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Government Guarantees and Banking: Evidence from the Mexican Peso Crisis

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Rethinking Bank Efficiency and Regulation: How Off-Balance-Sheet Activities Make a Difference

Thomas F. Siems and Jeffrey A. Clark

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Without question, fundamental economic, technological, and political forces have stimulated financial innovation and created new forms of intermediation and other fee-based activities for financial institutions. These activities, which are not traditionally captured on bank balance sheets, have made it even more difficult to get an accurate picture of a bank's condition. Most previous bank-efficiency models and measures are based only on traditional on-balance-sheet figures, which may be misleading as banks embrace nontraditional activities. In this article, Thomas Siems and Jeffrey Clark demonstrate the importance of including a measure for off-balance-sheet activities in these models. In doing so, they no longer find evidence of a statistically significant relationship between profit efficiency and size. This result, contradicting earlier bank-efficiency research, implies that banks of many sizes and types are competitively viable, which strengthens the view that ongoing consolidation in the banking industry will not harm and may improve overall profit efficiency. The authors' results suggest that failing to account for off-balance-sheet activities can have important statistical and economic effects on derived efficiency estimates by seriously understating actual bank output. Moreover, if the traditional efficiency computations are inaccurate, then the traditional regulatory process might be one step behind as well.

Government Guarantees and Banking: Evidence from the Mexican Peso Crisis

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What can an examination of Mexico and Argentina during the 1994 peso crisis reveal about the effects of bank supervisory policies? In both countries, the inflation-adjusted value of deposits declined from December 1994 to June 1995. The nature of those deposit flows differed, however. At banks in Mexico, deposit growth and financial strength were unrelated. In contrast, deposit growth in Argentina tended to be higher at financially strong banks than at weak ones. Because government guarantees were more extensive in Mexico than in Argentina, the difference in behavior in the two countries would be expected. Thus, an important cost of government guarantees is their potential for undermining the market mechanism that would otherwise tend to channel funding toward stronger banks and away from weaker ones.

Rethinking Bank Efficiency and Regulation: How Off-Balance-Sheet Activities Make a Difference

Thomas F. Siems and Jeffrey A. Clark

Banks across many asset-size ranges appear to be competitively viable and relatively equally efficient when off-balance-sheet activities are taken into consideration.

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In today's fast-changing world of banking, accurately modeling bank efficiency—how banks transform inputs into outputs—has become more difficult. Fundamental economic, technological, and political forces have stimulated financial innovation and created new forms of intermediation and other fee-based activities not traditionally captured on the balance sheet. With banking's financial intermediation role evolving and broadening through more off-balance-sheet activities such as loan securitizations, backup lines of credit, and financial derivatives, "traditional" bank efficiency and performance measures may no longer provide an accurate evaluation of a bank's condition.

What follows is an assessment of bank profit-efficiency measures that includes an estimate for off-balance-sheet activities as described in Boyd and Gertler (1994). We find that excluding this off-balance-sheet proxy as an output is not supported statistically and may distort traditional efficiency measures. In addition, the often-held view that efficiency tends to differ for banks in different size classes is not supported by our analyses. Once off-balance-sheet activities are accounted for, no efficiency differences are found for banks in size classes of more than \$25 million in total assets. As a result, banks across many asset-size ranges appear to be competitively viable and relatively equally efficient when off-balance-sheet activities are taken into consideration. This finding contradicts earlier research and suggests that ongoing consolidation in the banking industry will not harm and may improve overall profit efficiency.

This finding also may have some important implications for banking policy. The shift among banks, especially larger ones, to more nontraditional activities necessitates the rethinking of the traditional bank regulation process. Because of the swift changes affecting the way banks conduct business and provide intermediation services, the traditional regulatory process may have difficulty keeping pace with emerging technologies and financial globalization. As a result, banking regulators should consider shifting their focus even more from analyses of traditional balance-sheet activities to a more thorough evaluation of an institution's risk-management processes and behavior. They should also consider placing greater reliance on market forces to discipline bank activities.

THE DECLINE IN TRADITIONAL BANKING ACTIVITIES

In recent years, there has been a growing shift in banking activities from traditional on-

balance-sheet intermediation to off-balance-sheet activities. Traditional banking, in which banks attract deposits to make loans, is being replaced by new forms of intermediation and other fee-based activities. The decline in traditional U.S. banking activities is primarily the result of economic forces, financial innovations, and regulatory restrictions. To compete in this changing environment, many banks are providing nontraditional financial opportunities—ranging from standby letters of credit to newer financial derivatives products—moving many banking activities off the balance sheet.¹

Economic Forces

Edwards and Mishkin (1995) argue that “fundamental economic forces have undercut the traditional role of banks in financial intermediation.” These forces, according to Edwards and Mishkin, include banks’ diminished importance as a source of funds to nonfinancial borrowers, their deteriorating income advantages due to the growth of commercial paper and junk bond markets, and increased asset securitizations. As a result of these forces, competition from nonbank financial services providers has increased, which has significantly squeezed profit margins by eroding both cost and income advantages.

Financial Innovations

Banks have responded to increased competition by changing the way they provide traditional services and embracing new technologies to expand into nontraditional activities. Boyd and Gertler (1994) observe that “after correcting for both the mismeasurement of foreign bank loans and the exclusion of off-balance-sheet activities, any evidence of a substantial decline in commercial banks’ share of intermediated assets vanishes.” Indeed, the growth of off-balance-sheet activities has been swift and strong. Chart 1 documents the 224 percent increase in the notional value of financial derivatives activities that occurred at U.S. commercial banks between 1990 and 1996.² By comparison, banks’ total on-balance-sheet assets increased just 38 percent over the same period.

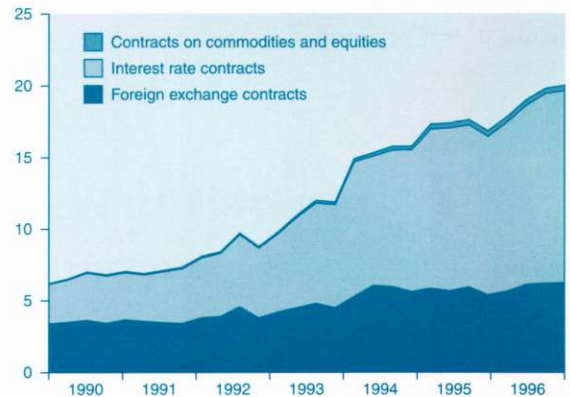
Regulatory Restrictions

Deposit insurance and other banking reforms introduced in the 1930s addressed depositor confidence. They also effectively diminished the disciplinary role the market mechanism provides by encouraging banks to maintain adequate capital levels and restrict excessive risk-taking. As a result, banking regu-

Chart 1

Growth of Financial Derivatives Activities at U.S.-Insured Commercial Banks

Notional value, trillions of dollars



DATA SOURCE: FFIEC Reports of Condition and Income.

lators have been responsible for ensuring that banks follow safe and sound management practices. Kaufman and Mote (1994) argue that, while the overall evidence does not support a recent decline in the banking industry, “banking has not grown as rapidly as it might have if banks had not been constrained from providing new products quickly in response to changes in market conditions.” In other words, banking may have grown more rapidly under alternative regulatory regimes. For example, today’s banks could be more efficient and the cost of banking to consumers could be less if restrictive regulations—such as those preventing expansion across state lines and the separation of commercial and investment banking activities—had been removed earlier.

LOOKING BEYOND THE BALANCE SHEET

Given the increasing growth of noninterest income from the expansion of off-balance-sheet activities, the need to acquire information concerning these activities has grown commensurately. Until recently, requirements for reporting off-balance-sheet activities were minimal. In fact, banking regulators did not require detailed reporting of derivatives activities until 1990. These requirements were modified in 1995 to provide greater detail. The development and implementation of these disclosures have been slow partly because of the difficulties inherent in accurately measuring and accounting for off-balance-sheet instruments, especially derivatives products.

A report by the General Accounting Office (1996) contends that accounting and disclosure issues related to nontraditional financial activi-

¹ See Boyd and Gertler (1994); Kaufman and Mote (1994); and Edwards and Mishkin (1995) for arguments supporting the decline in traditional banking and the rising importance of off-balance-sheet activities.

