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## Inside the Crisis: An Empirical Analysis of Banking Systems in Distress

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and Poonam Gupta*

**IMF Working Paper**

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**Inside the Crisis: An Empirical Analysis of Banking System in Distress**

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**Abstract**

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Using aggregate and bank level data for several countries, the paper studies what happens to the banking system in the aftermath of a banking crisis. Contemporary crises are not accompanied by declines in aggregate bank deposits, and credit does not fall relative to output, although the growth of both deposits and credit slows down substantially. Output recovery begins in the second year after the crisis and is not led by a resumption in credit growth. Banks, including the stronger ones, reallocate their asset portfolio away from loans.

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## I. INTRODUCTION

With the proliferation of banking problems around the world, in the last few years the empirical literature on systemic banking crises has grown substantially. This literature has mostly focussed on the factors associated with the onset of distress to identify the determinants of the crises or to look for “early warning indicators” of trouble.<sup>2</sup> In this paper, we shift attention to what happens to the economy and to the banking sector *after* a banking crisis breaks out. The evidence comes from both macroeconomic and bank level data. The macroeconomic sample includes 36 banking crises over the period 1980-95, while the bank-level data covers 16 crisis episodes during 1991-98.

While our main goal is to characterize the “stylized facts” of the postcrisis period, the analysis of the empirical evidence is centered on a few key issues: first, much of the theory of banking crises assigns a central role to depositor runs, and vulnerability to runs is viewed as a basic characteristics of banks as financial intermediaries.<sup>3</sup> However, systemic banking crises in which large segments of the banking system become financially distressed may occur even when depositors do not withdraw their deposits, if it is other bank creditors who “rush for the exit,” or if banks simply become insolvent. So the first question that we take up is whether contemporary banking crises are characterized by large declines in deposits.

The recent banking crises in Mexico and East Asia were accompanied by a strong but short-lived downturn in output; in both cases, the speed of the recovery has been attributed to the expansionary effects of the sharp real exchange rate depreciation associated with the crisis.<sup>4</sup> The second question that we examine is whether this pattern is typical of banking crises in general, or if it is a special feature of these recent cases. This is an important question in designing postcrisis macroeconomic policies. A third issue is to what extent the behavior of output is driven by that of aggregate bank credit. If the crisis forces banks to cut lending, and if the resulting “credit crunch” is important in the propagation of the crisis, then restoring the flow of credit should be a priority for policy-makers in the immediate aftermath

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<sup>2</sup> Among the first studies are Demirgüç-Kunt and Detragiache (1998) and Eichengreen and Rose (1998); among the second, Hardy and Pazarbaşıoğlu (1999), Kaminsky and Reinhart (1999) and Demirgüç-Kunt and Detragiache (2000).

<sup>3</sup> For theoretical models of bank runs see, among others, Diamond and Dybvig (1983), Chari and Jagannathan (1988), and Allen and Gale (1998). For a review of the literature, see Bhattacharya and Thakor (1988).

<sup>4</sup> On Mexico, see for instance Krueger and Tornell (1999). On the Asian crises see Lane et al. (1999).

of banking crises.<sup>5</sup> Finally, using bank level data, we study how profitability, capitalization, liquidity, asset and liability structure, and cost-efficiency change following a systemic crisis.

To identify the stylized facts of the postcrisis period, we test whether the variable of interest in each of the years immediately following a crisis is significantly different from the mean of the precrisis period. Thus, the exercise provides information as to which variables appear to be significantly affected by the occurrence of the crisis, but also as to how the response changes while the crisis unfolds. Besides looking at average behavior, we also try to identify differences in “aftermath behavior” among groups of countries and banks.

The paper is organized as follows: the next section discusses sample selection and methodology. The evidence from the aggregate data is in Section III. Section IV discusses foreign exchange valuation effects, while Section V discusses differences across groups of countries. The analysis of bank level data is in Section VI, while Section VII concludes.

## II. SAMPLE SELECTION AND METHODOLOGY

We define a banking crisis as a period in which significant segments of the banking system become illiquid or insolvent. To identify such episodes, we look at evidence of large scale bank failures, at the enactment of emergency measures by the government (deposit freezes, nationalizations, deposit guarantees, bank recapitalization plans), at whether there were reports of significant depositor runs, at the level of nonperforming loans at the peak of the crisis, and at the costs of the bailout. The baseline sample for the present study includes 36 banking crises in 35 countries (see Appendix I for details). For each variable of interest, a panel of observations is formed by pooling the 36 time series consisting of the three years before the crisis, the crisis year, and the three years following the crisis. For some variables, the panel may exclude one or more countries because of lack of data or because of outliers.

To characterize the stylized facts of the postcrisis period, we examine whether in the crisis year and in each of the three aftermath periods the variable in question took on values significantly different from the average of the three years preceding the crisis. To this end, we regress each variable on four time dummies, one for the year of the crisis, and one each for the three periods following the crisis. To control for heterogeneity across countries, country dummies are also introduced in the regression. The OLS estimate of the coefficient of the period  $t$  dummy is the mean difference between the value of the variable in period  $t$  and the average of the precrisis period. Comparing the coefficients of the period dummies

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<sup>5</sup> Bernanke (1983) argued that the contraction in credit brought about by the banking crisis was instrumental in the propagation of the Great Depression in the United States. Recent attempts to test for a credit crunch effect in East Asia include Ding, Domaç, and Ferri (1998), Ghosh and Ghosh (1999), and Borensztein and Lee (2000).

also allows us to trace the dynamic evolution of the variable over the postcrisis period. Because of heterogeneity across countries, we use heteroskedasticity-consistent standard errors to do hypothesis testing.

