. The model contains only traded goods so the real exchange rate is not a factor in the deposit spread, as it is empirically. The model should be taken as a simple framework to examine the effect of a deposit guarantee on interest rate spreads when the guarantee is not completely credible.

3.1 Interest Rate Determination Without a Government

The analysis is based on the simple two-period model of James (1988), but with the addition of a government that insures deposits and collects taxes. The first period is the

investment period and the second period is the consumption period. There are a countable infinity of risk-neutral agents in the economy who are divided into entrepreneurs, bankers, and savers. I will frame the discussion in terms of a single representative entrepreneur and single representative banker. The representative entrepreneur is able to undertake a risky indivisible investment project. The project requires one unit of endowment as investment. The entrepreneur's project will have a continuous payoff function $h_1(s)$ in period 2. The state of the world s is assumed to have a uniform distribution over the interval $[0, \bar{s}]$. The entrepreneur begins period 1 with an endowment $e < 1$, so he must borrow $1-e$ from other sources.

I assume that the representative bank incurs monitoring and origination costs c_b in making a loan. The payoff schedule for a loan is

$$a_1(s) \equiv \min[(1-e)r_\ell - c_b, h_1(s) - c_b] \quad (7)$$

where $(1-e)r_\ell$ is the contracted principal plus interest that the entrepreneur pays to the bank except in states of default. According to equation (7) the bank takes over the entrepreneur's project and gets a return $h_1(s) - c_b$ when the entrepreneur defaults. Other suppliers of funds have monitoring and origination costs $c > c_b$ so that the representative bank has a comparative advantage in lending. All savers have access to a risk-free investment that pays r^* in the second period, so that the bank must offer deposit contracts that pay the risk-free rate in expected value terms. Given these assumptions, a representative bank's expected return on its loan satisfies the following condition:

$$A_1 \equiv \int_0^{\bar{s}} a_1(s) f(s) ds = (1-e)(r^* + d) \quad (8)$$

where $f(s)$ is the probability density function of s and $d \equiv c - c_b$ is the intermediation rent per unit of loan.¹³

¹³Following James (1988) I assume that the intermediation rent is captured by the bank rather than by the bank's borrowers. See Kiyotaki and Moore (1995) for additional arguments in favor of this division.

The banker contributes an endowment w to the bank, where $e+w < 1$, so that the banker must raise an amount $1-e-w$ of deposits in order to fund the entrepreneur's project. Deposit contracts satisfy the following no-arbitrage condition:

$$D \equiv \int_0^{\bar{s}} \min[(1-e-w)r_d, a_1(s)] f(s) ds = (1-e-w)r^* \quad (9)$$

Equation (9) states that the bank will pay r_d on its deposit liabilities, provided that it can do so. If the bank has to default, depositors get the proceeds of the bank's loan, $a_1(s)$. The bank's net worth in period 1 is the expected present value of cash flows that exceed the promised payment r_d to depositors:

$$q_1 w \equiv \int_0^{\bar{s}} \max[a_1(s) - (1-e-w)r_d, 0] f(s) ds, \quad (10)$$

where q_1 is the ratio of the value of the bank's expected profits to the banker's initial endowment.

Figure 2 presents the bank's balance sheet, using the notation of equations (8)-(10):

Figure 2

In this setting, the deposit	Assets	Liabilities	and lending rates reflect the
riskiness of the	A_1	D	entrepreneur's project, the
endowments of the		-----	entrepreneur and banker,
and the intermediation rents		Net Worth	accruing to the banker.
Holding other things		$q_1 w$	constant, a decrease in the
entrepreneur's endowment will raise the lending rate and deposit rate. A decrease in the			banker's endowment will only raise the deposit rate, since the loan contract is independent of

the banker's net worth. Similarly, an increase in the bank's intermediation cost c_b will raise the deposit rate and lower the bank's net worth. The following proposition applies to the effect of increased risk on the entrepreneur and banker:

Proposition 1. *In the absence of deposit insurance, an increase in the riskiness of the entrepreneur's project, as measured by a mean preserving spread, will leave the entrepreneur's and banker's net worth unchanged.*

The greater risk will cause risk-neutral savers to raise the deposit rate so as to leave the expected return on deposits unchanged. Similarly, the bank will raise the lending rate up to the point (determined by the no-arbitrage condition in equation (1) where the expected value of the entrepreneur's payment is unchanged. As a result, the increase in the project's riskiness will leave both the entrepreneur's and banker's net worth unchanged.

3.2 A Government Guarantee on Deposits

Now add a government to the model. The government will guarantee the return on deposits, with state-contingent period-2 taxes $T(s)$ as the backing for the guarantee. Guarantees may arise for a number of reasons, including concern for the payments system, concern for small depositors, political pressure, or ignorance of the incentive effects of the guarantees on bankers' behavior. Here I take the guarantee as a given, and address the consequences of the guarantee (see Brock 1994 for a model with an explicit motivation for a guarantee).