² A word of caution about notional amounts: for derivatives, notional principal is the amount upon which interest and other payments in a transaction are based. Notional principal typically does not change hands; it is simply a quantity that is used to calculate payments and does not give any indication of the underlying risk exposures. Nevertheless, as a time-series measurement, notional amounts do indicate the growing importance of off-balance-sheet activities in the banking industry.

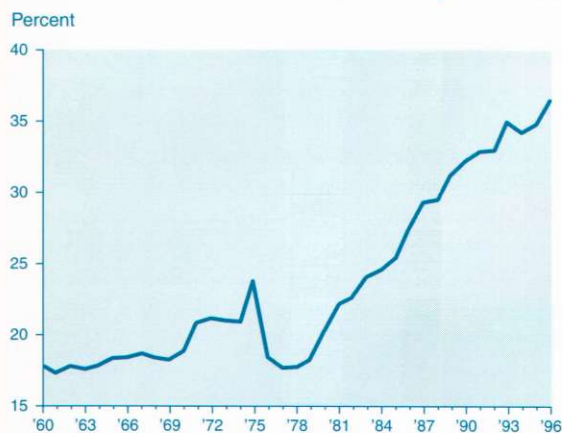
ties continue to be of concern. In a review of twelve banks and thrifts that were derivatives end users,³ the General Accounting Office (GAO) found that inadequate accounting standards for derivatives-hedging activities continue to be a major unresolved problem that adversely affects the quality of information available to users of financial statements. The GAO recommends comprehensive market-value accounting for all financial instruments as a way to resolve many of the accounting problems associated with derivatives.⁴

Moreover, the Financial Accounting Standards Board (FASB) has plans to move forward with an accounting standard that would require the fair value of all derivatives to be reported in financial statements.⁵ Many organizations are concerned about this proposal, however, stating that it has not received formal public comment, that it will not improve the financial reporting of derivatives activities, and that it could constrain prudent risk-management practices.

The absence of a consensus on the appropriate way to measure off-balance-sheet activities does not alleviate the need to assess their role in bank efficiency and performance. A crude measure of the growing importance of off-balance-sheet activities to a bank's bottom line is noninterest income as a share of total bank income (*Chart 2*). Over the 1960–80 period, noninterest income as a percent of total income averaged 19 percent, but since the late 1970s it has steadily increased to about 35 percent.

One way to incorporate some measure of off-balance-sheet activities into traditional bank

Chart 2
Share of Noninterest Income in Total Income for U.S.-Insured Commercial Banks, 1960–96



DATA SOURCE: Federal Deposit Insurance Corporation, *FDIC Historical Statistics on Banking 1934–1996*, <<http://www.fdic.gov/databank/sob/hist96/index.html>>.

efficiency measures is to adjust total assets to include the credit-equivalent amounts of off-balance-sheet assets as reported in the Risk-Based Capital Schedule of the Federal Financial Institutions Examination Council's (FFIEC) Consolidated Reports of Condition and Income. Since 1990, banks have been required to compute risk-based capital by categorizing assets and the credit-equivalent amounts of off-balance-sheet items according to various risk categories.⁶ In effect, the sum of these credit-equivalent amounts approximates the amount of on-balance-sheet assets that would result in comparable relative risk exposures to the bank, not the actual volume of their off-balance-sheet activities or their ability to generate income or incur costs.

The credit-equivalent amounts of off-balance-sheet activities almost certainly understate the true level of off-balance-sheet assets and their ability to generate income.⁷ One reason for the understatement is that reported credit-equivalent amounts exclude certain activities, such as loan servicing, consulting, and trust department services. That is, only the amounts of credit equivalents for those activities that regulators think will entail significant risk are reported. None of the on-balance-sheet assets are carried at their credit-equivalent amounts; if they were, then bank on-balance-sheet assets would also be understated. Hence, the actual value for off-balance-sheet assets is most likely greater than this measure.

Because of the apparent tendency for this credit-equivalent off-balance-sheet measure to understate the on-balance-sheet asset equivalence of off-balance-sheet activities, its use may produce erroneous results. The measure's deficiencies in approximating off-balance-sheet assets led Boyd and Gertler (1994) to emphasize the ability of off-balance-sheet activities to generate profit, which we consider here. The Boyd–Gertler measure, which we refer to as *BGEST*, takes an entirely different approach by focusing on the capitalization of noninterest income. This estimate can be best viewed as the hypothetical on-balance-sheet asset holdings needed to generate a bank's noninterest income stream. Assuming that on- and off-balance-sheet assets are equally profitable, Boyd and Gertler derive the following measure of off-balance-sheet equivalent assets:

$$BGEST = A_0 * \frac{NII}{I - E - LLP}$$

In this formulation, *BGEST* denotes the derived estimate of off-balance-sheet assets, *NII* de-

³ A derivatives end user is a counterparty that engages in a derivatives contract with the intent of managing its own risk exposures. By contrast, a derivatives dealer is a counterparty that enters into a derivatives contract in order to earn fees or trading profits by acting as an intermediary.

⁴ There are many difficulties in implementing market-value accounting and market-valuation models. Although improving the transparency of derivatives activities is the main challenge, accounting, public disclosure, and regulatory reporting requirements all continue to lag the marketplace. For more on this issue see Berger, King, and O'Brien (1991).

⁵ FASB is an independent organization funded by the private sector, with a stated mission to set accounting and reporting standards that protect the consumers of financial information—most notably, investors and creditors. More information about FASB and its derivatives project is available on their Web site at <<http://www.rutgers.edu/accounting/raw/fasb>>.

⁶ Since 1990, banks reporting total assets of \$1 billion or more and all banks with total capital of less than 8 percent of adjusted total assets must compute the credit-equivalent amounts of off-balance-sheet activities listed in the Risk-Based Capital Schedule. Adjusted total assets equals total assets less cash, U.S. Treasury securities, U.S. Government agency obligations, and 80 percent of U.S. Government-sponsored agency obligations plus the allowance for loan and lease losses and selected off-balance-sheet items.

⁷ See Boyd and Gertler (1994).

Table 1
Asset-Size Categories

Category	Total assets	1995 Number of U.S.-insured commercial banks	Average increase in total assets by adding <i>BGEST</i> (percent)
1	< \$25 million	1,715	47
2	\$25 million–\$50 million	2,352	23
3	\$50 million–\$100 million	2,511	28
4	\$100 million–\$300 million	2,186	33
5	\$300 million–\$500 million	388	46
6	\$500 million–\$1 billion	265	32
7	\$1 billion–\$5 billion	277	65
8	\$5 billion–\$10 billion	62	91
9	> \$10 billion	75	275

SOURCE: FFIEC Reports of Condition and Income, authors' calculations.

notes noninterest income, A_0 denotes on-balance-sheet assets, I denotes interest income, E denotes interest expense, and LLP denotes the loan-loss provision. Thus, *BGEST* is a measure obtained in units of on-balance-sheet assets that would generate the observed level of noninterest income produced primarily by off-balance-sheet activities.

Although a somewhat crude asset-equivalent measure, *BGEST* has several advantages over the credit-equivalent off-balance-sheet measure. The most important advantage is that it computes asset equivalents for all off-balance-sheet activities, not just those regulators think entail significant risk.⁸ One potential criticism of the *BGEST* measure, however, is the underlying assumption that off-balance-sheet activities earn a rate of return equal to that of on-balance-sheet assets. Nevertheless, when capitalizing fee income in this way to generate hypothetical asset equivalents, Boyd and Gertler obtain a more comprehensive measure of bank output.⁹

Table 1 shows the number of U.S.-insured commercial banks in nine asset-size categories for 1995, along with their average increases in total assets. These increases are determined by adding the *BGEST* off-balance-sheet asset measure to total assets. As discussed, these estimates of off-balance-sheet assets are crude approximations. Indeed, the challenge lies in being able to accurately measure them. Regulators must be careful not to put too much weight on traditional bank-efficiency and performance measures because banking continues to change.

Although *BGEST* measures the asset equivalence of off-balance-sheet activities with some potential degree of error, it is still possible to draw inferences about how its inclusion would affect traditional measures of bank efficiency. It

is likely that as banks expand into nontraditional activities, over time and across asset-size groupings, traditional bank-efficiency measures that exclude off-balance-sheet activities will become less accurate snapshots of true bank efficiency. Developing accounting practices that more accurately measure and disclose these activities remains an area of great concern and one that requires further research.