### **III. EVIDENCE FROM AGGREGATE DATA**

#### **A. The Behavior of Bank Deposits**

The rate of growth in real demand deposits falls significantly in the crisis year, but it recovers in the following year (Table 1). Furthermore, deposits as a share of output do not decline significantly. Total real deposits, which include time deposits as well as deposits denominated in foreign currency, are larger than in the precrisis period. In Section IV below we examine in more detail to what extent this reflects valuation effects of foreign currency deposits. Of course, this evidence is consistent with runs affecting some banks, as long as deposits are reinvested elsewhere in the banking system.<sup>6</sup> Also, short-lived runs, as in Argentina in 1995, may not be captured by annual data.

These findings suggest that, in contrast with the historical experience, which has inspired much of the theoretical literature, depositor panics have not been a major element of contemporary banking crises. But why is it that depositors do not run when many banks are insolvent? It may be that even in the most severe crises a segment of the banking system remains safe, and depositors flee to those banks. Another hypothesis is that depositors are protected through a generous safety net, including explicit deposit insurance, “lender of last resort” facilities, ex post guarantees of deposits, and prompt government rescues of troubled institutions.

#### **B. Output, Investment, and Bank Credit**

The banking crisis is accompanied by a sharp decline in output growth, of the order of 4 percentage points (Table 1). Growth remains depressed in the year following the crisis, but returns to its precrisis level thereafter. The ratio of investment to GDP is below its precrisis level in all the periods, but significantly so only in T+1. Thus, while financial distress wreaks havoc in the banking system and it often takes many years to clear up the mess, the effects on the real economy, albeit large, seem to be short-lived. This is consistent with the observed “U-shaped” output recovery following the Mexican 1995 crisis and the 1997 Asian crises.

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<sup>6</sup> Aggregate deposits did not decline during the recent Asian crises, while depositors switched from small to large banks and from domestic to foreign banks (Domaç and Ferri (1999), and Lindgren et al. (1999)). The Asian crises are not included in our macro sample.

Table 1. Crisis Aftermath—Evidence from Aggregate Data

	T	T+1	T+2	T+3
GDP Growth	-3.913*** (1.004)	-3.519*** (0.896)	-0.950 (0.662)	0.398 (0.829)
Credit Growth	-6.761*** (2.261)	-7.390*** (2.311)	-7.178*** (2.199)	-5.687** (2.334)
Credit/GDP	6.046*** (1.705)	7.849*** (2.675)	6.748*** (2.062)	5.646** (2.180)
Investment/GDP	-0.428 (0.551)	-1.067** (0.564)	-0.724 (0.621)	-0.854 (0.698)
Demand Deposit Growth	-5.798*** (2.0192)	-2.397 (1.7612)	-3.676 (2.814)	-4.280 (2.608)
Demand Deposits/GDP	0.286 (0.336)	0.333 (0.398)	0.734 (0.466)	0.878* (0.509)
Total Deposits/GDP	2.920** (1.382)	5.554*** (1.881)	5.177*** (1.292)	0.233*** (1.451)
Real Interest Rate	5.501 (6.768)	6.918 (11.525)	-7.239 (8.279)	-3.078 (4.548)
Real Lending Rate	10.504** (4.685)	21.312 (17.007)	16.249 (10.043)	3.827 (5.685)
Real Deposit Rate	1.806 (2.036)	0.827 (3.359)	-3.291 (3.686)	-4.903 (4.023)
Spread	10.079** (4.899)	22.332 (15.696)	21.016 (13.483)	10.906** (4.899)
Inflation	19.166** (6.816)	27.785** (13.408)	23.820** (10.449)	18.177*** (5.830)
Depreciation	28.714*** (8.274)	36.968** (14.415)	30.384*** (11.121)	23.232*** (6.707)
Fiscal Surplus/GDP	-0.494 (0.594)	-0.803 (0.512)	-0.041 (0.713)	0.974 (1.015)
Central Bank Funds/ Bank Assets	0.844 (1.565)	1.233 (0.999)	1.410 (1.610)	2.071 (2.368)

\*, \*\*and \*\*\* indicate significance levels of 10, 5, and 1 percent respectively. White's heteroskedasticity-consistent standard errors are given in parenthesis.

The observed decline in output and investment growth may be as much the consequence of the adverse shocks that contributed to the banking crisis as the effect of the crisis itself. Disentangling causality in this context is an impervious task. However, if bank distress contributes significantly to the downturn, credit to the private sector should decline along with output. In fact, while the growth of real bank credit is below its precrisis level beginning in the crisis year, credit as a share of GDP remains significantly *above* precrisis levels for the entire aftermath period. Thus, credit slows down, but less so than output. Moreover, in about half of the sample credit growth was still *positive* in  $t$  and  $t+1$ . On the other hand, in the second and third year following the crisis, when output growth returns to its precrisis levels, credit growth remains depressed. So the recovery does not seem to be driven by a resumption in bank lending.

This evidence casts doubts about the credit crunch hypothesis, according to which the lack of bank credit significantly contributes to output decline following a banking crisis and the resumption of bank lending is a necessary condition for output recovery. What may be happening, instead, is that, once the macroeconomic outlook improves, firms are able to “economize” on bank credit by switching to other sources of funding, such as suppliers’ credit, internal financing, foreign credit lines, equity, or bonds. This behavior was observed in Mexico following the 1995 crisis (Krueger and Tornell (1999)).