With the government's guarantee, deposit contracts will satisfy the following condition, where r_g is the deposit rate:

$$D' \equiv \int_0^{\bar{s}} \min \left[(1-e-w)r_g, a_1(s) + T(s) \right] f(s) ds = (1-e-w)r^* \quad (11)$$

If the government's tax base is sufficiently large, depositors will never face a loss and, consequently, the deposit rate will equal the risk-free rate ($r_g = r^*$). If there are states in which

the government's tax revenue is insufficient to pay the contracted payment, depositors will be given the returns on the project $a_1(s)$ plus the government's tax revenue $T(s)$.¹⁴ In general, the deposit rate will exceed the risk-free rate (due to the incomplete ability of the government to honor the guarantee), but will be less than the deposit rate without the guarantee: $r^* \leq r_g \leq r_d$. With the deposit guarantee, the bank's loan contract will remain unchanged, but the banker's net worth will increase as a result of being able to contract a lower deposit rate:

$$q_2 w \equiv \int_0^{\bar{s}} \max[a_1(s) - (1 - e - w)r_g, 0] f(s) ds > q_1 w \quad (12)$$

The government's guarantee is an asset to the bank. The expected value of the guarantee is the following:

$$V \equiv \int_0^{\bar{s}} \max\left\{0, \min\left[(1 - e - w)r_g - a_1(s), T(s)\right]\right\} f(s) ds = (q_2 - q_1)w \quad (13)$$

Equation (13) indicates that if the bank can pay off its depositors in any state of the world, the guarantee will be worth zero; if the bank cannot always pay off the depositors the guarantee will be worth $(1 - e - w)r_g - a_1(s)$ in default states s where the government can bail out depositors completely; and in those default states where the government cannot bail out depositors completely, the guarantee will be worth the amount of tax revenue $T(s)$. The last equality in (13) can be stated as the following proposition:

Proposition 2. *The value of the government's guarantee accrues entirely to the banker in the form of an increase in the bank's net worth: $V = (q_2 - q_1)w$.*

Figure 3 shows the balance sheet of the bank with the government guarantee on deposits:

¹⁴Here I am using the representative agent framework to combine the government's budget constraint involving aggregate taxes with the single representative bank's deposit contract (thereby avoiding the need to consider a *pro rata* assignment of tax revenue to the bank).

Figure 3

With a deposit guarantee a	Assets	Liabilities	decrease in the
entrepreneur's endowment	A_1	D'	will raise the loan rate, as in
section 3.1, but it will raise	V		the deposit rate less than in
the absence of a guarantee.		Net Worth	The increased riskiness of
the bank's loan will raise the		$q_2 w$	value of the government's

guarantee to the banker. Similarly, a mean-preserving increase in the spread on the return on the entrepreneur's project, $h_2(s)$, will raise the contracted loan rate, increase the riskiness of the loan, and raise the value of the guarantee. These considerations lead to the following proposition:

Proposition 3. *An increase in the riskiness of the entrepreneur's project will unambiguously raise the banker's net worth in the presence of a government deposit guarantee.*

This proposition follows from the no-arbitrage conditions in equations (8) and (11) that determine the expected value of loan payments and deposit liabilities. Those conditions, in conjunction with the larger expected value of the guarantee, establish the increase in the banker's net worth. The result also hinges on the inability of the entrepreneur to take actions to lower the value of the project to the bank in response to a higher lending rate. I will turn to that possibility in the next section.

3.3 Endogenous Project Riskiness

In the previous two sections the lending rate has been determined by the no-arbitrage condition for direct lending to the entrepreneur by suppliers of funds. This lending rate had to solve equation (8), taking the bank's cost of intermediation (c_b), the alternative cost of direct borrowing by the entrepreneur (c), and the entrepreneur's project ($h_1(s)$) as given. Now suppose that the entrepreneur has no potential outside source of funds for his project, but that he can add risk to the project (in the form of a mean-preserving spread) at a cost K , thereby converting the project into $h_2(s)$. The entrepreneur's ability to add risk creates two critical values of the lending rate, as shown in Figure 4. The first critical value, $\hat{r}_\ell$, occurs at the point at which the benefit to the entrepreneur of adding risk just equals the cost. At this point the following condition holds:

$$\int_0^{\bar{s}} \left\{ \max[h_2(s) - \hat{r}_\ell(1-e), 0] - \max[h_1(s) - \hat{r}_\ell(1-e), 0] \right\} f(s) ds = K \quad (14)$$

The left-hand side of equation (14) is the increase in the entrepreneur's net worth from adding risk (given debt financing at the rate $\hat{r}_\ell$), while the right-hand side is the cost K . At lending rates below $\hat{r}_\ell$, the entrepreneur will choose the safer project, while at rates exceeding $\hat{r}_\ell$, the entrepreneur will add risk to the project. Equation (14) indicates that the critical value $\hat{r}_\ell$ is a function of the entrepreneur's endowment e . A smaller endowment will lower the critical value of the lending rate at which the benefits from adding risk exceed the cost. This occurs because the benefits of adding risk increase with the entrepreneur's leverage.