PROFIT EFFICIENCY AND OFF-BALANCE-SHEET ACTIVITIES

Given the documented growth in banks' off-balance-sheet activities, along with the apparent ability for these activities to alter traditional measures of bank efficiency, a more systematic, statistical investigation of their role is warranted to determine their statistical and economic significance. While a large number of studies have examined various aspects of bank efficiency from the cost side, only a few have explicitly included a measure for off-balance-sheet activities.¹⁰ As in most bank cost-efficiency studies, the papers that include a measure for off-balance-sheet activities report that there appears to be a cost disadvantage associated with both the increasing size and the changing output mix of large banks. In other words, these studies conclude that it would be cost inefficient for large banks to expand their production and product mixes any further and suggest that large banks have financial incentives to shrink somewhat in order to capture scale economies.

But before using these results to infer that banks should be discouraged from expanding any further because doing so would likely result in a less efficient banking industry, it is important to consider several factors. First, there has been a significant increase in both bank mergers and off-balance-sheet activities since 1990. A growing number of these mergers and much of the growth in off-balance-sheet activities have involved large banks, which these studies suggest are already too large to be cost efficient. Thus, either bank decisions to expand size and output mix are inconsistent with maximizing shareholder wealth, or these decisions depend on factors other than, or in addition to, cost efficiency that these studies have not adequately captured.¹¹

Second, these studies utilize only the credit-equivalent asset measure of off-balance-sheet activity. As discussed above, this measure has been criticized for significantly understating off-balance-sheet activities. Thus, it may not be adequately capturing the impact that the recent

⁸ The credit-equivalent off-balance-sheet measure derived from the Reports of Condition and Income were also considered in our analysis, but the results were qualitatively similar to those obtained when the off-balance-sheet proxy was excluded from the models. We also considered a measure similar to *BGEST* that excludes service charges on deposit accounts from noninterest income and includes them in interest income. Our results using this measure were not quantitatively or qualitatively different from results obtained by using *BGEST*.

⁹ Moreover, from microeconomic theory, a firm selling output capacity should add products to its output mix as long as the marginal revenue from the product is greater than or equal to the marginal cost associated with the use of the productive capacity necessary to produce the product. Since average production costs are fairly constant over a large range of output and assuming reasonably competitive output markets, profit margins may not be significantly different across products. Thus, the assumption of equal rates of return for on- and off-balance-sheet activities may indeed be reasonable, and the development of accurate measures for off-balance-sheet activities is certainly an area of further research.

¹⁰ See Clark (1988); Berger, Hunter, and Timme (1993); Clark (1996); Berger and Humphrey (1997); and Berger and Mester (1997) for extensive reviews of the literature on bank efficiency. See Jagtiani and Khanthavit (1996) and Jagtiani, Nathan, and Sick (1995) for cost efficiency studies that include a measure for off-balance-sheet activities. See Berger and Mester (1997) for a profit-efficiency study that also includes a measure for these activities.

¹¹ See Amihud, Dodd, and Weinstein (1986); Jensen and Meckling (1976); and Siems (1996) for studies that present and discuss various hypotheses for why banks expand size and output mix.

surge in off-balance-sheet activities may suggest.

Third, a number of recent studies have identified the presence of X-inefficiency—deviations from the most efficient, or best-practice, frontier within size classifications. Such inefficiencies typically result when firms do not use the least costly combination of inputs in producing outputs and thereby fail to match the performance of banks on the efficient frontier. Although there is no consensus on the best methodology to compute X-inefficiency, nearly all recent studies conclude that there are relatively large X-inefficiency differences across bank-size classifications and that these inefficiencies dominate scale and scope inefficiencies. Berger, Hancock, and Humphrey (1993) find that larger banks are substantially less X-inefficient on average, or closer to the frontier, than smaller banks. In addition, Clark (1996) finds that the presence of X-inefficiency may distort conventional measures of size and output-mix cost efficiencies. However, the studies that explicitly incorporate estimates for off-balance-sheet activity neither test nor make adjustments for the presence of X-inefficiency in their data.

Finally, and most important, it is possible that increasing size and changing output mix may be revenue efficient even if they are not cost efficient. If revenue efficiencies exceed any cost inefficiencies, increases in size and changes in output mix can be justified. Several recent studies highlight the need to reexamine bank efficiency using a profit function approach.¹² By focusing on profit efficiency instead of cost efficiency, the combined revenue and cost effects of alternative output levels and mixes and input levels and mixes can be assessed. Although most studies do not directly incorporate a measure for off-balance-sheet activities, some report evidence suggesting that profit efficiency is greater for larger banks, despite whether these activities are controlled for. According to Berger, Hunter, and Timme (1993), this result suggests that larger banks may have an advantage in terms of achieving high-value output bundles. However, failing to control for off-balance-sheet activities may be contributing to this result because the expansion of these activities has occurred disproportionately at larger banks.

METHODOLOGY AND DATA

Profit X-inefficiency occurs when profits are lower than those produced by the best-practice banks after removing random error. To separate random error, we employ the thick frontier

approach to allow an evaluation of potential X-inefficiency effects.¹³ In this approach, a best-practice profit frontier is estimated using data drawn from the most profitable banks in each of several size categories. Any error in estimating this frontier is assumed to be random and not the result of other inefficiency effects. The thick frontier methodology compares estimates of profit derived from the best-practice profit function with those derived from a profit function estimated using data from low-profit, or worst-practice, banks. Thus, while this methodology does not provide exact point estimates of individual firm-level inefficiency, it can provide estimates of overall profit X-inefficiency across size categories.

As is standard in the literature, profit X-inefficiency is computed to determine whether a systematic relationship exists between bank size and X-inefficiency differences. If such a relationship is found, the profit X-inefficient banking organizations should be excluded from further analyses, and derived efficiency estimates should be based only on the best-practice profit frontier. Failure to eliminate such institutions may lead to erroneous results by confounding scale and scope economies with X-inefficiency effects.¹⁴

Data from the 1995 FFIEC Reports of Condition and Income were used to assemble a sample of 9,831 banks with complete data.¹⁵ Using this sample, two thick frontier subsamples are formed. The best-practice frontier includes the top profit quartile (25 percent) of banks in each size category, as measured by return on equity.¹⁶ In implementing this approach, the full sample is first sorted by a measure of total assets that combines on-balance-sheet assets with the *BGEST* measure for off-balance-sheet activities. Then, within each of the nine asset-size categories, the quartile of banks with the highest rates of return on equity is selected to form the best-practice frontier. A second profit frontier, needed to evaluate profit X-inefficiency, includes the quartile of least profitable banks and is formed from the 25 percent of banks in each asset-size group with the lowest rates of return on equity.

Once we measure overall profit X-inefficiency, we compute two other efficiency measures using the estimated best-practice profit function: *profit elasticity* and *profit expansion path subadditivity*. Profit elasticity measures the percentage change in profit to equal percentage changes in all outputs in the product mix in order to capture only changes in size. Profit expansion path subadditivity measures the relation-

¹² See Berger, Hancock, and Humphrey (1993); Berger, Hunter, and Timme (1993); Swamy, Akhavan, and Taubman (1994); and Humphrey and Pulley (1997) for studies that argue that bank efficiency should be computed using a profit function approach.

¹³ The thick frontier approach is one of the main parametric frontier approaches used by researchers to evaluate efficiency. Berger and Humphrey (1997) summarize studies that have applied various frontier approaches to evaluate the efficiency of financial institutions in various countries.

¹⁴ The empirical evidence presented in Berger and Humphrey (1991); Mester (1993); and Berger, Hancock, and Humphrey (1993) supports using only the X-efficient, or best-practice, frontier in estimating scale and scope efficiencies.

¹⁵ The initial sample consisted of a total of 9,942 banks. The elimination of banks resulting in negative *BGEST* computations brought the number of banks to 9,831.

¹⁶ It is necessary to scale net income because the sample is broken into nine broadly defined but adjacent size categories. The rate of return on equity (ROE) is selected over the rate of return on assets (ROA) for two reasons. First, ROE is arguably the more appropriate measure of profitability from the standpoint of both owners and regulators. Second, ROE is a more comprehensive profit performance measure than ROA because it also incorporates the degree of financial leverage utilized by the bank.

