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Inside the crisis: An empirical analysis of banking systems in distress

Aslı Demirgüç-Kunt [a], Enrica Detragiache [b,*], Poonam Gupta [b]

[a] *The World Bank, 1818 H Street, NW, Washington, DC 20433, USA*
[b] *International Monetary Fund, 700 19th Street, NW, Washington, DC 20431, USA*

Abstract

Using aggregate and bank-level data for several countries, the paper studies what happens to the banking system following a banking crisis. Crises are not accompanied by a significant decline in aggregate bank deposits relative to GDP, although depositors leave weaker banks for stronger ones. Credit slows substantially, but the credit-to-GDP ratio is higher after the crisis. Output recovery begins in the second year after the crisis while credit still stagnates. Banks, including healthier ones, reallocate their asset portfolio away from loans, suggesting a lack of loan demand or collateral. Banks also improve their cost efficiency.

JEL classification: G21, E44

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1. Introduction

After the proliferation of banking problems around the world in the 1980s and 1990s, several studies have used cross-country data to study the factors associated with the onset of crises, to identify the determinants of the crises or to look for "early warning indicators" of trouble.[1]

* Corresponding author. Tel.: +1 202 623 6376; fax: +1 202 623 4376.
E-mail address: edetragiache@imf.org (E. Detragiache).

[1] Among the first studies are Demirgüç-Kunt and Detragiache (1998,2002), Eichengreen and Rose (1998), and Glick and Hutchison (2000); among the second, see Kaminsky and Reinhart (1999) and Demirgüç-Kunt and Detragiache (2000).

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Less attention has been devoted to what happens to the economy and the banking sector *after* a banking crisis breaks out.[2] This paper attempts to fill this gap by studying the aftermath of banking crises using both aggregate and bank-level data. To identify the characteristics of the post-crisis period, we construct a cross-section of banking crises and test whether a number of banking and macroeconomic variables significantly change their behavior in the years following a crisis.

Much of the theory of banking crises, inspired by the experience of the 1880s and early 1900s, assigns a central role to depositor runs. Runs may be self-fulfilling (Diamond and Dybvig, 1983), may be caused by incomplete information on the part of depositors (Chari and Jagannathan, 1988), or may originate in weak bank "fundamentals" (Allen and Gale, 1998). Vulnerability to depositor runs is also viewed as a basic characteristic of banks as financial intermediaries.[3] 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 because of a deterioration in the quality of their assets. So the first question that we take up is whether banking crises are characterized by large declines in deposits.

A second question is whether bank distress has contributed to propagate adverse economic shocks, thereby prolonging recessions. Bernanke (1983) argued that a contraction in credit brought about by banking problems was instrumental in the propagation of the Great Depression in the US. Mishkin (1996) warned of potential similar effect of banking crises in emerging markets.[4] Identifying the effect of bank distress on economic activity, however, is notoriously difficult, because a decline in bank credit may reflect a lack of demand as much as problems on the supply side. In addition, the adverse shocks that accompany bank distress are often also plausible negative shocks to loan demand. Combining both aggregate and bank-level cross-country evidence, we will attempt to shed light on this complex issue.

Bank-level evidence will also allow us to study how banks perform during a crisis: is there evidence of poor asset quality? Does the structure of assets and liabilities change? Do bank balance sheets contract? Can banks improve their operating efficiency following a crisis?

The paper is organized as follows: Section 2 discusses sample selection and methodology. The evidence from the aggregate data is in Section 3. Section 4 discusses foreign exchange valuation effects, while Section 5 presents the analysis of bank-level data. Section 6 concludes.

2. Sample selection and methodology

2.1. The sample

We define a banking crisis as a period in which significant segments of the banking system become illiquid or insolvent. To identify systemic crisis episodes, we look at evidence of large-scale bank failures, the adoption of emergency measures by the government (deposit freezes,

[2] Eichengreen and Rose (1998) and Kaminsky and Reinhart (1999) are exceptions, as discussed in Sections 2 and 3. In contrast to ours, their analysis relies exclusively on aggregate data.

[3] See, for instance, Calomiris and Kahn (1991), Flannery (1994), and Diamond and Rajan (2000).