At the critical value $\hat{r}_\ell$ the expected return to the banker will undergo a discrete drop since, as in Stiglitz and Weiss (1981), the expected return to the loan contract is decreasing in the riskiness of the entrepreneur's project:

$$\int_0^{\bar{s}} \min[\hat{r}_\ell(1-e), h_1(s)] f(s) ds = (r^* + d_1)(1-e) \quad (15a)$$

$$\int_0^{\bar{s}} \min[\hat{r}_\ell(1-e), h_2(s)] f(s) ds = (r^* + d_2)(1-e) \quad (15b)$$

where $d_1 = c_1 - c_b$ and $d_2 = c_2 - c_b$. At the critical value $\hat{r}_\ell$ the entrepreneur's addition of risk implies a loss to the bank of intermediation rents. This is shown in Figure 4 as a discrete drop in the bank's expected rate of return on the loan from $r^* + d_1$ to $r^* + d_2$.

The second critical value of the loan rate, $\hat{\hat{r}}_\ell$, is determined by the condition that the expected return to the riskier project cannot be less than the risk-free return on the entrepreneur's endowment:

$$\int_0^{\bar{s}} \max[h_2(s) - \hat{\hat{r}}_\ell(1-e), 0] f(s) ds = r^* e \quad (16)$$

If the banker were to raise the loan rate above $\hat{\hat{r}}_\ell$, the entrepreneur would invest his endowment at the safe gross rate of return r^* .

In sections 3.1 and 3.2 the bank's expected return on a loan is determined by the exogenously given spread $d \equiv c - c_b$. When the entrepreneur can choose the riskiness of the project, the bank's expected return on the loan will be increasing in the loan rate, but decreasing in the riskiness of the project. Figure 4 shows that the bank's expected return on a loan is endogenously determined and either will equal $r^* + d_1$ if the bank chooses the loan rate $\hat{r}_\ell$ (to induce the entrepreneur to adopt the safer project) or will equal $r^* + d_2$ if the banker chooses $\hat{\hat{r}}_\ell$ (to cause the entrepreneur to take on the riskier project)¹⁵. Figure 4 is drawn under the assumption that the expected value of a bank loan at the rate $\hat{r}_\ell$ exceeds the expected value of a bank loan at $\hat{\hat{r}}_\ell$:

$$\int_0^{\bar{s}} \hat{a}(s) f(s) ds > \int_0^{\bar{s}} \hat{\hat{a}}(s) f(s) ds \quad (17)$$

¹⁵I once again assume, as in footnote 12, that intermediation rents are captured by the bank so that the equilibrium lending rate must either be $\hat{r}_\ell$ or $\hat{\hat{r}}_\ell$.

where $\hat{a}(s) \equiv \min[(1-e)\hat{r}_\ell - c_b, h_1(s) - c_b]$ is the return to the bank on the safe loan and $\hat{\hat{a}}(s) \equiv \min[(1-e)\hat{\hat{r}}_\ell - c_b, h_2(s) - c_b]$ is the return to the bank on the risky loan.

In the absence of deposit insurance, the bank's net worth will decrease by charging $\hat{\hat{r}}_\ell$ instead of $\hat{r}_\ell$. In the presence of government deposit insurance, however, the banker has an incentive to raise the loan rate beyond $\hat{r}_\ell$, since the deposit guarantee functions as a put option on the bank's loan portfolio: increases in risk raise the option value of the guarantee.

With deposit insurance the deposit rate (r_s) is determined by the market-clearing condition (11) that guarantees depositors the expected risk-free rate of return, given the government's limited ability to bail out depositors in the second period. With the government guarantee in place, the representative banker takes the deposit rate as exogenous when choosing the lending rate corresponding to the safer loan $\hat{a}(s)$ or the riskier loan $\hat{\hat{a}}(s)$:

$$qw \equiv \int_0^{\bar{s}} \max[\hat{a}(s) - (1-e-w)r_s, 0](s)ds \quad (18)$$

The promised payment to depositors, $(1-e-w)r_s$, shifts the distribution of the banker's returns by giving the banker only the upper tail of returns. Figure 5 is drawn so that the deposit rate r_s^1 results in a distribution of profits to the right of $(1-e-w)r_s^1$ that is greater in expected value for the less risky loan $\hat{a}(s)$. The deposit rate r_s^2 , on the other hand, results in a distribution of profits to the right of $(1-e-w)r_s^2$ that is greater in expected value for the riskier loan $\hat{\hat{a}}(s)$. This shift in the distribution of returns to the banker associated with different deposit rates motivates the following proposition:

Proposition 4. *In the presence of deposit insurance, there will be a deposit rate $\tilde{r}_s$ that will be high enough to induce the banker to raise the loan rate to $\hat{\hat{r}}_\ell$ in order to raise the value of the bank's equity by increasing the riskiness of the bank's loan.¹⁶*

¹⁶In algebraic terms Proposition 4 can be expressed as the following inequality:

Even though the expected return on the loan falls with the increase in risk of the project, the increase in the value of the government's guarantee may more than offset that loss, thereby raising the expected value of the banker's second period profits.

3.4 Recapitalization of Banks

If the government is guaranteeing deposits, a high loan rate in this model signals that the banker finds it in his interest to increase the riskiness of the projects that the bank is funding. Accompanying the increase in riskiness of the loan is the real resource cost K spent by the entrepreneur on adding risk to the project. Taking the government guarantee as given, the government has an incentive to prevent the resource loss K by inducing the entrepreneur not to add risk to the project. There are two cases to consider:

Case 1. The government's tax base is large enough that depositors will always be paid the contracted risk-free rate, whether by the bank or by the government.

Since the decision to add risk to the project is partly determined by the bank's lending rate decision and partly determined by the entrepreneur's incentives to add risk, the government must alter the incentives of both the banker and the entrepreneur. With the ability to borrow at the risk-free rate the government can recapitalize the bank by injecting government bonds into the bank's balance sheets.¹⁷ A sufficiently large injection of bonds will lower the banker's probability of default, thereby making it less profitable to add risk to the project, as shown in equation (19):

$$\int_0^{\bar{s}} \left\{ \max \left[\hat{a}(s) - (1 - e - w)\tilde{r}_g, 0 \right] - \max \left[\hat{a}(s) - (1 - e - w)\tilde{r}_g, 0 \right] \right\} f(s) ds > 0$$

¹⁷This bond injection is sometimes accompanied by a transfer to the central bank of an equal face value of the bank's bad assets. The market value of the bad assets is generally close to zero. As a consequence I ignore the transfer of worthless assets to the government when considering the incentive effects of the recapitalization.

$$\hat{q}w \equiv \int_0^{\bar{s}} \left\{ \max \left[\hat{a}(s) + r_g b - (1 - e - w)r_g, 0 \right] \right\} f(s) ds \quad (19)$$

The government bond is to some extent a substitute for the deposit guarantee, although it is not a perfect substitute. As shown in equation (19), the government's bond commitment is not state contingent, whereas the deposit guarantee is state contingent. The deposit guarantee only requires government resources in bad states of the world, whereas the bond commitment requires government resources in all states of the world. This leads to the following proposition:

Proposition 5. *An injection of one unit of bonds onto the balance sheets of the bank will result in a less than one-for-one reduction in the expected value of the government's deposit guarantee.*

Proposition 5 states that a bond injection represents a net transfer of resources to the bank. As long as the government has sufficient tax revenue to borrow at the risk free rate, then it should go ahead and recapitalize the bank (since I am abstracting from any deadweight losses associated with tax collection). In general, however, the government's budget constraint will imply that the rate of return on government debt will not be the risk-free rate, leading to case 2:

Case 2. The government's second period tax base is not large enough to allow the government to borrow at the risk-free rate.

When the government issues bonds that are placed on the asset side of the bank's balance sheet, the action is infra-marginal with respect to depositors' calculation of their expected return on their deposits. Deposits are ultimately backed up by the value of the projects funded by the bank and by the government's tax resources, so that deposit contracts must satisfy equation (11)':

$$\int_0^{\bar{s}} \min \left[(1-e-w)r_g, \hat{a}(s) + T(s) \right] f(s) ds = (1-e-w)r^* \quad (11)'$$

Equation (11)' indicates that an injection of bonds cannot directly affect the deposit rate. The only way a bond injection can lower the deposit rate is by inducing the banker to choose the safer loan $\hat{a}(s)$.

The bond injection *will* affect the bank's marginal decisions since, as in Proposition 5, the bond injection commits the government to a transfer of resources in good times as well as in bad times, unlike the deposit guarantee. The extent to which the bond transfer alters the bank's marginal decisions will depend upon the banker's evaluation of the value of the bonds, as shown in equation (20):

$$B = \int_0^{\bar{s}} \min \left\{ r_g^b, \max [T(s) - V(s), 0] \right\} f(s) ds \quad (20)$$

where r_g^b is the book or par value of the promised gross return on the bonds and $V(s) = \max \left\{ 0, \min \left[(1-e-w)r_g - a_1(s), T(s) \right] \right\}$ is the state-contingent value of the government's deposit guarantee (from equation 13). Equation (20) states that the value of the bonds injected into the bank is ultimately determined by the expected value of the government's tax resources relative to the expected magnitude of its deposit guarantee. When the government has unlimited tax revenue, the bank will value the government bond injection at par, $B = r_g^b$. When the government's tax revenue is expected to be absorbed by the government's deposit guarantee, $T(s) - V(s) \leq 0$, for all s , then the bank will value the government's bonds as worthless, $B = 0$.