Table 2
Estimated Profit Inefficiency (INEFF)

Category	Total assets	INEFF when excluding an off-balance-sheet measure	INEFF when including BGEST
1	< \$25 million	.699	.765
2	\$25 million–\$50 million	.617	.652
3	\$50 million–\$100 million	.574	.599
4	\$100 million–\$300 million	.551	.573
5	\$300 million–\$500 million	.542	.559
6	\$500 million–\$1 billion	.529	.549
7	\$1 billion–\$5 billion	.535	.582
8	\$5 billion–\$10 billion	.540	.680
9	> \$10 billion	.586	2.599

SOURCE: FFIEC Reports of Condition and Income, authors' calculations.

ship between profitability and size when output mix is allowed to vary. To provide a basis for evaluating the effect of including a measure of off-balance-sheet activity in the profit function, we derive the two efficiency measures for two profit function models: one in which three comprehensive on-balance-sheet output measures are included, the other in which the *BGEST* proxy for off-balance-sheet assets is included.

The three on-balance-sheet outputs are (1) the sum of commercial and industrial loans, agricultural loans, direct leasing, foreign loans, and loans to financial institutions; (2) the sum of consumer and real estate loans; and (3) the sum of demand deposits, savings deposits, and retail time deposits.¹⁷ The measure for off-balance-sheet activity, *BGEST*, may be included as a fourth output measure. Inputs in the production process include the following:

cost of labor = salaries and benefits divided by the number of full-time-equivalent employees;

cost of premises and fixed assets = total expenses for premises and fixed assets, divided by the book value of premises and fixed assets; and

cost of funds = weighted average cost of funds.¹⁸

Also included in the model are four dummy variables to control for regional differences in profitability,¹⁹ an additional dummy variable to control for holding company affiliation, and the equity-to-risk asset ratio to control for differences in financial leverage and risk of

insolvency. The dependent variable in all cases is net income. The profit function and efficiency measures are described more fully in the appendix.

THE SIGNIFICANCE OF OFF-BALANCE-SHEET ACTIVITIES

A profit function that excludes *BGEST* is nested within one that includes this measure. Therefore, in the nested profit function the estimated parameters on all terms that involve the off-balance-sheet proxy *BGEST* are being implicitly restricted to be zero. A statistical test of the importance of including this measure in the profit function can be carried out as a test of the restrictions implied in the model that excludes the off-balance-sheet proxy.

The results of likelihood ratio tests of these restrictions show that when *BGEST* is used to proxy off-balance-sheet activities, restricting the respective profit function parameters to zero can be rejected at the 1 percent significance level.²⁰ This indicates that including *BGEST* as a measure for off-balance-sheet activities statistically improves the profit function's performance.²¹

PROFIT X-INEFFICIENCY

To evaluate the extent of profit X-inefficiency in the data, we compute the measure *INEFF* for each asset-size category.²² The measure *INEFF* captures differences between the efficient technology utilized by high-profit banks in a given size class and the inefficient technology utilized by low-profit banks in the same size class. Thus, across all size categories, *INEFF* represents differences in predicted profit between the most profitable and least profitable frontiers.

Table 2 presents the computed values of *INEFF*, which suggest that there may be some relationship between profit X-inefficiency and bank size. Average profit X-inefficiencies between the highest and lowest profit frontiers range from about 53 percent to about 77 percent.²³ This means that differences in predicted profitability between the high-profit-frontier banks and the low-profit-frontier banks range in this same percentage across the nine asset-size categories. Further, average profit X-inefficiency, when including the *BGEST* off-balance-sheet output measure, appears to decline substantially through a bank size of approximately \$300 million of total on-balance-sheet assets. For banks between the \$300 million and \$1 billion asset

¹⁷ Only three outputs are included in the model to provide for a parsimonious estimation of the parameters and to promote tractability. We define one output to capture primarily short-term loans, one to capture longer-term loans, and one to measure core deposits. There is a long-standing controversy concerning whether deposits should be included in efficiency models as inputs or outputs. As in many other studies, we resolve this issue with a dual approach that captures both the input and output characteristics of deposits in which the interest paid on deposits is included in the inputs and the quantities of deposits in the outputs. See Berger and Humphrey (1997) for more on this issue.

¹⁸ The weighted average cost of funds is defined as $\sum_i (D_i/TF) i_i + \sum_s (BF_s/TF) i_s$, where D_i represents funds of deposit type i ; BF_s represents nondeposit, borrowed funds of type s ; i_i and i_s denote the respective interest rates paid on each type of deposit and borrowed funds, respectively; and total funds is designated by $TF = \sum_i D_i + \sum_s BF_s$.

¹⁹ The four geographic regions are West, North Central, Northeast, and South, as defined by the Bureau of the Census, U.S. Department of Commerce.

²⁰ The likelihood ratio test takes the form $2[\log(F_{UR}) - \log(F_R)] - \chi^2$, where $\log(F_{UR})$ and $\log(F_R)$ are the maximum values of the unrestricted and restricted likelihood ratio functions, respectively. For our model, the likelihood ratio test statistic equals 317.98, which is statistically significant at the 1 percent level. Because of the methodology used to calculate *BGEST*, the likelihood of this statistical significance might be increased.

²¹ A similar test of including the credit-equivalent off-balance-sheet asset measure could not be rejected, suggesting that this measure is not sufficiently comprehensive to capture off-balance-sheet activities.

levels, average profit X-inefficiency with the *BGEST* estimate is fairly constant but increases again for larger asset-size categories (*Chart 3*).²⁴

This slight U-shaped pattern traced by average profit X-inefficiency across size categories suggests that including banks that lie off the high-profit frontier when deriving estimates of other profit-efficiency measures may contaminate the results. Thus, subsequent efficiency computations utilize data from only the high-profit frontier. By using only the profit-efficient banks for subsequent efficiency computations, any potential contamination effect from the relationship between bank size and X-inefficiency is significantly diminished.

PROFIT ELASTICITY

To measure size-related profit efficiency using the profit-function parameter estimates, a measure of profit elasticity is computed that is similar to the cost-elasticity measure used in most cost-efficiency studies.²⁵ Profit elasticity, *PE*, is intended to capture the responsiveness of profit to an equally proportionate increase in all outputs. Averages of the explanatory variables are found within each size category and then used to compute *PE* for that category. That is, *PE* measures the percentage change in profit that results from an equal, proportionate change in all outputs in the product mix. Product mix is being held locally constant so that *PE* will capture only changes in size.

If profits rise proportionately with increases in size, then $PE = 1$. If profits increase disproportionately more (less) than a proportionate increase in all outputs, then $PE > 1$ (< 1). A value of $PE > 1$ indicates that a given percentage increase in size is associated with an

Table 3
Estimated Profit Elasticities (*PE*)

Category	Total assets	<i>PE</i> when excluding an off-balance-sheet measure	<i>PE</i> when including <i>BGEST</i>
1	< \$25 million	.663*	.818†
2	\$25 million–\$50 million	.832*	.911
3	\$50 million–\$100 million	.917†	.963
4	\$100 million–\$300 million	.965†	.985
5	\$300 million–\$500 million	.985‡	.994
6	\$500 million–\$1 billion	.991	.996
7	\$1 billion–\$5 billion	.993	.992
8	\$5 billion–\$10 billion	1.055	.982
9	> \$10 billion	1.020	.481

* significantly different from 1 at the 1 percent level.

† significantly different from 1 at the 5 percent level.

‡ significantly different from 1 at the 10 percent level.

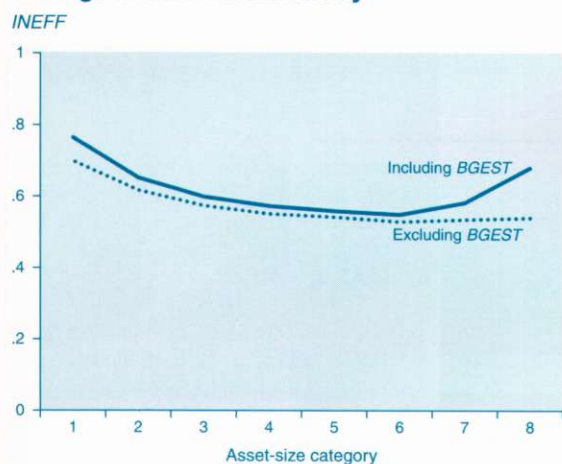
SOURCE: FFIEC Reports of Condition and Income, authors' calculations.

even larger percentage increase in net income. As a result, profit efficiency can be improved through increases in size as long as $PE > 1$. When $PE < 1$, profit efficiency declines with increases in size so that expanding output does not increase profits by as much.