[4] The banking crises in Mexico in 1995 and East Asia in 1997–1998 were accompanied by a strong but short-lived downturn in output, with the recovery in economic activity taking place while problems still plagued the banking system. On Mexico, see for instance Krueger and Tornell (1999). On the Asian crises, see IMF (1999). Attempts to test for a credit crunch effect in East Asia include Ding et al. (1998), Ghosh and Ghosh (2000), and Borensztein and Lee (2002).

nationalizations, deposit guarantees, bank recapitalization plans), whether there were reports of significant depositor runs, the level of non-performing loans (at the peak of the crisis), and the costs of the bailout.[5] The baseline sample for the present study includes 36 banking crises in 35 countries (see Appendix B for a list of countries and dates). For some variable of interest the sample panel may exclude one or more countries because of lack of data.[6]

2.2. A regression framework

To construct a simple test of whether the occurrence of a banking crisis is followed by a significant change in the behavior of the variable of interest, we estimate OLS regressions in which each variable is regressed 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, we also introduce country dummy variables in the regression. More formally, let N denote the number of countries, and let y_{it} be an observation for variable y in period t and country i. Furthermore, let u_{it} be a disturbance term, let γ and β be regression coefficients, and define as T the year of the crisis. Then, in the empirical model we estimate:

$$y_{it} = \gamma_i + u_{it} \quad \text{for } t = T-1,\ T-2, \text{ and } T-3 \text{ and } i = 1,\ldots,N, \tag{1}$$

and

$$y_{it} = \gamma_i + \beta_t + u_{it} \quad \text{for } t = T,\ T+1,\ T+2, \text{ and } T+3 \text{ and } i = 1,\ldots,N \tag{2}$$

In this framework, the OLS estimate of each β (the coefficient of the period t dummy) is the mean difference between the value of the variable at t and the mean of the pre-crisis period. Thus, if the estimated β values are significantly different from zero, then the variable behaves differently in the post-crisis period than in the pre-crisis years. Furthermore, comparing the coefficients of the time dummies with one another allows us to trace the dynamic evolution of the variable over the post-crisis period. Because tests indicate the presence of heterogeneity across countries, we use heteroskedasticity-consistent standard errors to do hypothesis testing.

To accurately evaluate the impact of a banking crisis on the economy would require a full macroeconometric model, which specified the behavior of the main economic variables and their interaction with one another and with the financial sector. This would be an exceedingly complex endeavor if one wants to draw from the experience of 35 separate countries. We recognize that the simple approach followed here cannot identify causal links, as a common shock could be responsible for both the banking crisis and, with a longer lag, the change in behavior of the variable studied. Nonetheless, we think that the methodology provides a useful way to summarize information, and can offer potentially valuable insights in identifying possible causal links to investigate more closely.

An alternative methodology would be to compare the crisis aftermath with all non-crisis observations rather than with the period immediately preceding a crisis. This is the strategy followed by Kaminsky and Reinhart, who use as a comparison "tranquil" observations, defined as

[5] Specifically, we consider the crisis systemic if non-performing loans reached at least 10% of total loans or if the cost of cleanup operations was at least 2% of GDP.

[6] The cross-section of banking crises certainly includes cases with significantly different levels of distress; in principle, it would be useful to investigate whether the effects of the crises changed with the severity of the crisis, but the information available about the episodes is often too rudimentary to attempt a classification of the episodes.

observations occurring outside an 18-month window around the banking crisis. This approach is certainly justified when the purpose is to identify anomalous behavior before, during, and after a financial crisis. In contrast, the present study focuses exclusively on the aftereffects of banking sector distress, and a comparison with the years immediately preceding the crisis may allow for a sharper characterization. In addition, using a long time series as a term of comparison may introduce extraneous elements into the picture, such as structural changes unrelated to bank distress, which could complicate the interpretation. For instance, the credit-to-GDP ratio or the interest rate may be higher after a banking crisis than in tranquil times because ''aftermaths'' tend to be periods in which the financial system has been liberalized, while tranquil periods include many observations dating before liberalization. This problem would not arise in our approach, provided the structural change takes place more than three years before the crisis.