With the bond injection the bank's expected second period profits are the following, where the representative banker takes the deposit rate r_g and the state-contingent value of the government's bonds $B(s)$ as exogenous:

$$\hat{q}w \equiv \int_0^{\bar{s}} \left\{ \max \left[\hat{a}(s) + B(s) - (1 - e - w)r_g, 0 \right] \right\} f(s) ds \quad (21)$$

When the government has unlimited tax revenue equation (21) reduces to the special case given in equation (19). If the value of the government bonds is less than par but still sufficiently great to the banker, the bonds will give the banker the incentive to choose the less risky project $\hat{a}(s)$. By the market-clearing condition (11)' the contracted deposit rate will also fall, since depositors will face a lower probability of default by the banks. The bond injection will move the economy to a better equilibrium.

If the government bond injection does not raise the representative bank's net worth sufficiently to cause the banker to lower the real lending rate, then the recapitalization attempt will fail. As long as tax revenue is lump sum, there are no deadweight losses associated with a recapitalization that does not successfully alter bankers' incentives to lower the lending rate. If taxes are *not* lump sum, however, a government that cannot make a recapitalization work should limit itself to the deposit guarantee in order to minimize the deadweight cost of taxation.

3.5 Alternatives to Recapitalization While Maintaining the Deposit Guarantee

If the deposit guarantee cannot be removed, then one remaining avenue for the government is to improve the tax collection distribution function $T(s)$. A larger tax base will lower the interest rate paid on deposits by reducing the probability that second-period tax resources will fall short of revenue commitments, as indicated by equation (11)'. Lowering the deposit rate will raise the bank's net worth in (21). If the increase in the tax base is sufficiently large, the deposit rate will fall enough to induce the banker to charge the lower lending rate $\hat{r}_l$. This motivates the following:

Proposition 6. *When a bond injection fails to reduce high lending rates and the incentive to add risk to projects, a government can indirectly reduce those incentives to add risk by*

enlarging the tax base $T(s)$, thereby raising the credibility of the government's deposit guarantee, lowering the deposit rate demanded by depositors to compensate them for default risk, and raising the bank's net worth.

Proposition 6 suggests that a tax reform that broadens the tax base may help to lower real interest rates by raising the credibility of the deposit guarantee. Another way to think about Proposition 6 is in terms of new investment possibilities that the economy may have, if banks and firms can be induced to undertake the investments. Under plausible assumptions, new investments would create a larger tax base that would raise the credibility of the deposit guarantee. This possibility of encouraging entrepreneurs to undertake new investments in a financially fragile environment was the subject of Brock (1994).

Since the treatment of new growth options parallels the treatment of adding risk to existing projects, I will give a verbal treatment of the problem. Suppose that the banker is charging $\hat{r}_t$ as in Proposition 4, so that the representative entrepreneur is investing in the risky project. Suppose also that there are new investment opportunities that could be financed with debt. If these investment opportunities have a high expected return and a relatively small variance, then a bank that lends money for one of these projects will acquire a relatively safe loan. The expected cash flows from this loan, when combined with the risky cash flows on the initial loan, will lower the bank's portfolio risk. In the process, the value of the government's deposit guarantee to the banker will be lowered. If the government's guarantee is lowered enough, the banker's net worth may actually be lowered by the new loan, since a large part of the banker's net worth previously was the value of the deposit guarantee associated with the risky loan. This possible effect of the new loan on the banker's net worth is the mirror image of adding risk to the portfolio: adding risk may *raise* the bank's net worth while adding a safe loan may *lower* the bank's net worth in the presence of a government deposit guarantee.

This underinvestment problem in new loans, which was first analyzed by Myers (1977), can be partially addressed by the use of junior debt that is secured by the cash flows of the

new projects, as shown by Stultz and Johnson (1985). But that solution may be difficult from a regulatory standpoint, and will not always solve the underinvestment problem, even when new deposits can be explicitly secured by new loans.