Unfortunately, the interpretation of the evidence is complicated by the fact that the change in the stock of real credit is a poor measure of the aggregate amount of funds available to bank borrowers, particularly during a crisis. An increase in credit may reflect the capitalization of interest payments to avoid open defaults. Also, where a sizable portion of credit is in foreign currency, there may be a revaluation effect due to a real exchange rate depreciation. In Section IV below we assess the relevance of this particular source of bias. Other factors may lead to underestimate the volume of credit following a crisis, such as the transfer of impaired loans to special institutions outside the banking system (for instance, asset management companies). Also, when loans are set in nominal terms, inflation reduces the value of real bank debt outstanding.

### C. Interest Rates

The first interest rate in Table 1 is a “policy” interest rate, i.e. the rate on short-term government securities where available, and a central bank rate otherwise. The real rate is obtained by subtracting inflation. This interest rate is higher in the year of the crisis and in the following year and lower thereafter, but these differences are not significant due to large standard errors. Deposit interest rates change little from precrisis levels, so there is no evidence that banks have to pay higher real rates to attract depositors. This reinforces the view that depositor safety nets were strong. Interestingly, both the real lending interest rate and the spread rise significantly in the crisis year, possibly reflecting an increase in default risk premiums.

#### **D. Inflation, the Exchange Rate, and the Government Balance**

Banking crises are accompanied by a substantial increase in inflation that peaks in the year after the crisis at almost 28 percentage points above the precrisis level, and persists throughout the aftermath period. The increase in the rate of depreciation of the exchange rate is even more marked than that of inflation, even if only eight countries in the sample had a full blown currency crisis in the year of the banking crisis.<sup>7</sup> The loss of monetary control, however, does not seem to be driven by central bank lending to the banking system, as central bank credit does not significantly increase as a share of bank assets in the sample countries.<sup>8</sup> Finally, there is no systematic decline in the government surplus in the aftermath period, despite the large fiscal costs of banking crises documented in the literature (Caprio and Klingebiel (1996)). This may be because the fiscal impact of the rescues is spread over a long period of time, or because other expenses are cut or revenues raised to make room for bank bailout costs. Another plausible hypothesis is that bailout costs are kept off budget.<sup>9</sup>

#### **IV. CORRECTING FOR EXCHANGE RATE VALUATION EFFECTS**

Since banking crises are often accompanied by a large exchange rate depreciation, valuation effects may play an important role in shaping the movements of bank credit and total deposits in countries in which a sizable portion of these claims is denominated in foreign currency. Careful measurement of these valuation effects requires much country-specific information that is not available in cross-country databases and it is beyond the scope of this paper. Nonetheless, to get a better sense of the magnitude of this phenomenon, we have searched central bank bulletins and other miscellaneous data sources for information on the size of foreign currency deposits and credit for the episodes in our sample.

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<sup>7</sup> The exchange rate depreciation also results in a sharp and persistent increase in bank foreign liabilities as a share of assets, of the order of over 20 percentage points.

<sup>8</sup> The central bank may play an active role in providing liquidity to the system by injecting liquidity in some banks and withdrawing it from others.

<sup>9</sup> Kharas and Mishra (2000) find that large off-budget liabilities in developing countries are attributable to realized contingent liabilities following financial crises.

Information on credit was obtained for 20 episodes and information on deposit for 23 episodes.<sup>10</sup> These data allowed us to correct real credit and deposits for exchange rate valuation effects as follows: for the crisis year and the aftermath years, a “corrected” measure of real credit (deposits) is computed as the sum of two terms, the domestic currency component divided by the domestic price index, and the foreign currency component multiplied by the real exchange rate prevailing *in the year before the crisis*. The real exchange rate is defined as the nominal rate (vis-à-vis the U.S. dollar) divided by the price index. For the years before the crisis the “corrected” measures are equal to the standard ones. Thus, the corrected variables measure the foreign currency component of total real credit and deposits as if the real exchange rate had remained at its precrisis level.

The new variables were used to rerun the regressions for the rates of growth of real credit and deposits and for the ratios of each variable to GDP. The results are reported in Table 2. Perhaps surprisingly, the coefficient estimates and standard errors are not much different whether valuation effects are eliminated or not, although for some individual countries these effects are not trivial. Both using the corrected and noncorrected measures, credit growth declines substantially in the crisis year, and remains depressed through the third year after the crisis; credit, however, increases as a share of GDP as compared to the precrisis period. This is exactly what happens in the baseline sample. As for deposits, the ratio of total deposits to GDP increases in the aftermath years relative to the precrisis period even after correcting for valuation effects, further confirming that depositor runs had limited aggregate impact.

## V. DIFFERENCES AMONG GROUPS OF COUNTRIES

To test whether the crisis response differs across countries with different characteristics, we add to the regressions an interaction term between each of the period dummies and the country characteristic of interest. A positive and significant sign for the interaction term indicates that the difference between the value of the variable in the period of interest and the precrisis period is larger for countries with a high value of the characteristic. Tables 3-5 summarize the results. For brevity, only the variables for which at least one of the interaction terms has a significant coefficient are reported.

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<sup>10</sup> The episodes for which both foreign currency credit and deposit data are available are: Argentina (1995), Bolivia (1995), Chile (1980), Ecuador (1995), Finland (1991), Indonesia (1992), India (1991), Israel (1983), Italy (1990), Japan (1992), Panama (1988), Papua New Guinea (1989), Paraguay (1995), Peru (1993), Sweden (1990), United States (1981), Uruguay (1981), Venezuela (1993). In addition, information on deposits only is available for Thailand (1983), Nigeria (1991), Portugal (1986), El Salvador (1989), and Turkey (1991), and for credit only for Mexico (1982) and Norway (1987).