As a robustness check and to conserve degrees of freedom, we repeat the analysis by using one dummy for all the aftermath years, as well as only one dummy for both the crisis and the aftermath years. To investigate how the crisis aftermath may differ across different groups of countries, we also conduct robustness tests on subsamples including only developing countries or excluding countries from a particular region. A third robustness test consists of estimating the model with time dummies to allow for the possibility of time-varying intercepts. Finally, we test the sensitivity of the result to the exclusion of outliers, defined as observations outside an interval of four standard deviations around the mean.

3. Evidence from aggregate data

3.1. The behavior of bank deposits

Summary statistics for all the variables of interest are in Table 1. Turning to the regression results, the rate of growth in demand deposits falls relative to the pre-crisis period in the crisis year and the aftermath, but these differences are not significant (Table 2). Furthermore, deposits as a share of output do not decline significantly; in fact, the sign of the coefficient is positive, although not significant except in the third year after the crisis.[7] Total deposits, which include time and foreign currency deposits, are larger than those in the pre-crisis period. This aggregate, however, is more difficult to interpret than demand deposits, since its change may reflect in part the revaluation of foreign currency deposits in countries where a large currency depreciation accompanied the banking crisis. We address this issue in Section 4. Finally, deposit interest rates are higher compared to pre-crisis levels only in the crisis year, but by the following year the difference is no longer significant.[8]

These findings suggest that depositor panics have not been a major element of banking crises. Of course, individual banks may experience runs, but if the funds are redeposited elsewhere in the system the aggregate need not decline. Also, runs may be short-lived, and not be captured in annual data, as in the case of Argentina in 1995.

[7] If we repeat the exercise using the level of deposits rather than their ratio to GDP, we find that nominal deposits significantly increased in the aftermath of a crisis, and that real deposits did not change significantly.

[8] Kaminsky and Reinhart (1999) find total deposit growth after banking crises to be less than that in tranquil periods. They neither examine the behavior of demand deposits or the ratio of deposits to GDP, nor do they test whether the difference between deposit growth before and after the crisis is statistically significant. Eichengreen and Rose (1998) do not examine the behavior of bank deposits.

Table 1
Aggregate data – summary statistics

	Mean	Median	Standard deviation	Maximum	Minimum	Observations
Panel A						
Demand deposit growth	2.07	−0.30	35.64	506.91	−50.53	210
Demand deposits/GDP	8.88	6.65	6.77	31.34	1.62	245
Total deposits/GDP	40.63	31.21	26.28	130.26	10.41	245
Real deposit rate	0.65	2.51	14.92	56.00	−88.06	217
GDP growth	3.08	3.67	4.96	21.60	−16.66	250
Credit growth	4.88	2.46	13.27	51.94	−43.02	214
Credit/GDP	37.61	33.67	24.11	118.84	5.55	243
Real lending rate	11.66	7.85	36.43	440.67	−79.12	221
Spread	10.79	5.33	35.24	384.68	−6.42	205

	Demand deposit growth	Demand deposits/GDP	Total deposits/GDP	Real deposit rate	GDP growth	Credit growth	Credit/GDP	Real lending rate	Spread
Panel B: Cross correlations									
Demand deposit growth									
Demand deposits/GDP	−0.044								
Total deposits/GDP	−0.046	0.528***							
Real deposit rate	−0.177***	0.028	0.085						
GDP growth	0.028	−0.149***	−0.085	−0.006					
Credit growth	−0.020	−0.134**	−0.042	0.375***	0.304***				
Credit/GDP	−0.034	0.602***	0.709***	0.225***	−0.184***	−0.068			
Real lending rate	−0.057	−0.140**	0.249***	0.347***	−0.018	0.100	0.090		
Spread	0.018	−0.155**	0.233***	−0.059	−0.000	−0.048	−0.009	0.916***	
Banking crisis	−0.022	−0.009	−0.005	0.093	−0.231***	−0.106*	0.016	0.004	−0.035
Banking crisis$_{t+1}$	−0.016	0.001	0.047	−0.076	−0.196***	−0.106*	0.046	0.125**	0.107
Banking crisis$_{t+2}$	−0.039	0.025	0.041	−0.027	0.018	−0.096	0.035	0.066	0.091
Banking crisis$_{t+3}$	−0.002	0.041	0.037	−0.060	0.124**	−0.027	0.020	−0.071	−0.030