An alternative solution is to create new banks that fund new projects, while restricting the lending of old banks. This solution requires the creation of capital for the new banks. When a government has transfer obligations, such as social security payments, one way to create collateralizable net worth is to capitalize the value of the transfer payments in the form of government bonds. This technique was used by the Meiji government in Japan in 1876, when it commuted the *samurai* stipends into government bonds and, at the same time, encouraged the *samurai* to found new banks using the bonds as bank capital.¹⁸ Similarly, Chile moved to a fully-funded pension system in 1981 with the use of government "recognition bonds" that capitalized the value of promised social security payments under the old pay-as-you-go system and that were deposited in the private pension funds. A number of writers, including Diamond and Valdés (1994), have commented on the dominant role of the pension funds in directing new investment in Chile at a time when the major banks were insolvent. In both the Japanese and Chilean cases the securitization of formerly unmarketable assets (pensions linked to human capital) created collateralizable net worth that could be used to set up new financial intermediaries, thereby easing the underinvestment problem associated with the deteriorated balance sheets of banks and firms.

4. High Real Rates and the Unit of Account

Sections 2 and 3 have focused on the determinants of high deposit and loan rate spreads. The role of the unit of account for deposits and loans, which has been implicit in the discussion, will now be addressed explicitly. By unit of account I will mean one of three possibilities: domestic-currency denominated (e.g., peso-denominated) transactions, price-level indexed transactions (such as financial contracts tied to the UF in Chile, UPAC in

¹⁸See Brock (1994) for a discussion of this episode.

Colombia, and UDI in Mexico, all three of which are linked to the consumer price index), and dollar-indexed transactions.

In a world of perfect capital mobility, there are three reasons for high real deposit rates, as noted in Section 2. All three reasons are partially dependent upon the unit of account. The first two reasons are based on no-arbitrage conditions where there is no default risk associated with deposits:

1) Forecast error, where anticipated inflation exceeds realized inflation, perhaps because of an anticipated monetization of the fiscal deficit. The forecast error is especially problematical when the monetary expansion will not, in fact, take place so that high nominal rates become *ex post* high real rates that transfer wealth from borrowers to lenders. A government can insulate the banking system from this problem by introducing units of account (such as the UF and UDI) that are indexed to the price level.

2) Expected depreciation of the real exchange rate due, perhaps, to an anticipated decline in the relative price of nontradables. Such an expected depreciation is often associated with an anticipated decline in nontraded consumption expenditure (as in Calvo and Végh 1993) or investment expenditure (as in Brock 1992a). Indexing deposits to the consumer price index does not take care of real exchange rate risk (since the value of a UF or UDI rises in dollar terms when the real exchange rate appreciates and falls when the real exchange rate depreciates), but by guaranteeing purchasing power over a consumption bundle of traded and nontraded goods, such indexation may be attractive to domestic deposit holders. One can eliminate real exchange rate risk with dollar-denominated deposits. But depositors are still left with the following problem:

3) asset risk/guarantor risk of the type modeled in section 3. With risky assets, a bank may go bankrupt and be unable to pay off deposits. If the government guarantees the deposits, lack of fiscal resources may prevent the government from covering the value of deposits in some states of the world. Dollar-denominated deposits may increase guarantor risk, since the real liability of banks to depositors (in terms of domestic goods) increases when

the real exchange rate depreciates. It is partly for this reason that Ronald McKinnon (1991, p. 105) states that "a large foreign currency component in the domestic financial system has the characteristics of an 'economic time bomb'."¹⁹

As emphasized by the accounting framework of Section 2, high real interest rates on deposits denominated in domestic currency will generally incorporate all three types of risk. For example, high real interest rates on peso-denominated deposits may include an *ex post* forecast error for inflation, expectations of real exchange rate depreciation, and a positive probability of deposit confiscation by the government. With nominally-denominated deposits the confiscation often takes place by the combined use of interest rate ceilings and high inflation to produce real depositor "haircuts", such as happened in the United States in the 1970s with interest rate (Regulation Q) ceilings and in Argentina in 1982 (see Brock 1992b, Chapter 1). With CPI-indexed deposits, the haircuts are more explicit, such as Chile's conversion of savings deposits into government bonds at a real loss of 20 to 40 percent to depositors or Colombia's *ad hoc* 40 percent cumulative under-adjustment of the UPAC between 1972 and 1990 (see Lora and Sánchez 1993).

Without default risk, the loan rate spread (over the domestic deposit rate) is unaffected by forecast errors or expectations of real exchange rate depreciation. Explanations of increases in the loan rate spread must therefore look to other reasons, such as an increase in reserve requirements or an increase in the riskiness of banks' loans. Section 3 demonstrated that guarantor risk, by raising the cost of deposits, may induce banks to lend to riskier projects at higher contracted real interest rates. Actions that reduce guarantor risk are therefore likely to lower the loan rate spread.