Table 3 provides estimates of *PE* derived from the parameters of best-practice profit functions estimated with data from the high-profit frontier. Estimated profit elasticities for the model that excludes the *BGEST* off-balance-sheet measure indicate the presence of statistically significant, though decreasing, profit diseconomies extending to about the \$500 million on-balance-sheet asset size. This result suggests that proportionately expanding all outputs does not proportionately increase profits by as much. While *PE* exceeds a value of one for banks in size categories of \$5 billion and above, these estimates are never statistically different from one. Thus, above the roughly \$500 million total asset size, there does not appear to be any significant profit diseconomies associated with further increases in size.

When the *BGEST* proxy is included in the model, the resulting estimates of *PE* suggest an alternative inference. All *PE* estimates are less than one, but only the estimate obtained for the smallest bank category (less than \$25 million in total assets) is statistically significant. Thus, with the exception of those banks, there appear to be no significant profit efficiencies or inefficiencies associated with alternative sizes. That is, the statistically significant profit diseconomies found in the model that excludes *BGEST* seem to disappear (except for the smallest banks); the view that profit improvements are proportionate to increases in size for all asset-size categories

Chart 3
Average Profit X-Inefficiency



²² See the appendix for a more formal description of the *INEFF* calculation.

²³ This excludes the *INEFF* measure for the largest size category in the model. Efficiency computations for the largest size category are unstable because the category contains fewer banks, which are of widely varying sizes. The variance of the prediction error for predicted profits gets very large when the values of the explanatory variables are far from their mean values, which clearly happens for the largest size category.

²⁴ We use on-balance-sheet assets to provide a comparison with other studies.

²⁵ See the appendix for a formal description of this profit-elasticity measure.

Table 4
Estimated Profit Expansion Path Subadditivity (PEPSUB)

Adjacent size categories	PEPSUB when excluding an off-balance-sheet measure	PEPSUB when including BGEST
1 to 2	.168*	.088
2 to 3	.083†	.037
3 to 4	.036†	.014
4 to 5	.015†	.006
5 to 6	.009	.003
6 to 7	.005	.004
7 to 8	-.002	.011
8 to 9	.025	.232

* significantly different from 0 at the 1 percent level.

† significantly different from 0 at the 5 percent level.

SOURCE: FFIEC Reports of Condition and Income, authors' calculations.

greater than \$25 million cannot be statistically rejected when including the *BGEST* off-balance-sheet output measure in the model. Locally, in asset-size categories ranging between \$100 million and \$10 billion, the respective profit elasticities are extremely close to a value of one. An elasticity value of one indicates that net income expands at approximately the same rate as asset size. Thus, with the exception of the smallest size category, there is no scale-related profit-efficiency advantage or disadvantage associated with expansion.

The above result is important for two reasons. First, it suggests that omitting the proxy for off-balance-sheet assets from the profit function leads to estimates that incorrectly support the notion that local profit diseconomies exist with increases in size for banks with up to \$500 million in total on-balance-sheet assets. Second, it suggests that there is no single optimum bank size but rather a wide range of sizes throughout which there is little or no difference in scale-related profit efficiencies.

PROFIT EXPANSION PATH SUBADDITIVITY

The estimates of *PE* presented above are derived under the assumption that size increases are unaccompanied by changing output mix. Because off-balance-sheet activities are more common in larger banks, the relationship between size and profit efficiency should be examined when output-mix changes are not held constant. In other words, the combined effects of size and output mix should be examined to see whether there is a profit incentive to either grow or shrink. To do this, we adapt a commonly used competitive viability measure, which we call profit expansion path subadditivity (*PEPSUB*).²⁶ This measure examines whether

the profit of a larger bank (given its output mix) can be duplicated by the profits of a smaller bank (given its output mix) and that of a hypothetical bank, which, together with the smaller bank, duplicates the outputs of the larger bank. If the profits of the larger bank exceed the sum of the profits of the smaller and hypothetical banks, then a profit advantage exists for the larger bank.

If profit (or net income) of the larger bank exceeds the combined net incomes of the smaller bank and the hypothetical bank, then *PEPSUB* > 0 and the larger bank's size and output-mix combination provides a profitability advantage over the smaller bank with different output mixes. Under these circumstances, smaller banks will not be competitively viable in the long run. If *PEPSUB* < 0, then larger banks do not have a profit-efficient size and output mix and will not be competitively viable in the long run.

Table 4 provides estimates of *PEPSUB* for adjacent asset-size categories estimated using the high-profit frontier.²⁷ The *PEPSUB* estimates for the model without the off-balance-sheet measure indicate that statistically significant profit expansion path subadditivity can be found through the first five asset-size categories. This suggests that increasing size and changing output mix improve profit efficiency up to approximately the \$500 million asset size. So among the smaller size categories, this measure suggests that smaller banks will not be competitively viable in the long run. Beyond \$500 million in assets, however, increasing size and changing output mix have no statistically significant influence on profit efficiency.

But, similar to the results for *PE*, when *BGEST* is incorporated into the model to proxy off-balance-sheet activities, the results indicate that the combined effects of changing size and output mix have no statistically significant impact on profit efficiency. Although the estimates for *PEPSUB* are always greater than zero, they are never statistically significant. Thus, once the off-balance-sheet measure *BGEST* is included in the profit function, there is no longer evidence suggesting that smaller banks are not competitively viable.

EFFICIENCY RESULTS SUMMARY

Taken together, the profit-efficiency results presented here indicate that *BGEST* helps to explain the differences in net income across different size banks by including a useful output measure for off-balance-sheet activities. We pro-

²⁶ See the appendix for a formal derivation of the profit expansion path subadditivity measure. Berger, Hanweck, and Humphrey (1987) introduced a measure to compute expansion path subadditivity with a focus on costs. The measure gives the proportional cost increase from two-firm instead of one-firm production of outputs. As explained in Berger, Hunter, and Timme (1993), expansion path subadditivity provides a more reasonable representation of the opportunity of existing banking firms to change their outputs than scope economies by combining the scale and product mix effects of moving from each size class mean to the mean of the next largest size class.

²⁷ Consistent with the literature, adjacent size classes are used to evaluate expansion path subadditivity. Furthermore, given the ranges used to represent the nine size categories, the relevant move is to the next largest asset-size category, not to the largest.

vide evidence that excluding a measure for these activities is not supported statistically and may distort efficiency computations. When including the *BGEST* measure as an output in the profit function, however, no evidence of a statistically significant relationship between profit efficiency and size remains, except for the smallest size category.

Moreover, given that other studies that have addressed off-balance-sheet activities report that the largest banks appear to be cost inefficient, the absence of profit inefficiency found here suggests that off-balance-sheet activities are revenue efficient. The inclusion of *BGEST* with on-balance-sheet assets seems to indicate that traditional measures used to evaluate efficiency are distorted. This result contradicts earlier efficiency research that concludes that increased consolidation in the banking industry would likely result in a less efficient banking industry. Instead, banks appear to be relatively equally efficient across most size categories, and no apparent profit economies or diseconomies are evident when including the *BGEST* off-balance-sheet output in the models. This result implies that banks of many sizes and types are competitively viable and that ongoing consolidation in the banking industry will not harm and may improve overall profit efficiency.

POLICY IMPLICATIONS

These results also highlight a common situation faced by bank regulators: if the traditional efficiency computations are inaccurate because they lack a growing and significant output measure, then the traditional regulatory process might be one step behind as well. Banking regulators are primarily concerned with maintaining the safety and soundness of the banking system. Key to this effort is early identification of a bank's troubled status so that failure can be avoided, or the resolution costs minimized, and any potential contagion effects eschewed.²⁸

One of the most important causes of bank failure that is consistently identified in the research is the quality of bank management—a crucial element of institutional success but difficult to measure empirically.²⁹ Yet, closely related to the quality of bank management is bank efficiency: the process of transforming banking inputs into outputs. Accurately modeling this transformation process as a proxy for management quality has proved effective in differentiating between banks that survive and those that fail.³⁰

Traditional bank regulation focuses on in-depth knowledge of individual institutions and relies primarily on the evaluation of traditional bank efficiency and performance outcomes. But this approach cannot be utilized in the new banking environment—characterized by financial innovation and more off-balance-sheet activities. Bank regulators, therefore, are faced with the difficult task of having to accurately quantify the risks and returns from nontraditional activities and then incorporate them into new measures of efficiency and performance. Or, they may have to rethink the regulatory process so that these risks are evaluated and curbed more by banks themselves, with increased reliance on market discipline.