***,**, and * indicate statistical significance at 1, 5, and 10%, respectively.

But why did depositors not run in spite of widespread insolvency in the banking system? One possibility is that depositors felt safe because of explicit deposit insurance, blanket guarantees enacted at the time of the crisis, or the expectation of government bailouts.[9] Also, in spite of the generalized distress, depositors may have had access to some healthy banks, and chose to redeposit their funds there rather than flee to non-bank assets.[10] We return to this question in Section 4.

[9] In regressions not reported here, we find that countries without explicit deposit insurance experience a decline in the demand deposit-to-GDP ratio after a crisis. However, in these countries total deposits grow more sharply as a share of GDP than in countries with deposit insurance. We do not have an explanation for this puzzling result.

[10] Studies of the Asian crises of 1997–1998 show that aggregate deposits did not fall as depositors switched from small to large banks and from domestic to foreign banks (Domaç and Ferri, 1999; Lindgren et al., 1999). The Asian crises are not included in our macro sample.

Table 2
Crisis aftermath – evidence from aggregate data

	T	$T+1$	$T+2$	$T+3$
Demand deposit growth	−4.146 (6.181)	−3.599 (5.956)	−5.616 (6.075)	−2.491 (6.230)
Demand deposits/GDP	0.286 (0.366)	0.333 (0.433)	0.734 (0.506)	0.878* (0.554)
Total deposits/GDP	2.920** (1.238)	5.554*** (2.046)	5.177*** (1.405)	4.233*** (1.578)
Real deposit rate	5.390*** (2.256)	4.461 (3.219)	0.374 (2.534)	−1.186 (3.314)
GDP growth	−3.763*** (1.105)	−3.366*** (0.974)	−0.798 (0.765)	0.554 (0.934)
Credit growth	−6.761*** (2.472)	−7.390*** (2.528)	−7.178*** (2.404)	−5.687*** (2.442)
Credit/GDP	3.334*** (0.964)	4.275*** (1.291)	3.721*** (1.191)	2.778* (1.674)
Real lending rate	4.670 (4.004)	15.488 (11.034)	10.426** (4.755)	−0.986 (5.231)
Spread	−5.095 (4.719)	7.152 (5.384)	5.701 (4.139)	−4.596 (5.058)

*, ** and *** indicate significance levels of 10, 5, and 1%, respectively. "T" is a dummy for the year of the crisis. "$T+1$", "$T+2$", and "$T+3$" are dummies for each of the three years following a crisis. White's heteroskedasticity-consistent standard errors are in parentheses.

3.2. Output and bank credit

The banking crisis is accompanied by a sharp decline in output growth, of the order of four percentage points (Table 2). Growth remains depressed in the year following the crisis, but returns to its pre-crisis level thereafter. Thus, while financial distress wreaks havoc in the banking system and it often takes many years to clean up the mess, the effects on the real economy seem to be short-lived. This is consistent with the findings of Kaminsky and Reinhart (1999) and Eichengreen and Rose (1998), and with the observed "U-shaped" output recovery following the 1995 Mexican crisis and the Asian crises of 1997–1998.[11]

Turning now to credit to the private sector, the rate of growth of real credit falls below its pre-crisis level beginning in the crisis year. However, credit as a share of GDP remains significantly above pre-crisis levels for the entire aftermath period, indicating that credit slows down less rapidly than output.[12] Moreover, in about half of the sample credit growth was still positive in T and $T+1$. Thus, while the credit boom that often precedes banking crisis clearly comes to an end, there is not much evidence of a sudden collapse in bank lending.