One action that may reduce guarantor risk is the appropriate choice of a unit of account for loans. For example, if the value of banks' loans covaries positively with the real exchange rate (perhaps because the value of buildings and land serving as collateral for the loans rises when the real exchange rate appreciates and falls when the real exchange rate depreciates),

¹⁹McKinnon attributes this phrase to Jacob Frenkel.

then CPI-indexed loans and deposits -- whose dollar value also covaries positively with the real exchange rate -- will create less guarantor risk than dollar-denominated loans and deposits. Fontaine (1995) has suggested that financial indexation helped to preserve the stability of the Chilean financial system during the last decade while Lora and Sánchez (1993) have attributed the stability of Colombia's savings and loan system partially to the use of CPI-indexed mortgages and deposits.

5. Conclusion

This paper has been concerned with developing a methodology that may be useful for analyzing episodes of high real interest rates in emerging market economies. The basic premise is that one should begin with accounting identities that decompose the deposit spread and the loan spread into several components. One can measure the relative importance of the components of the spreads to get some idea of the sources of the high real rates. The stylized facts that emerge from the literature review of Section 2 suggest that expected depreciation of the exchange rate and the credit quality of borrowers are among the most important, but not the only, determinants of high real rates. In any given country the relative importance of the determinants must be established.

Section 3 then develops a model that links the loan spread with the deposit spread by assuming that a government guarantee exists on deposits. The guarantee affects both the deposit and the loan spread by altering the marginal incentives of depositors, bank owners, and firms. The model ultimately points to the fact that even though high real rates may signal financial distress and risky lending by banks, standard recapitalization mechanisms pursued by governments may not improve the situation if the government's tax base is not sufficiently large to eliminate guarantor risk (that is, the risk that the government will default on its bonds or its guarantee commitment).

Section 4 emphasizes that the behavior of real interest rates depends on the unit of account that has been chosen for financial transactions. Guarantor risk, in particular, may vary

between financial systems that have only nominal contracts denominated in domestic currency and those that have contracts denominated in dollars or contracts whose nominal value is linked to the consumer price index.

Episodes of high real interest rates often occur when an economy is close to widespread debtor default on privately-contracted loans or to government default on government debt or deposit guarantees. These high real rates are contracted at a time when the financial sector operates within the formal legal rules governing bankruptcy proceedings. Nevertheless it should be clear that expectations regarding the possible departure of the government from the enforcement of standard bankruptcy procedures will matter for the level of real interest rates. Section 3's model tackles some of the issues regarding real interest rate determination in the presence of guarantor risk, but in Section 3 the government's actions are well specified for all states of nature. In practice it is difficult to write contracts that take into account all possible *ad hoc* actions that may be taken by the government in response to an impending debtor default. Uncertainty regarding the nature and incidence of these actions (such as the creation of special bailout packages to favored groups of debtors, the establishment of preferential exchange rates for the repayment of dollar-denominated debts, and the use of inflation to engineer a depositor haircut) increases the uncertainty of deposit and loan contracts beyond the uncertainty connected to the *ability* of the government to pay that is the subject of Section 3. If high real interest rates are a symptom of financial sector distress, as is often the case, then the high real rates will incorporate expectations of a breakdown in the government's enforcement of financial contracts in addition to the factors addressed by this paper.

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Table 1. Loan and Deposit Spreads

		Argentina 1993.3	Uruguay 1992
		(Percentage Points)	
$i_\ell - i_d \equiv$			
	$(i_\ell - i_\ell^{prime})$	15.0	32.8
	$+ (i_\ell^{prime} - i_d)$	0.24	15.5
$i_d - \hat{E} - i^* \equiv$			
	$+ (i_d - \hat{E} - i_d^{\$})$	2.93	10.8
	$+ (i_d^{\$} - i^*)$	4.61	0.0
		<hr/>	<hr/>
$i_\ell - \hat{E} - i^*$		22.8	59.0

Source: Rodríguez (1994)

Table 2. Comparative Real Exchange Rates, 1979-1992

	Colombia	Chile	Indonesia	Thailand	Turkey
1979	99.6	108.1	102.6	104.7	75.4
1980	100.0	100.0	100.0	100.0	100.0
1981	98.6	97.3	98.0	103.2	117.0
1982	95.2	114.3	95.6	105.5	133.0
1983	99.3	141.6	119.0	103.0	142.3
1984	111.8	158.4	124.6	107.5	159.7
1985	126.4	193.8	127.9	119.8	156.0
1986	141.0	189.3	135.6	110.7	145.5
1987	146.7	182.3	163.3	108.4	136.6
1988	146.9	174.7	161.3	106.8	136.2
1989	156.8	176.7	167.1	108.2	130.6
1990	164.9	175.3	160.1	105.2	103.7
1991	159.7	165.4	155.2	99.5	100.1
1992	151.7	151.1	151.1	95.6	97.5

Note: The real exchange rate (e) is the average nominal exchange rate for the year (E) times the U.S. PPI (P^*) divided by the country's CPI (P): $e = EP^*/P$.