Table 2. Real Credit and Deposit Corrected for Exchange Rate Effects

	T	T+1	T+2	T+3
Real Credit Growth	-7.971** (3.961)	-9.430** (3.872)	-13.532*** (3.961)	-14.931*** (3.960)
Corrected Real Credit Growth	-8.031** (3.759)	-12.887*** (3.675)	-14.075*** (3.675)	-14.753*** (3.759)
Credit/GDP	4.117*** (1.651)	4.677*** (1.588)	3.791** (1.589)	1.584 (1.824)
Corrected Credit/GDP	4.122** (1.725)	4.780*** (1.659)	4.093** (1.659)	2.109 (1.907)
Real Deposit Growth	-8.930 (8.071)	-4.885 (8.030)	-12.121 (8.030)	-12.201 (8.356)
Corrected Real Deposits Growth	-11.076 (7.977)	-7.700 (7.937)	-11.488 (7.937)	-12.305 (8.260)
Deposits/GDP	4.117*** (1.651)	4.677*** (1.588)	3.791** (1.588)	1.584 (1.824)
Corrected Deposits/GDP	4.123** (1.725)	4.780*** (1.659)	4.093** (1.659)	2.109 (1.907)

\*, \*\*and \*\*\* indicate significance levels of 10, 5, and 1 percent respectively. White's heteroskedasticity-consistent standard errors are given in parenthesis.

The first characteristic is the level of development measured by GDP per capita. In more developed countries the slowdown in growth and investment is more persistent, in contrast with the commonly voiced view that developing country financial crises are more severe (Table 3).<sup>11</sup> Credit growth decelerates more markedly in countries with higher GDP per capita, but not quite as fast as GDP growth, so bank credit as a share of GDP tends to be higher relative to the precrisis period in those countries. Bank deposits tend to fall at the lower levels of development but not at the higher, suggesting that the depositor safety net is not as extensive or effective in poorer developing countries. Interestingly, a worse safety net does not lead to worse output performance. Government finances seem to deteriorate more the higher the level of development, perhaps because of the higher costs of the safety net.

A second issue is whether the presence of explicit deposit insurance makes any difference in the response to crises, given that depositors are often bailed out in systemic crises even if they have no explicit protection.<sup>12</sup> Table 4 shows that demand deposits fall significantly in countries without deposit insurance, suggesting that deposit insurance does matter. However, total deposits exhibit the opposite pattern, indicating that, when they are not insured, depositors shift to time deposits or to foreign currency deposits. Perhaps because total deposits do not fall, bank credit-to-GDP remains above its precrisis level also in countries without deposit insurance. Another interesting question is whether deposit insurance makes crises less costly, perhaps because it makes the resolution more orderly. If the cost of a crisis is measured in terms of output growth, then the answer is negative, as output growth remains below its precrisis level also in T+3 in deposit insurance countries.<sup>13</sup>

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<sup>11</sup> Gupta, Mishra, and Sahay (2000) find also currency crises to be more recessionary in more developed countries.

<sup>12</sup> Demirgüç-Kunt and Detragiache (1999) find that explicit deposit insurance makes banking crisis more likely, suggesting that a formal guarantee does play an important role.

<sup>13</sup> Of course, we are not controlling for the severity of the shocks that cause the initial output decline. In countries without deposit insurance output may recover faster because the initial shock was small, as without deposit insurance even small shocks could give rise to depositor panics. However, Demirgüç-Kunt and Detragiache (1999) find that, for given level of macroeconomic shocks, countries without deposit insurance are *less* likely to experience crises.

Table 3. Difference among Countries Based on Level of Development

	T	T*DEV	T+1	T+1xDEV	T2	T+2xDEV	T+3	T+3xDEV
Growth	-3.913** (1.225)	0.000 (0.083)	-2.461** (1.171)	-0.191 (0.108)	0.285 (0.829)	-0.229*** (0.055)	2.065* (1.149)	-0.220** (0.085)
Investment	-0.389 (0.713)	-0.048 (0.079)	-0.792 (0.739)	-0.131 (0.085)	-0.027 (0.767)	-0.279*** (0.089)	-0.044 (0.881)	-0.362*** (0.073)
Growth of Real Bank Credit	-4.583 (2.908)	-0.358 (0.218)	-3.939 (2.883)	-0.802*** (0.204)	-4.100** (2.907)	-0.876*** (0.243)	1.233 (2.760)	-1.376** (0.255)
Bank Credit/GDP	0.893 (1.079)	0.338** (0.127)	2.890 (1.951)	0.276* (0.145)	1.325 (1.217)	0.288** (0.134)	-1.178 (1.564)	0.285 (0.177)
Demand Deposit/ GDP	-0.935*** (0.245)	0.369** (0.103)	-1.111*** (0.275)	0.455*** (0.109)	-0.777** (0.346)	0.476*** (0.124)	-0.951*** (0.325)	0.549* (0.112)
Fiscal Surplus/ GDP	0.162 (0.712)	-0.113 (0.077)	0.366 (0.592)	-0.218** (0.088)	1.419 (0.810)	-0.288** (0.103)	3.181*** (0.978)	0.454*** (0.169)

\*, \*\*, and \*\*\* indicate significant levels of 10, 5, and 1 percent respectively. White's heteroskedasticity-consistent standard errors are given in parenthesis.