Interestingly, in the second and third year following the crisis, when output growth returns to its pre-crisis levels, credit growth remains depressed. So the recovery does not seem to be driven by a resumption in bank lending. What may be happening 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

[11] It could be conjectured that the recovery is due to the expansionary effects of a real exchange rate depreciation, since a number of banking crises are accompanied by currency crises. To investigate this point, we have identified eight cases of "twin crises" in our sample using the definition of currency crises in Milesi-Ferretti and Razin (1998). When we re-estimate the output growth equation adding an interaction term between a currency crisis dummy and the period dummies, we found no evidence that "twin crisis" countries experienced faster output recovery. This is consistent with Kaminsky and Reinhart (1999) who found that the GDP growth declined more sharply in twin crises.

[12] Using credit in level rather than as a ratio to GDP yields the same result: credit significantly increased both in nominal and real terms relative to the pre-crisis period.

bonds. This interpretation is in line with what was observed in Mexico following the 1995 crisis (Krueger and Tornell, 1999).

The real lending interest rate rises in the crisis year and the following two years, possibly reflecting an increase in default risk premiums, but it is only significant in $t+2$. Changes in spreads are not significant.

In considering this evidence some caveats are in order, as the change in the stock of real credit is an imperfect measure of the aggregate amount of funds available to bank customers, particularly during a crisis. Some of the increase (or lack of decline) in credit may reflect the capitalization of interest payments to avoid open defaults in a situation in which interest rates have increased dramatically. Also, in countries with a sizable portion of foreign currency loans, there may be a revaluation effect due to a real exchange rate depreciation.[13] Both these factors tend to bias credit growth upwards. Other factors may lead to underestimate credit growth following a crisis: restructuring operations following the crisis may appear to reduce aggregate bank credit to the private sector if some loans are transferred to a special institution outside the banking system (for instance, an asset management company). Also, when loans are set in nominal terms, inflation reduces the value of real bank debt outstanding.

4. Robustness

4.1. 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 or bank 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 is beyond the scope of this paper. Nonetheless, to get a better sense of the magnitude of these phenomena for the sample crises, we have gathered information on the size of foreign currency deposits and credit for the episodes in our sample from central bank bulletins and other miscellaneous data sources. The search yielded foreign currency credit data for 20 episodes and foreign currency deposit data for 23 episodes.[14] Using this information, we computed measures of aggregate real credit and deposits ''purged'' of exchange rate valuation effects as follows: for the crisis year and the aftermath years, total ''corrected'' real credit (deposits) is 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*, where the real exchange rate is the nominal rate (vis-à-vis the US 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 pre-crisis level.

[13] This source of bias is addressed in Section 3.

[14] 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), and 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).

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 3. 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. Using both the corrected and non-corrected 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 pre-crisis period. This is exactly what was happening for the baseline sample. As for deposits, the ratio of total deposits to GDP has a positive but insignificant coefficient in the crisis and in the aftermath years relative to the pre-crisis period even after correcting for valuation effects, further confirming that depositor runs had limited aggregate impact.

4.2. Other robustness tests

The lack of significance of some of the coefficients of the aftermath dummy variables may be the result of the small number of observations. To increase the degrees of freedom, we have reestimated the regressions using only one dummy for the entire aftermath period and, again, using one dummy for both the crisis year and the aftermath. The basic results are unchanged.

To test whether the response to banking crises depends on the type of country, we have reestimated the baseline regressions for different subsets. If we exclude developed countries, there is now some evidence of a decline in demand deposits relative to GDP in the year of the crisis and the following year. However, total deposits increase, casting doubts over the hypothesis of extensive bank runs. Excluding various geographical regions does not alter the results, except that the decline in credit growth is no longer significant once Latin American countries are excluded from the sample.

The results are also robust to the introduction of time and regional dummy variables in the regression (the latter replacing the country means) and to the elimination of outliers, defined as observations outside of a two standard deviation interval from the country mean.

5. Evidence from bank-level data

5.1. 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 1980s 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.[15] The resulting sample includes 16 banking crises (listed in Appendix B) all occurring in developing countries or transition economies. Four of the crises

[15] 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.