Source: International Monetary Fund, *International Financial Statistics Yearbook*. Washington, D.C., 1994

Table 3. Comparative Real Deposit Rates of Interest, 1979-1992

	U.S. T-Bill	Colombia	Chile	Indonesia	Thailand	Turkey
1979	-2.9	6.2	4.7	-9.5	-1.3	-41.8
1980	-0.2	6.0	5.0	-7.9	-1.3	-37.7
1981	8.7	9.0	28.7	-4.4	7.6	-5.4
1982	9.3	13.0	22.4	-4.2	10.0	10.6
1983	7.0	13.4	3.9	-4.6	9.6	3.9
1984	8.9	12.3	2.3	7.8	11.7	3.2
1985	9.6	11.4	4.1	12.1	11.1	6.8
1986	6.3	8.3	1.5	7.3	5.8	2.8
1987	2.6	4.3	3.2	7.5	2.6	-13.6
1988	2.3	5.6	2.0	9.8	3.8	-11.5
1989	3.6	4.6	5.1	8.4	3.9	-5.2
1990	5.4	4.5	9.7	5.7	6.6	-9.5
1991	5.1	6.1	2.8	13.7	5.4	-3.0
1992	2.6	1.0	4.8	10.8	3.1	0.4

Note: The real *ex post* deposit rate (r_d) is measured as follows: $r_d \equiv \frac{1+i_d}{1+\pi} - 1$, where i_d is the nominal deposit rate and π is the inflation rate.

Source: International Monetary Fund, *International Financial Statistics Yearbook*.
Washington, D.C., 1994

Table 4. Cost of Deposits at Texas Thrifts
(First Quarter 1988)

	Total Capital (GAAP, Billion \$)	Average Capital Ratio (%)	Average Cost of Deposits (%)	Premium
Texas Thrifts	-11.2	-11.2	7.70	0.74
Texas Thrifts by Capital Groupings ¹				
1	0.8	8.0	7.29	0.33
2	0.8	2.5	7.50	0.54
3	-1.7	-5.5	7.73	0.77
4	-11.1	-50.3	8.28	1.32
Other U.S. Thrifts	42.8	3.7	6.96	--

¹The Texas thrifts are divided into 4 groups on the basis of their individual capital (GAAP) ratios.

Source: Federal Home Loan Bank Board Thrift Financial Report as reported by Short and Gunther (1989)

Table 5. The Loan Spread and Inflation Tax Revenue in Chile: 1975-1980

	Gross Spread Between Deposit and Lending Rate (percentage points)	Cost of Holding Required Reserves (percentage points)	Spread Not Accounted for by Required Reserves (percentage points)
	(1)	(2)	(3)=(2)-(1)
1975	91.0 ¹	91.0 ¹	0.0 ¹
1976	57.1	45.7	11.4
1977	34.6	14.8	19.8
1978	14.5	3.4	10.9
1979	12.0	4.4	7.6
1980	7.0	1.8	5.2

Inflation Tax Revenue as a Percentage of GDP				
	Inflation Tax Revenue from Currency (10)*(12)	Inflation Tax Revenue from Demand Deposits (8)*(10)*(13)	Inflation Tax Revenue from Time Deposits [(10)-(11)]*(9)*(14)	Total Inflation Tax Revenue (4)+(5)+(6)
	(4)	(5)	(6)	(7)
1975	4.05 ¹	3.97 ¹	0.67 ¹	8.7 ¹
1976	3.05	3.27	0.66	7.0
1977	1.97	1.65	0.32	3.9
1978	1.47	0.74	0.09	2.3
1979	1.08	0.44	0.22	1.7
1980	0.93	0.19	0.17	1.3

	Reserve Requirement for Demand Deposits (percent)	Reserve Requirement for Time Deposits (percent)	30 Day Nominal Interest Rate (percent)	Interest Rate Paid on Time Deposit Reserves (percent)	Currency ÷ GDP (percent)	Demand Deposits ÷ GDP (percent)	Time Deposits ÷ GDP (percent)
	(8)	(9)	(10)	(11)	(12)	(13)	(14)
1975	80 ¹	82 ¹	234 ¹	195 ¹	1.73	2.12	2.09
1976	83	58	198	166	1.54	1.99	3.54
1977	70	36	100	85	1.97	2.35	5.88
1978	47	20	64	58	2.30	2.47	1.26
1979	42	15	46	30	2.34	2.27	9.08
1980	16	4	39	0	2.38	3.08	10.60

¹These figures are annualized based on August-December (post-liberalization) information.

Source: Columns (1)-(3) and (8)-(11) were obtained from Banco Central de Chile, *Indicadores Económicos y Sociales 1960-1988*, Santiago, Chile, 1989. Columns (12) - (14) were taken from International Monetary Fund, *International Financial Statistics*.

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