Table 4. Differences between Countries With and Without Deposit Insurance

	T	TxDI	T+1	T+1xDI	T+2	T+2xDI	T+3	T+3xDI
Growth	-3.533** (1.498)	-1.031 (1.760)	-2.988** (1.239)	-1.459 (1.693)	-0.567 (0.910)	-1.061 (1.213)	1.771 (1.043)	-3.872** (1.552)
Bank Credit/GDP	-7.039** (2.514)	-2.745 (2.887)	9.773** (4.022)	-5.206 (4.283)	8.479** (3.091)	-4.619 (3.306)	7.791** (3.306)	-5.989* (3.525)
Demand Deposit/ GDP	-0.526** (0.214)	2.152** (0.764)	-0.887*** (0.218)	3.284*** (0.912)	-0.262 (0.333)	2.683** (1.090)	-0.526*** (0.269)	3.293*** (1.263)
Total Deposits/ GDP	4.286** (1.818)	-3.634** (1.806)	7.885** (2.891)	-6.275** (2.936)	7.059*** (1.911)	-5.066** (2.091)	5.741** (2.066)	-4.134** (2.502)

\*, \*\*and \*\*\* indicate significance levels of 10, 5, and 1 percent respectively. White's heteroskedasticity-consistent standard errors are given in parentheses.

Next, we differentiate among crisis episodes based on whether banking sector problems were accompanied by a currency crisis.<sup>14</sup> There are eight episodes in which a currency crisis occurred in the same year as the banking crisis. Interestingly, while it is these eight cases that cause the increase in the average rate of exchange rate depreciation reported in Table 1, the output response does not significantly differ between the two groups of countries (Table 5). This suggests—among other things—that output recovery following a banking crisis is not just the effect of an expansionary real exchange rate depreciation, but is a more general phenomenon. There is no indication that the real interest rate behaved any different in the two groups of countries, but the bank lending rate was lower in currency crisis countries in T and T+1, and so was the spread in T and T+3.

Table 5. Differences between Countries With and Without Currency Crisis

	T	TxCC	T+1	T+1xCC	T+2	T+2xCC	T+3	T+3xCC
Depreciation	-7.362** (3.718)	49.017 (14.221)	11.457 (9.923)	15.382 (15.116)	10.874 (7.070)	-7.953 (8.858)	2.262 (9.134)	-2.138 (11.095)
Investment/GDP	-0.329 (0.636)	-0.329 (1.174)	-1.659** (0.620)	3.057** (1.264)	-1.089 (0.733)	1.883 (1.141)	-1.293 (0.727)	2.540 (2.112)
Real Lending Rates	13.161** (5.421)	-14.632** (6.607)	28.642 (21.369)	-34.272** (7.026)	19.771 (12.490)	-18.559 (12.853)	3.592 (6.706)	-2.419 (7.253)
Spread	11.813** (5.547)	-12.734* (5.750)	25.881 (18.727)	-22.863 (18.853)	24.883 (16.453)	-22.453 (16.495)	11.913** (5.405)	-98.641* (5.544)
Total Deposits/ GDP	3.180** (1.523)	-1.028 (1.734)	6.964** (2.464)	5.481** (2.713)	5.431*** (1.517)	-0.986 (2.876)	4.507** (1.875)	-1.050 (2.183)

\*, \*\*and \*\*\* indicate significance levels of 10, 5, and 1 percent respectively. White's heteroskedasticity-consistent standard errors are given in parentheses.

<sup>14</sup> The definition of a currency crisis follows Milesi-Ferretti and Razin (1998). The occurrence of "twin crises" has received much attention in the recent literature (Kaminsky and Reinhart (1999), Goldfajn and Valdes (1998)).

## **VI. EVIDENCE FROM BANK-LEVEL DATA**

### **A. Data Sources and Sample Selection**

To build a panel of bank-level data, we use the 1999 and 2000 releases of the Bankscope database compiled by Fitch IBCA. Countries include all OECD countries and several developing and transition economies, but the time series extends back only to 1991, so all of the crisis episodes of the eighties have to be excluded from the sample. To preserve sample size, we restrict attention to a five-year period centered around the crisis year rather than the seven-year period used in the macro analysis.<sup>15</sup> The resulting sample includes 16 banking crises (listed in Appendix I) all occurring in developing countries or transition economies. Four of the crises (Croatia, Latvia, Paraguay, and Costa Rica) are not in the macro sample because some of the macro series are missing.

Bankscope surveys most of the world's largest banks and coverage is supposed to reach 80-90 percent of bank assets in each country. For the countries in our sample, Bankscope includes 595 banks, but complete five years series are available for only 257 institutions. Mergers and acquisitions that do not lead to a name change for the bank are not explicitly identified in the database. We found specific history information for 35 percent of the banks in the sample, either from Bankscope or from other sources. When a merger or acquisition was identified, if we had information for both banks involved we treated them as one bank from the beginning of the sample period. Otherwise, the bank was dropped. This reduced the sample size to 247. Coverage in terms of total bank assets, though uneven across countries, remains quite good (see Table 10 in Appendix I for detailed coverage information).

The data set contains a number of outliers, some of which were obvious data mistakes. Rather than eliminating extreme observation in an arbitrary way, we excluded observations outside a four standard deviation interval around the mean, and explicitly report the few cases in which the exclusion of outliers significantly changes the results.<sup>16</sup> Of course, the sample is affected by survivorship bias, as banks that fail during the period drop out from the sample. An upper bound to the fraction of banks that failed is 10.7 percent, namely the percentage of banks in the Bankscope database that stopped reporting data in the year of the crisis or in the two subsequent years.

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<sup>15</sup> We include banks from Malaysia though we have data only through the first aftermath year (1998), because coverage for this country is quite good and the Asian episodes are of particular interest. Excluding Malaysia does not significantly alter the picture.

<sup>16</sup> Excluding outliers should alleviate the impact of unidentified mergers or acquisitions on variables such as credit and deposits growth.