While incremental improvements to maintain capital requirements, update supervisory oversight and monitoring capabilities, and restrict risky activities can be effective in the short run, regulators should also consider more radical changes to bank regulation in the long run. Such approaches might include the precommitment approach to capital requirements proposed by Kupiec and O'Brien (1995), reduced regulatory oversight in exchange for limited access to the government safety net discussed in Hoenig (1996), privatizing the FDIC as an insurance company and redefining the social contract by rethinking the role banks play in society addressed by the Bank Administration Institute and McKinsey & Company (1996), or adopting some form of a collateralized banking system as outlined in Edwards (1996). These proposed changes to the regulatory process are important because of the difficulties inherent in identifying, monitoring, and controlling risks from state-of-the-art financial innovation.

CONCLUSION

We have shown that the use of traditional methods and measures to evaluate bank efficiency can be misleading for banks that have embraced nontraditional activities. Using a traditional set of inputs and on-balance-sheet outputs in a profit function model utilizing the thick frontier approach, we find statistically significant profit diseconomies and profit expansion path subadditivity out to an asset size of approximately \$500 million. In particular, the profit elasticity results suggest that expanding output while holding mix constant up to roughly this asset size does not increase profits at nearly the same rate. However, when product mix is allowed to vary, the profit expansion path subadditivity results suggest that increas-

²⁸ Understanding the causes of bank failure and the development of accurate bank failure-prediction models has become an important area of research. See Barr and Siems (1997) and Cole, Cornyn, and Gunther (1995) for more on bank failure-prediction models.

²⁹ See Siems (1992); Seballos and Thomson (1990); Pantalone and Platt (1987); and Graham and Horner (1988) for evidence that bank failures are primarily the result of mismanagement.

³⁰ See Barr, Seiford, and Siems (1993) for a data envelopment analysis approach to measuring bank efficiency that finds significant differences in average efficiency scores between surviving and failing institutions.

ing size—again up to approximately \$500 million in assets—appears to provide a profitability advantage.

In contrast, we find that when including the Boyd and Gertler (1994) proxy for off-balance-sheet activities as an essential and necessary output in our profit function model, evidence of a statistically significant relationship between profit efficiency and size can no longer be found. Moreover, excluding the Boyd and Gertler off-balance-sheet approximation from the profit function models is not supported statistically, and its absence may distort traditional efficiency computations by seriously understating actual bank output. This result—which contradicts earlier bank-efficiency research—implies that banks of many sizes and types are competitively viable and suggests that ongoing consolidation in the banking industry will not harm and may improve overall profit efficiency.

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Appendix

The methodology we use to compute profit efficiency is well established in the literature. This appendix provides a broad overview of the methodology and equations used to compute the various efficiency measures we employ in this study. Interested readers are directed to Clark (1988); Berger, Hancock, and Humphrey (1993); Berger, Hunter, and Timme (1993); and Berger and Humphrey (1997) for more details on bank efficiency models.

A GENERALIZED INDIRECT PROFIT FUNCTION

The profit function to be estimated has the composite specification similar to profit functions utilized in several other recent studies.¹ The general composite profit function utilizes a quadratic structure for outputs and a log quadratic structure for input prices.² It is best viewed as a flexible, second-order approximation to a wide class of specifications and takes the following general form:

$$P^{(\theta)} = \left[\alpha_0 + \sum_m \alpha_m Z_m + \sum_i \beta_i y_i + \frac{1}{2} \sum_i \sum_j \beta_{ij} y_i y_j + \sum_i \sum_k \gamma_i \ln r_k \right] \cdot \exp \left[\sum_k \delta_k \ln r_k + \sum_k \sum_l \delta_{kl} \ln r_k \ln r_l \right]^{(\theta) + \epsilon}$$

The superscript θ indicates the application of the Box-Cox transformation to both sides of the expression.

The i outputs included in the profit function appear as y_i , the k input prices appear as r_k , and Z_m denotes the m additional variables that are included to capture other influences on profitability that are neutral with respect to the included outputs.³ In all instances the measure of profit, P , employed as the dependent variable is net income.⁴ A nonlinear least squares procedure is used to estimate the parameters using a method discussed in Carroll and Ruppert (1988) and Clark (1996).⁵

MEASURING PROFIT X-INEFFICIENCY

Humphrey and Pulley (1997) use a measure of profit X-inefficiency similar to this in their study:

$$INEFF = \frac{\frac{\beta_{Q1} X_{Q1}}{EQ_{Q1}} - \frac{\beta_{Q4} X_{Q1}}{EQ_{Q1}}}{\frac{\beta_{Q1} X_{Q1}}{EQ_{Q1}}}$$

$INEFF$ measures the difference between the efficient technology used by the high-profit banks (β_{Q1}) and the inefficient technology used by the low-profit banks (β_{Q4}),⁶ using the data for the efficient frontier as a base where X_{Q1} is the mean value of each explanatory variable across all banks in the most profitable frontier and EQ_{Q1} represents average equity capital across all banks in the most profitable frontier. Thus, the difference in predicted profitability between the high- and low-profit banks can be rewritten as

$$INEFF = \frac{ROE_{Q1}^* - ROE_{Q4}^*}{ROE_{Q1}^*}$$

where ROE_{Q1}^* denotes the predicted rate of return on equity. $INEFF$, therefore, measures the percent difference in predicted profit between the most profitable and least profitable quartiles.

MEASURING PROFIT ELASTICITY

The following profit elasticity measure is the counterpart of the cost elasticity measure used in many cost efficiency studies:

$$PE = \sum_i (\partial P / \partial y_i) \cdot (y_i / P),$$

where P denotes profit (net income) and y_i denotes the i th output. PE captures the responsiveness of profit to an equally proportionate increase in all outputs. Variable averages are found within each size category and then used to evaluate profit elasticity for that size category. When $PE > 1$, profits increase disproportionately more than a proportionate increase in all outputs. When $PE < 1$, profit elasticity declines, so a proportionate increase in outputs does not increase profits by as much.

PROFIT EXPANSION PATH SUBADDITIVITY

The following $PEPSUB$ measure was recently used by Clark and Siems (1997):

$$PEPSUB = \frac{P(Q_L) - [P(Q_S) + P(Q_H)]}{P(Q_L)}$$

where $P()$ denotes the profit function, Q_L denotes the mean output mix of banks in a given large-size category, Q_S denotes the mean output mix of banks in the next smallest size category, and Q_H denotes the output mix of a hypothetical-size bank necessary to duplicate the output mix of the large-size banks so that $Q_H = Q_L - Q_S$.⁷ Consistent with the literature, adjacent size classes are used to evaluate expansion path subadditivity. For most banks, the relevant move is to the next largest asset-size category, not to the largest. $PEPSUB$ is computed across size categories to see whether the combined changes in size and product mix provide a profit incentive to grow or shrink.

When $PEPSUB > 0$, the profit from the large bank exceeds the combined profits from the smaller bank and the hypothetical bank, which indicates that the smaller bank will not be competitively viable in the long run. When $PEPSUB < 0$, the larger bank does not have a profit-efficient size and output mix and will not be competitively viable in the long run.

¹ See Pulley and Braunstein (1992); Pulley and Humphrey (1993); and especially Humphrey and Pulley (1997).

² Cross-product terms between the output and input price vectors link these two structures so that separability is not imposed.

³ The simplifying assumption that the variables Z_m are neutral with respect to the y_i outputs significantly reduces the number of parameters that must be estimated and the high probability of multicollinearity problems that may result by eliminating a whole set of second-order and interaction terms.

⁴ Humphrey and Pulley (1997) report that dropping output quantities from the profit function, while including output prices, is strongly rejected by the data. In contrast, they report that dropping output prices does not appear to quantitatively or statistically alter their results.

⁵ The method is a two-stage iterative procedure with a maximum of 400 iterations and a tolerance level of 0.0001.

⁶ The β 's are the parameter estimates obtained from the respective profit functions.

⁷ We use $P(Q_L)$ in the denominator as a matter of convenience to convert the measure into a percentage. In theory, $Q_H = Q_L - Q_S$ could be negative, but the size categories are so large that this does not happen.