Table 3
Crisis aftermath – evidence from aggregate data – robustness: real credit and deposit corrected for exchange rate effects

	T	$T+1$	$T+2$	$T+3$
Credit growth	−7.971** (4.108)	−9.430** (4.541)	−13.532*** (3.790)	−14.931*** (3.500)
Corrected credit growth	−8.031* (4.484)	−12.887*** (2.770)	−14.075*** (3.675)	−14.753*** (3.856)
Credit/GDP	4.117*** (1.240)	4.677*** (1.365)	3.791*** (1.608)	1.584 (2.466)
Corrected credit/GDP	4.122** (1.323)	4.780*** (1.285)	4.093** (1.816)	2.109 (2.434)
Total deposit growth	−8.931 (6.774)	−4.885* (6.233)	−12.121* (7.333)	−12.202 (7.605)
Corrected total deposit growth	−11.076* (6.930)	−7.700 (6.245)	−11.488* (6.938)	−12.305* (7.298)
Total deposits/GDP	1.365 (1.898)	4.009 (2.835)	2.250 (1.750)	0.588 (2.912)
Corrected total deposits/GDP	0.771 (1.653)	3.201 (2.070)	2.571 (1.767)	1.715 (2.615)

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

included here (Croatia, Latvia, Paraguay, and Costa Rica) are not in the macro sample because of lack of data.

The Bankscope database is designed to cover the world's largest banks and coverage is supposed to reach 80–90% of bank assets in each country. For the countries in our sample, Bankscope covers 595 banks, but this number includes banks that were created, closed, or merged during the sample period, or that simply did not report information for one or more years. Thus, the sample of usable banks is much smaller, consisting of 257 banks. Coverage in terms of total bank assets, though uneven across countries, remains quite good (see Table B2 in Appendix B for detailed coverage information).

A problem with the Bankscope data is that mergers and acquisitions that do not lead to a name change for the bank are not explicitly identified in the database. We were able to find specific history information for 35% of the banks in the sample, either from Bankscope or from other sources.[16] 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. The data set contains a number of outliers, some of which were obvious data mistakes. Rather than eliminating extreme observation in an arbitrary way, observations outside a four standard deviation interval around the mean were excluded from each regression. We will point out when the exclusion of outliers significantly changes the results. The exclusion of outliers should also alleviate the impact of unidentified mergers or acquisitions on variables such as credit and deposits growth.

Finally, while interpreting the results, it is important to keep in mind that the sample is affected by survivorship bias: banks that fail during the sample period drop out, so the sample is biased towards the healthier institutions. To assess the potential extent of this source of bias, we have looked at what percentage of banks in the Bankscope database stopped reporting data in the year of the crisis or in the two subsequent years. This figure, which provides an upper bound to the fraction of banks that closed because of the crisis, is 10.7%.

[16] For a large number of banks, Bankscope history information only includes the year of establishment, but it is not clear whether this means that the bank was not involved in any merger or acquisition.

5.2. The variables of interest

The information from Bankscope allows us to examine several bank characteristics in the aftermath of a banking crisis. The first aspect is performance, measured by gross and net return on average assets (see Appendix B for details on variable definitions). If the banking crisis is driven by a deterioration in the quality of the bank loan portfolio, we expect to find a decline in profitability as well as an increase in loan loss provisions as the crisis unfolds, so we also examine the evolution of loan loss provisions and loan loss reserves. Another aspect of interest is bank efficiency, which is measured here by the interest margin (the difference between interest earned and interest paid) and by overhead costs. To examine whether depositor panics were an important element of the crises, we look at the ratio of deposits to assets as well as the rate of growth of real deposits. Another important issue is whether bank distress led to a fall in bank lending, so we examine the growth rate of total assets and of credit, and the breakdown of bank assets between loans and other earning assets. Finally, we look at the evolution of equity over assets to determine whether crises were accompanied by an erosion of bank capital.

5.3. Estimation results

To characterize bank behavior in the aftermath of a crisis we employ the same methodology used for the macro variables, except that, as explained in the preceding section, the period covered is limited to five years. Thus, for each variable of interest we run a regression on a panel consisting of five observations for each bank in the sample; the independent variables are country dummies and three period dummies, one for the crisis year and one for each of the two years following the crisis. The coefficient of each time dummy is the mean difference between the value of the variable in the year and the country-specific average of the value of the variable in the two pre-crisis years.