## B. Estimation Results

The first bank characteristic examined is performance, measured by gross and net return on average assets (see Appendix II for details). Bank performance worsens in the year of the crisis, and more markedly so in the first postcrisis year, while in T+2 the difference is no longer significant (Table 6). Nonperforming loans and loan loss reserves rise substantially in the crisis year, while by T+2 they are back to their precrisis level, probably because at that stage banks begin writing off bad assets. Thus, banking crises are accompanied by a decline in bank profitability and asset quality.<sup>17</sup> Liquidity (measured by cash over assets) also declines, and so do operating costs and the interest margin. Thus, financial difficulties seem to force banks to improve efficiency.

Turning to deposits, the rate of growth of real deposits falls significantly below that of the precrisis period in the first year after the crisis. However, because growth rates were high before the crisis, deposits are still increasing in absolute terms in 57 percent of the sample banks.<sup>18</sup> In fact, the sample banks lose other sources of funding (such as interbank credit, foreign loans, commercial paper, or equity) more rapidly than deposits, as witnessed by the significant increase in the ratio of deposits to assets. These results are probably affected by survivorship bias, since healthier banks may have attracted deposits from weaker banks or from weak nonbank institutions. Nonetheless, because the banks in the sample represent a sizable portion of the banking system, this evidence supports the view that extensive depositor runs are not a major cause of bank distress.

On the asset side, the rate of growth of total assets (in real terms) is not significantly different from its precrisis level in T and T+1, while in T+2 it is above that level. In contrast, real credit slows down substantially beginning in the crisis year, with the growth rate declining by nine percentage points in both T and T+1. As in the case of deposits, because of the high rates of growth before the crisis, in both periods real credit was still growing in absolute terms in a majority of the sample banks. Also, by T+2 credit growth recovered strongly, so, in contrast with the evidence from the macro data, the credit contraction here seems to be short-lived. Differences in sample or survivorship bias may account for these differences. Also, the averages examined here are not weighted by the size of the bank, so they do not tell much about aggregate behavior.

Another interesting regularity is that banks reallocate funds away from loans, as witnessed by the significant decline in the loan-to-asset ratio in T and T+1 and by the increase in the ratio of other earning assets to total assets in T+1, a phenomenon also

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<sup>17</sup> If outliers are included in the sample the loan loss variables lose significance.

<sup>18</sup> If outliers are included deposit growth is not significantly different from the precrisis period.

Table 6. Crisis Aftermath—Evidence from Bank Level Data

	T	T+1	T+2
Return on Average Asset	-0.0054** (0.0025)	-0.0072*** (0.0022)	-0.0019 (0.0025)
Profitability	-0.0062** (0.0027)	-0.0077*** (0.0025)	-0.0013 (0.0024)
Interest Margin	0.0006 (0.0034)	-0.0076*** (0.0030)	-0.0102*** (0.0031)
Overhead	-0.0010 (0.0020)	-0.0052*** (0.0017)	-0.0105*** (0.0019)
Loan Loss Provisions	0.0157*** (0.0050)	0.0115*** (0.0041)	-0.0036 (0.0039)
Loan Loss Reserves	0.0217*** (0.0085)	0.0259*** (0.0093)	0.0049 0.0100
Cash/Assets	-0.0026 (0.0028)	-0.0076*** (0.0026)	-0.0075*** (0.0027)
Deposits/Assets	0.0144* (0.0081)	0.0161* (0.0086)	0.0228*** (0.0082)
Equity/Assets	-0.0047 (0.0050)	-0.0062 (0.0054)	-0.0112** (0.0050)
Loan/Assets	-0.0247** (0.0103)	-0.0390*** (0.0106)	-0.0121 (0.0113)
Other Earning Assets/ Assets	0.0167 (0.0108)	0.0359*** (0.0111)	0.0196* (0.0119)
Growth of Real Assets	0.0273 (0.0258)	-0.0054 (0.0255)	0.0859*** (0.0255)
Growth of Real Loans	-0.1061*** (0.0311)	-0.0759** (0.0331)	0.1107*** (0.0352)
Growth of Real Deposits	-0.0404 (0.0320)	-0.0651** (0.0335)	0.0090 (0.0319)

\*, \*\*and \*\*\* indicate significance levels of 10, 5, and 1 percent respectively. White's heteroskedasticity-consistent standard errors are given in parenthesis.

identified by case studies.<sup>19</sup> This portfolio shift may reflect a contraction in loan demand which, in turn, may be caused by higher lending interest rates or by the adverse shocks that accompany the crisis. Another possibility is that banks cut collateral-based lending because of lower asset prices (Kiyotaki and Moore (1997)). In times of stress banks may also shift to safer assets to economize on regulatory capital (the “capital crunch”). A fourth possibility is that the shift reflects rescue operations in which banks exchange nonperforming loans for government securities. Whatever the explanation, this evidence suggests that protecting bank deposits during a crisis may not be sufficient to preserve the flow of credit, as banks tend to redirect funds away from lending. The reduction in bank lending activity may also help explain the reduction in overhead costs.<sup>20</sup>

### C. Differences Among Banks

The results described so far reflect the average behavior of banks, but the effects of the crisis may not be uniform across the banking sector. To identify differences across types of bank, the regressions of the preceding section are reestimated after dividing the banks in five subsamples based on profitability in the year of the crisis. Accordingly, the first subsample includes banks that, in each country, belonged to the lowest quintile of the distribution of the return on assets, and similarly for the other subsamples. The results are summarized in Table 7. For brevity, the table reports only the signs and significance levels of the coefficients.