Government Guarantees and Banking: Evidence from the Mexican Peso Crisis

Robert R. Moore

While [government] guarantees are reassuring to depositors, they weaken the competitive advantage that would otherwise accrue to financially strong banks.

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Ongoing growth in Mexico is pushing the 1994 peso crisis further into the background. Mexico's gross domestic product (GDP), which has been growing since the second quarter of 1996, rose 8.1 percent in the third quarter of 1997 on a year-over-year basis. However, Mexico's economy continues to show some lingering effects from the crisis. While inflation has moderated, it remains above its precrisis level. And the Mexican government estimates that its cost of addressing stress in the banking industry may amount to 8.4 percent of 1996 GDP on a present-value basis.¹

Mexico is not the only country that experienced significant economic fluctuations following the December 1994 peso devaluation, (see the box entitled "Synopsis of the Peso Crisis"). Argentina also suffered turmoil in its banking system and economy. As in Mexico, the banking system in Argentina experienced a sharp reduction in the inflation-adjusted value of bank deposits.

Argentina and Mexico differed, however, in the supervisory policies they pursued both before and after the devaluation. When the peso crisis occurred, Mexico had a deposit insurance system in place that provided extensive coverage of bank deposits. After the onset of the crisis, these government guarantees were augmented by additional programs to assist banks and their borrowers. Argentina, in contrast, did not provide deposit insurance at the onset of the peso crisis but thereafter adopted a limited deposit insurance system and offered some support to its banks.

Government guarantees weaken the link between a bank's financial strength and the safety of its deposits. In so doing, they diminish depositors' incentive to avoid financially weak banks. Hence, to the extent that government guarantees were extensive in Mexico but negligible in Argentina, I would expect deposit growth at individual banks to be unrelated to bank financial strength in Mexico but to be positively related to bank financial strength in Argentina.

The empirical examination below supports these expectations and highlights an important cost of government guarantees: guarantees can suppress the market forces that would otherwise tend to channel funding toward stronger banks and away from weaker ones.

BANKING POLICY BACKGROUND

How governments should respond to financial difficulties in banking has long been debated. Some analysts argue that government

I would like to thank Bill Gruben, Moisés Schwartz, and Carlos Zarazaga for helpful comments and Agustín Villar for providing data on Argentinean banks.

¹ Bank of Mexico (1997).

Synopsis of the Peso Crisis

The "peso crisis" refers to the economic turmoil that followed Mexico's abandonment of a policy that set explicit limits on the exchange rate between pesos and U.S. dollars. The Mexican government initiated a policy of exchange-rate-based stabilization in March 1988. Several modifications were made to this policy between March 1988 and December 1994, but throughout this period the government was committed to keeping the peso within a specified range of values.

On December 20, 1994, Mexico devalued the upper limit on the peso's value by 15 percent and two days later allowed the exchange rate to float. The accompanying chart shows the subsequent decline in the value of the peso and the increase in its volatility. A decline in GDP and an increase in inflation and interest rates are some of the other changes in the Mexican economy that followed the devaluation. These negative effects are all considered part of the peso crisis. (For a more detailed description of the crisis, see Gould 1996.)

The effects of the crisis extended beyond Mexico. Argentina experienced a decline in bank deposits and an increase in interest rates. The impact of the Mexican peso crisis on other Latin American countries varied in magnitude and form.

Mexico's Exchange Rate

Pesos per U.S. dollar, monthly average



SOURCE: Instituto Nacional de Estadística Geografía e Informática (INEGI) database.

The inflation-adjusted value of bank deposits contracted in Colombia but to a smaller degree than in Mexico or Argentina. Other countries in the region experienced a slump in share prices and a rise in interest rates. These spillover effects represented a potentially significant source of stress on the affected countries' banking systems.

assistance to the industry is undesirable because it distorts market incentives in a harmful way.² These analysts argue that policies that attempt to reduce the problems associated with banking distress create incentives that make such distress more likely. Shifting the costs associated with bad outcomes to the government reduces the incentive to avoid risks and thus makes risk-taking more likely.

Others argue that there are no close substitutes for bank credit for some borrowers; therefore, reductions in the supply of such credit can negatively affect the economy.³ Under this view, government assistance allows troubled banks to continue lending to viable businesses that might otherwise have difficulty obtaining credit.

Such government assistance could come in the form of regulatory forbearance, whereby regulators temporarily refrain from imposing their customary standards for bank safety and soundness. If, for example, a bank did not have enough capital to meet regulatory requirements, regulators could allow the bank to continue operating. Regulators might pursue such a policy if they believed the bank's weak capital position was transitory and imposing the usual standard would be deleterious.

A complete welfare analysis of the desirability of forbearance needs to consider several factors, including its impact on solvent institutions and the effect the anticipation of forbearance has on the incentive to adopt risky banking strategies. The policy's desirability also depends on whether the cost to the government of honoring deposit guarantees increases or decreases under forbearance—that is, whether closing an insolvent institution as soon as possible costs less than allowing the institution to attempt to grow out of its problems. Finally, the effect of forbearance on preserving lending flows and ameliorating weakened macroeconomic performance needs to be considered.

These factors contributed to the debate about government assistance to financial institutions in several recent episodes in the United States. When problems developed in the thrift industry, forbearance policies were pursued. As capital ratios at thrifts declined, the Federal Home Loan Bank Board reduced the amount of capital thrifts were required to hold and adopted an accounting methodology that artificially inflated the amount of capital thrifts carried on their books.⁴ Thrifts with depleted capital then had an incentive to pursue high-risk strategies to restore their capital positions. Kane

² See, for example, Kareken (1985).

³ See Bernanke and Gertler (1995) and the citations therein for a discussion of credit's role in the macroeconomy.

⁴ See Kane (1989) and Barth (1991) for more on the evolution of the thrift crisis.

(1989) argues that forbearance allowed thrifts to pursue high-risk strategies that ultimately increased the cost to the taxpayer of paying for thrift failures.

While the effects of the thrift crisis were felt nationwide, the situation in Texas was especially severe. Short and Gunther (1988) report that the continued operation of insolvent thrifts in Texas under forbearance policies created an unfavorable operating environment for solvent financial institutions. In particular, they find that solvent banks and thrifts in Texas offered higher interest rates on deposits than did their counterparts elsewhere in the country. Consequently, they conclude that the forbearance that kept insolvent thrifts operating in Texas penalized the solvent institutions.

More recently, financial problems among New England banks again raised the issue of the appropriate policy on weakened financial institutions in a regional downturn. Peek and Rosengren (1995) show that reductions in bank credit in New England during the 1990–91 recession were linked to reductions in bank capital. They point out that in a regional downturn, greater account of the macroeconomic consequences of bank regulatory actions is needed. While not an explicit call for regulatory forbearance, this is at least suggestive of easing standards when a region's financial industry and economy are weak.

Current U.S. policy is tilted away from government assistance to banks. In the wake of the bank and thrift crisis, the United States moved away from forbearance. In particular, the Federal Deposit Insurance Corporation Improvement Act of 1991 (FDICIA) ties regulatory actions to bank capital. Under FDICIA, a bank is subject to greater regulatory restraints as its capital ratio falls, culminating in closure when it falls below a critical level. These "prompt corrective action" features of FDICIA limit regulators' ability to forbear.⁵

Kaufman (1996) argues that FDICIA-type legislation offers a useful system for counterbalancing the effects of government guarantees in banking in developing countries. As Mishkin (1996) and others discuss, building a strong bank supervisory system to limit the potentially harmful effects of government guarantees is particularly important for developing countries. Because the banking system plays such a significant role in allocating capital in developing countries, banking disruptions will have an especially severe economic impact. Moreover, difficulties in acquiring information in developing countries may create a veil behind which the banks can abuse the government guaran-

tees. If government guarantees are available, then penetrating this veil with a strong supervisory system is important. With these issues in mind, the remainder of this article examines the extent of government banking guarantees in Mexico and Argentina and the relationship between those guarantees and deposit flows and bank financial condition.

RECENT BANKING POLICIES IN MEXICO AND ARGENTINA

A government's bank supervisory policies influence the relationship between banks and their depositors. Policies that guarantee deposits diminish depositors' concern about the soundness of their bank. This loss of concern tends to be more complete when government guarantees are extensive. While such guarantees are reassuring to depositors, they weaken the competitive advantage that would otherwise accrue to financially strong banks. By reducing that advantage, economic theory suggests that extensive government guarantees diminish banks' incentive to pursue policies that build financial strength.