Returns on average assets and profits are below the pre-crisis level in the year of the crisis, and more markedly so in the first post-crisis year, while in $T+2$ the difference is no longer significant (Table 4). Non-performing loans and loan loss reserves rise substantially beginning in the crisis year, while by $T+2$ they are back to their pre-crisis level, probably because at that stage banks begin getting bad assets off their books. Thus, the banking crises were accompanied by a decline in bank profitability and asset quality.[17] Interestingly, the crisis is also followed by a significant decline in both operating costs and the interest margin. Thus, financial difficulties seem to have provided a stimulus for banks to improve their operating efficiency.

Turning now to bank deposits, the rate of growth of real deposits is significantly below that of the pre-crisis period in the first year after the crisis (Table 5). However, because growth rates were high before the crisis, deposits were still increasing in absolute terms in 57% of the sample banks.[18] In fact, the sample banks lost 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, as healthier banks may have attracted deposits from weaker banks or from weak non-bank institutions. Nonetheless, because the banks in the sample represent a sizable portion of the banking system, this evidence supports the view that extensive runs did not take place

[17] If outliers are included in the sample the loan loss variables lose significance.

[18] If outliers are included deposit growth is not significantly different from the pre-crisis period.

Table 4
Crisis aftermath – evidence from bank-level data – profitability, asset quality, efficiency

	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	0.02117*** (0.0085)	0.0259*** (0.0093)	0.0049 (0.0100)
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%, respectively. White's heteroskedasticity-consistent standard errors are given in parentheses.

despite signs of deteriorating bank profitability and asset quality. The shift towards deposit financing may be a consequence of the introduction or broadening of depositor guarantees by the government in the midst of a crisis, since such guarantees make deposits a cheaper and more stable source of funding.

On the asset side, the rate of growth of total assets (in real terms) is not significantly different from its pre-crisis 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 of nine percentage points below its pre-crisis level both in T and in $T+1$. 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 of countries or survivorship bias may account for these differences; also, if credit growth reflects mostly growth in interbank market, it would not be captured in the macro data, where interbank flows are netted out. Finally, 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 reallocated funds away from lending, 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 identified by a number of case studies.[19] There are several possible explanations for why banks may want to switch to safer securities in times of crisis: there may be a contraction in loan demand due to the adverse shocks that accompany the crisis. Also, lower asset prices may reduce the value of collateral, a phenomenon sometimes referred to as the "collateral crunch."[20] These are demand-side factors, which would affect a healthy banking system as well as a distressed one. Supply-side factors may also be at work, however. In times of stress banks may shift to safer assets to economize on regulatory

[19] Luzio-Antezana (1999) finds that the positive net inflows of deposits into Mexican banks beginning in the second quarter of 1996 were used to purchase government securities (as well as to increase provisioning). Catao (1997) documents that Argentine banks increased their investment in government securities after the 1995 crisis over and above what was mandated by increased liquidity requirements. Domaç and Ferri (1999) present evidence suggesting a similar phenomenon in Korea, Malaysia, and the Philippines in 1998. In Thailand, large banks benefiting from deposit flight from small banks in the immediate aftermath of the crisis increased their liquidity instead of expanding their loan portfolio (Ito and Pereira da Silva, 1999).

[20] Kiyotaki and Moore (1997) show how collateral-based lending can give rise to multiple equilibria.

Table 5
Crisis aftermath – evidence from bank-level data – asset and liability composition and balance sheet growth

	T	$T+1$	$T+2$
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)

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

capital (the ''capital crunch''). Finally, rescue operations in which banks exchange non-performing loans for government securities, as in Mexico in 1995, may result in a decline in the loan-to-asset ratio. We return on this issue in the next section.

Whatever the explanation, this evidence suggests that maintaining banks' access to deposits and other sources of funding 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.[21]

5.4. Differences among banks

The results described so far reflect the average behavior of banks, and it is natural to ask at this stage whether the effects of the crisis were rather uniform across the banking sector, or significant differences existed. To answer this question, we have reestimated the regressions of the preceding section dividing the sample banks into five subsamples based on their 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 6. 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 is 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. Thus, in spite of the systemic nature of the crisis, a number of banks seem to be able to survive relatively well.