The first observation is that the negative effects of the crisis on profitability are concentrated in the bottom two quintiles of banks, which also experience a marked increase in loan loss reserves and provisions in T and T+1 and a decline in equity over assets. Interestingly, deposits become a more important source of funding for these institutions, while there is some evidence that loans tend to decline relative to assets while other earning

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<sup>19</sup> Beginning in the second quarter of 1996 Mexican banks used positive deposit inflows to purchase government securities (and to increase provisioning), Luzio-Antezana (1999). Argentine banks increased their investment in government securities after the 1995 crisis over and above what was mandated by increased liquidity requirements, Catao (1997). Domaç and Ferri (1999) document a similar phenomenon in Korea, Malaysia, and the Philippines in 1998. In the Thai crisis, large banks benefiting from deposit flight from small banks increased liquidity instead of expanding their loan portfolio, Ito and Pereira da Silva (1999).

<sup>20</sup> The portfolio shift away from lending is more marked in countries with deposit insurance, and so is the decline in overhead costs.

Table 7. Crisis Aftermath—Differences Among Banks Based on Return on Assets in the Crisis Year

	First Quintile			Second Quintile			Third Quintile			Fourth Quintile			Fifth Quintile		
	T	T+1	T+2	T	T+1	T+2	T	T+1	T+2	T	T+1	T+2	T	T+1	T+2
ROAA	-.***	-.***	-.*	.***	-.***	-.**	-	-	+	+	-	+.***	+.***	-	-
Profitability	-.***	-.***	-	-.***	-.***	-.**	-	-	+	+	-	+.*	+.*	-	-
Interest Margin	-.**	-.***	-.***	-	-.**	-.**	-	-	-	+	+	-	+.*	-	-.*
Overhead/Assets	+	-.*	-.*	+	-	-.***	-.**	-.*	-.***	-	-	-.**	+	-.**	-.***
Loan Loss Provisions	+.***	+.***	+	+	-	-	+.*	+.*	-	+	+	-	+	+	-.*
Loan Loss Reserves	+.***	+.***	+	+.***	+.***	+	+	-	-	+	+	-	+	+	-
Cash/Assets	-	-	-	-	+	-	-	-.***	-.***	-	-.***	-.**	-	-.*	-
Deposits/Assets	+.***	+.***	+	+.*	+.***	+.***	+.*	+.***	+.*	-	-	-	-	+	+
Equity/Assets	-	-.*	-	-.*	-.*	-.**	-	-	-	+	-	-	-	-	-.*
Loan/Assets	-	-.**	-	-	+.*	-	-	-.*	-	-	-	+	-.**	-.**	-
OEA/Assets	-	+.*	+	+	+	+	+	+.*	+	+	+	-	+.*	+	+
Asset Growth	-	-	+	+	+	+	+.***	+	+.*	+	-	+.*	-	+	+.***
Credit Growth	-.***	-.***	+	-	-	+	+	-	+	-.**	-	+.***	-.*	-	+.***
Deposit Growth	-.**	-.***	-	-	+.*	-	+.***	-	+	-	-	+	-	+	+

\*, \*\*and \*\*\* indicate significance levels of 10, 5, and 1 percent respectively.

assets become more important. Most strikingly, in the lowest quintile of banks both credit and deposits decelerate substantially both in T and T+1. The decline in the rate of growth of these variables are of the order of 15-20 percentage points, so they are quite substantial. Thus, while on average there is no evidence of a strong decline in deposit growth, the weakest banks in each country do experience a severe decline, which is also accompanied by a drastic slowdown in credit growth. Other trends do not appear to be concentrated among the weakest banks: for instance, the decline in overhead costs is shared by all the banks, suggesting that financial difficulties lead to improvements in cost efficiency across the board. Also, the shift from loans to other earning assets takes place also in the top and middle quintile of banks, suggesting that it is not just the effect of recapitalization operations in rescued banks. Finally, the decline in cash appears to be more marked among the stronger institutions.

## VII. CONCLUDING REMARKS

Perhaps the most interesting empirical regularity uncovered in this study is that contemporary banking crises are not accompanied by substantial declines in bank deposits. Thus, while depositor runs have played a central role in the theoretical literature on banking crises, in practice they seem to be a sideshow at best. Furthermore, while bank lending interest rates and spreads rise in the wake of a crisis, we find no evidence of increased deposit interest rates. A plausible interpretation of these findings is that bank safety nets have succeeded in keeping depositors from fleeing despite widespread insolvency in the banking system. Of course, to the extent that depositor runs also help maintaining appropriate incentives for bankers, the lack of runs may be seen as a lack of discipline.

Sharp declines in liquidity due to depositor runs, forcing banks to cut lending even to creditworthy borrowers, have been often viewed as an important mechanism through which bank distress affects the real economy and helps propagating adverse shocks.<sup>21</sup> Contemporary banking crises do not seem to be followed by prolonged recessions: the slowdown in output growth is usually sharp but short-lived, with growth rates back to their precrisis levels in the second year after the crisis. This evidence raises the question of whether the quick rebound in output is the result of the lack of widespread depositor panics. Our analysis cannot give a definite answer to this complex question. Nonetheless, some of the evidence discussed in the paper points in a different direction: in our sample, credit growth remains below its precrisis level even after output growth has rebounded, suggesting

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<sup>21</sup> Mishkin (1996) views panics as an important mechanism through which banking crises propagate to the real sector.

that the recovery may not result from a resumption in bank lending. At the same time, even banks in the best financial position, who do not see significant declines in profitability or capital, decrease their loan-to-asset ratio following a crisis.

These two findings suggest that during a banking crisis protecting deposits may not be sufficient to protect bank credit, as lack of usable collateral and poor borrower creditworthiness discourage banks from lending. However, protecting bank credit may not be a priority in the immediate aftermath of a crisis, as the real economy can rebound without it at least while there is substantial unutilized capacity.<sup>22</sup>

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<sup>22</sup> For a discussion of policies followed to support credit in the recent Asian crisis, see Lindgren et al. (1999).

### Data Sources and Definitions

Table 8. Definitions and Data Sources for Macro Variables<sup>23</sup>

Variable Name	Definition	Source
Growth	Rate of growth of real GDP	IFS where available. Otherwise, WEO.
Investment/GDP	Ratio of investment to GDP	IFS
Real credit growth	Rate of growth of credit by deposit money banks deflated by the GDP deflator	Credit: IFS. GDP deflator: IFS or WEO.
Demand deposit growth	Rate of growth of demand deposits in deposit money banks, deflated by GDP deflator	Demand deposits: IFS. GDP deflator: IFS or WEO.
Total deposits/GDP	Ratio of total deposit in deposit money banks to GDP	Total deposits: IFS. GDP: IFS or WEO.
Real interest rate	Nominal interest rate minus the contemporaneous rate of inflation	IFS. Where available, nominal rate on short-term government securities. Otherwise, a rate charged by the Central Bank to domestic banks such as the discount rate.
Real lending rate	Bank average lending interest rate minus rate of change of GDP deflator	Lending rate: IFS. GDP deflator: IFS or WEO.
Real deposit rate	Bank average deposit interest rate minus rate of change of GDP deflator	Deposit rate: IFS. GDP deflator: IFS or WEO.
Spread	Lending rate minus deposit rate	
Inflation	Rate of change of the GDP deflator	IFS or WEO.
Depreciation	Rate of change of the nominal exchange rate (period average)	IFS
Fiscal surplus/GDP	Government surplus divided by GDP	Deficit: IFS. GDP: IFS or WEO.
Central bank funds/bank assets	Loans from the monetary authorities to deposit money banks divided by total assets of deposit money banks.	IFS

The macroeconomic variables are available for the following sample of banking crises: Argentina (1995), Bolivia (1995), Colombia (1982), Chile (1980), Ecuador (1995), El Salvador (1989), Finland (1991), Guyana (1993), Indonesia (1992), India (1991), Israel (1983), Italy (1990), Jordan (1989), Japan (1992), Kenya (1993), Mali (1987), Malaysia (1985), Mexico (1982, 1994), Nigeria (1991), Norway (1987), Nepal (1988), Panama (1988), Papua New Guinea (1989), Paraguay (1995), Peru (1993), Philippines (1981), Portugal (1986),

<sup>23</sup> IFS stands for International Financial Statistics, published by the IMF. WEO stands for the World Economic Outlook database of the IMF.

Sri Lanka (1989), South Africa (1985), Sweden (1990), Thailand (1983), Turkey (1991), United States (1981), Uruguay (1981), Venezuela (1993).

### A. Bank Level Data

All bank level data come from the 1999 release of the Bankscope database, compiled by Fitch IBCA.

Table 9. Definition of Bank Level Variables

Variable Name	Definition
ROAA	Ratio of after tax profits to total assets.
Profitability	Ratio of gross profit to total assets.
Interest Margin	Ratio of net interest income (interest income–interest expenditure) to total assets.
Overhead/Assets	Ratio of overhead expenses (personnel expenses and Other non interest expenses) to total assets
Loan Loss Provisions	Ratio of loan loss provisions to total assets.
Loan Loss Reserves	Ratio of loan loss reserves to total assets.
Cash/Assets	Ratio of cash and dues from banks to total assets
Deposits/Assets	Ratio of total deposits (demand deposits, saving deposits, time deposits, interbank deposits and other deposits) to assets
Equity/Assets	Ratio of equity to assets
Loan/Assets	Ratio of loans (commercial loans, public sector loans, consumer loans, secured loans and other loans, net of LLR) to total assets
OEA/Assets	Ratio of other earning assets (deposit with banks, Government securities, other investments and equity investments) to total assets.
Asset Growth	Growth rate of real total assets, real assets calculated using CPI data from the IFS.
Credit Growth	Growth rate of total real credit, real credit calculated using CPI data from the IFS.
Deposit Growth	Growth rate of total real deposits. real deposits Calculated using the data from the IFS.

The sample contains the following crisis episodes: Argentina (1995), Bolivia (1995), Costa Rica (1994), Croatia (1995), Ecuador (1995), Kenya (1995), Korea (1997), Latvia (1995), Malaysia (1985), Mexico (1994), Paraguay (1995), Swaziland (1995), Thailand (1997), Turkey (1994), Venezuela (1993) Zambia (1994).

Table 10. Sample Coverage

Country	Total Number of Banks	Number of Banks Included in the Sample	Fraction of Banks Covered (In percentage)	Fraction of Assets (or Loans or Deposits) Covered (In percentage) 1/
Argentina	130	43	33	66
Bolivia	16	13	81	NA
Costa Rica	28	11	39	72
Croatia	60	19	32	71
Ecuador	41	21	51	80
Kenya	53	7	13	46
Korea	18	18	100	100
Latvia	33	8	32	53
Malaysia	35	25	71	73
Mexico	27	10	37	57
Paraguay	32	8	25	NA
Swaziland	4	2	50	56
Thailand	15	13	87	NA
Turkey	55	34	62	85
Venezuela	30	10	33	60
Zambia	18	5	28	64

1/ The denominator is total unconsolidated assets (or loans or deposits) of the banking system in the last year in the sample (which varies depending on the year of the crisis). Because these figures are from miscellaneous country sources, the definition of the banking system may change from country to country.

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