Interestingly, for weaker institutions deposits become a more important source of funding, while there is some evidence that loans tend to decline relative to assets while other earning 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

[21] The portfolio shift away from lending is more marked in countries with deposit insurance.

Table 6
Crisis aftermath – evidence from bank-level data – grouping 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	+**	+***	+	+***	+**	+	+	−	−	+	+	−	+	+	−
Deposits/assets	+**	+**	+	+*	+**	+**	+*	+**	+*	−	−	−	−	+	+
Equity/assets	−	−*	−	−*	−*	−**	−	−	−	+	−	−	−	−	−*
Loan/assets	−	−**	−	−	−*	−	−	−*	−	−	−	+	−**	−**	−
OEA/assets	−	+*	+	+	+	+	+	+*	+	+	+	−	+*	+	+
Asset growth	−	−	+	+	+	+	+***	+	+*	+	−	+*	−	+	+***
Credit growth	−***	−***	+	−	−	+	+	−	+	−**	−	+**	−*	−	+***
Deposit growth	−**	−***	−	−	+	−	+**	−	+	−	−	+	−	+	+

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

a drastic slowdown in credit growth. This result points to a "flight to safety" on the part of depositors.

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 on the top and middle quintiles of banks. This tends to underscore the role of demand factors, such as low demand for bank credit and lack of collateral, as opposed to supply factors, because healthier banks would neither experience a capital crunch nor recapitalization operations.

6. Concluding remarks

Perhaps the most interesting empirical regularity uncovered in this study is that banking crises are not accompanied by substantial declines in bank deposits relative to GDP. 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. A possible explanation is that generous bank safety nets are present, and depositors have little to lose despite widespread insolvency in the banking system. However, our bank-level analysis indicates that deposits do decline in weaker, less profitable banks, suggesting that depositors are actively and accurately monitoring financial institutions. If funds withdrawn are redeposited in healthier banks, then the stability of aggregate deposits can be reconciled with the evidence of runs on weaker banks. This is an issue that deserves further study. For instance, if indeed large-scale reallocations of deposits occur following banking crises, how is the functioning of the financial system affected? Can the payment system, the interbank market, and the supply of credit continue to work smoothly?

Bank financial distress, be it the result of illiquidity or insolvency, may help propagating adverse shocks to the real economy if it forces banks to curtail lending to creditworthy borrowers. 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 pre-crisis levels in the second year after the crisis even though credit growth remains depressed. An open question for future research is how do firms finance the recovery in the immediate aftermath of a banking crisis, and at what stage, if any, does the lack of bank credit become a hindrance to growth.

The analysis of bank-level data indicates that even healthier banks, which did not experience significant declines in profitability or capital, reduce their loan-to-asset ratio following a crisis. This evidence in favor of the hypothesis that weak loan demand, rather than supply disruption, is the main cause of depressed credit growth following a banking crisis. From this perspective, policies to quickly (and sometimes indiscriminately) recapitalize weak banks so that they can start lending again may be misguided.

Because banking crises are often accompanied by sharp adjustments in the exchange rate (Kaminsky and Reinhart, 1999), and in some countries bank deposits and loans are denominated in foreign currency, correcting for exchange rate valuation effects is potentially important to understanding the aftermath of a banking crisis. Another important result of our analysis is that these valuation effects, while they may be sizable for individual countries, do not significantly alter the overall picture.

A last finding of our study is that banks, regardless of how severely distressed, seem to be able to improve their operational efficiency following a banking crisis. An interesting topic for future research would be to investigate how these cost reductions are achieved.

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Appendix A. Macroeconomic data

Table A1
Definitions and data sources[a]

Variable name	Definition	Source
Growth	Rate of growth of real GDP	IFS where available. Otherwise, WEO
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 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	

[a] IFS stands for International Financial Statistics, published by the IMF. WEO stands for the World Economic Outlook database of the IMF.

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

Appendix B. Bank-level data

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

Table B1
Variable definitions

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 noninterest 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
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) and Zambia (1994).

Table B2
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)[a]
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

[a] 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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