Economists describe *market discipline* as the extent to which bank depositors—or bank liability holders in general—reduce banks' incentives to take risk. Gilbert (1990) reviews the related literature and reports that evidence of market discipline is mixed. Bank liability holders' sensitivity to a bank's risk profile depends on whether those liability holders believe they are covered by government guarantees. When government safety nets are prevalent—as they are in many countries—bank liability holders have little incentive to respond to changes in bank risk. Consequentially, neither the volume nor the price of bank liabilities would respond to such changes. An examination of Mexico and Argentina in the wake of the devaluation can potentially provide new evidence on the influence of liability holders on banks' risk-taking incentives and contribute to the market discipline literature. Because Argentina stands out as a country that offers a setting with relatively limited safety nets, it provides an environment in which market discipline may be likely to occur.⁶

Mexico Before the Devaluation

Even before the peso crisis, the Mexican government provided an important guarantee to depositors in its banking system through deposit insurance. The coverage offered by Mexico's deposit insurance fund, FOBAPROA

⁵ Such a policy has been endorsed by the Shadow Financial Regulatory Committee, a group of independent authorities that seeks to influence public policy on the financial industry. See Shadow Financial Regulatory Committee (1992) for some of its views on FDICIA.

⁶ The following description of government guarantees shows that Mexico has a more extensive set of guarantees than Argentina, based on the explicit guarantees established in the two countries. However, implicit government guarantees may also be important. Because of complexities associated with implicit guarantees, the discussion that follows is limited to explicit guarantees.

(Bank Fund for the Protection of Savings), is extensive. FOBAPROA explicitly offers full coverage of deposits, with limited exceptions.⁷ Such coverage could leave depositors with little concern about the condition of their bank, depending on their faith in the FOBAPROA guarantee.

Mexico After the Devaluation

As banks and their borrowers suffered financial stress during the peso crisis, the government stepped in to provide support beyond the FOBAPROA guarantee. Some of these programs aid banks directly, while others help them indirectly by assisting their borrowers. By supporting troubled banks, these programs further insulate depositors from the condition of their bank.

One program to help borrowers is the UDI (units of inversion) restructuring program, which indexes loans to the rate of inflation. The principal balance appreciates at the rate of inflation, and the borrower pays the real rate of interest on that principal balance.⁸ Moreover, the government funds discounted payments for borrowers with mortgages in the UDI program. When inflation and nominal interest rates soared during the peso crisis, some borrowers could not make the payments on their loans; the restructuring of those loans under the UDI program reduced the borrowers' monthly payments. Thus, borrowers that might have been driven into default by the rise in nominal interest rates were not, insulating lenders from inflation-induced defaults.⁹

The ADE (Immediate Support Program for Debtors) program also assists financially troubled borrowers.¹⁰ ADE offers interest subsidies and loan restructuring to distressed borrowers for up to eighteen months, in the hope that those borrowers can resume free market interest payments after they have recovered from their current difficulties. Here, too, banks may benefit indirectly from assistance to their borrowers.

PROCAPTE (Temporary Capitalization Program) provides direct capital assistance to banks through convertible subordinated debt. Unlike an issue of subordinated debt to the private sector, this debt does not provide banks with new funding because the government requires that they hold compensating reserve deposits against the PROCAPTE debt.

Finally, the loan-purchase/recapitalization program also assists capital-impaired banks. Under this program, the government purchases two pesos in loans from a bank for each peso in new capital the bank attracts. The govern-

ment bears part of the losses on those loans, with the bank bearing the remainder. In addition, the government purchases these loans with long-term, nonmarketable government bonds that pay capitalized interest until maturity. This program provides incentives to attract new capital to banks and insulates the banks from part of the losses on the affected loans.

Argentina Before the Devaluation

Before the Mexican crisis, Argentina offered the banking system little in the way of government guarantees. Not only was there no deposit insurance, but the government's ability to guarantee liquidity through the lender-of-last-resort function was limited by the central bank's charter and by a convertibility law.¹¹ In this environment, depositors would have viewed the financial strength of their bank as an important determinant of deposit safety.

Argentina After the Devaluation

Although Argentina took several steps to help its banking system after the peso devaluation, the support was not so pervasive that it precluded exit from the industry.¹² Of the 204 banks operating in December 1994, fourteen had been closed and forty-eight were merged with other banks by March 1997.

Part of the assistance to the banking industry took the form of deposit insurance. In April 1995, Argentina initiated insurance coverage of up to 10,000 pesos for short-term deposits and up to 20,000 pesos for long-term deposits.¹³ This insurance applies to both dollar- and peso-denominated deposits.¹⁴ Although such insurance could leave small depositors unconcerned about the condition of their bank, larger depositors would have the incentive to remain attuned to the financial condition of their bank, especially if other government support of the banking industry is limited.

Another step taken to support Argentinean banks was a reduction in reserve requirements, which provided banks with additional liquidity to satisfy depositor withdrawals. In addition, banks were allowed to satisfy the reserve requirements with dollar-denominated reserves at Argentina's central bank; this flexibility reduced banks' exposure to potential devaluations.¹⁵

Argentina also established several programs to assist banks directly. The central bank set up two funds, totaling \$1 billion, for buying assets from illiquid banks. The government established an additional \$2 billion fund for facilitating mergers of troubled banks and eased

⁷ See Bank of Mexico (1996) for details regarding FOBAPROA's commitment to insuring bank liabilities.

⁸ The UDI program moves the restructured loans off the balance sheet and replaces them with special government securities. The government estimates its cost (in present value) for this program at 21.6 billion pesos. In addition, the government estimates its cost for the additional benefits program for UDI mortgages at 27.2 billion pesos (Bank of Mexico 1997).

⁹ Gruben and Welch (1996) discuss the government's assistance to banks during the peso crisis in the context of the evolution of the Mexican financial system.

¹⁰ Urbina-Nandayapa (1995).

¹¹ The central bank charter limited the maturity and amount of loans to any one borrower. The convertibility law constrained the aggregate amount of central bank lending by tying the monetary base to foreign reserves.

¹² Calomiris (1996) discusses the tendency for governments to increase support of the banking system during times of financial stress.

¹³ Argentina has maintained an exchange rate of one peso for one U.S. dollar, so the insurance limits correspond to \$10,000 and \$20,000.

¹⁴ Republic of Argentina (1996).

¹⁵ See note 14 above.

a restriction that had limited the central bank's loans to illiquid banks to thirty days or less.¹⁶

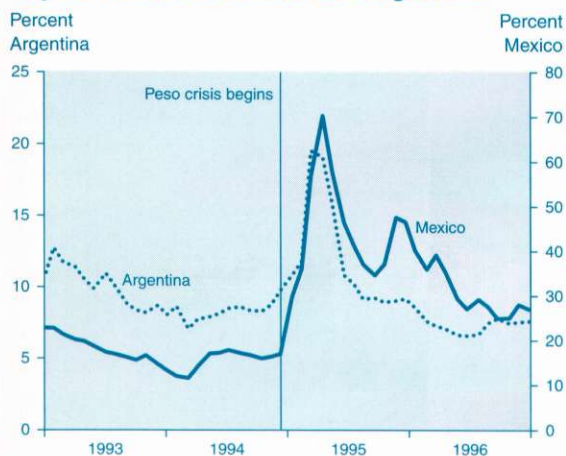
While these measures provided relief to banks, Argentina's convertibility law continued to constrain the extent of government assistance significantly. As discussed by Zarazaga (1995), the convertibility law ties Argentina's monetary base to its foreign reserves. Specifically, the monetary base cannot exceed foreign reserves by more than 25 percent, under the stipulated exchange rate of one Argentinean peso per U.S. dollar. This limit restricted the government's ability to finance its bank assistance through money creation.¹⁷

AGGREGATE BANKING EFFECTS

Chart 1 shows the large increases in interest rates banks in Mexico and Argentina faced following the onset of the peso crisis. In both countries, interest rates were higher in early 1995 than they had been in several years. As the chart shows, interest rates in Mexico rose more than they did in Argentina. Banks in both countries, however, experienced an increase in the cost of deposit funding.

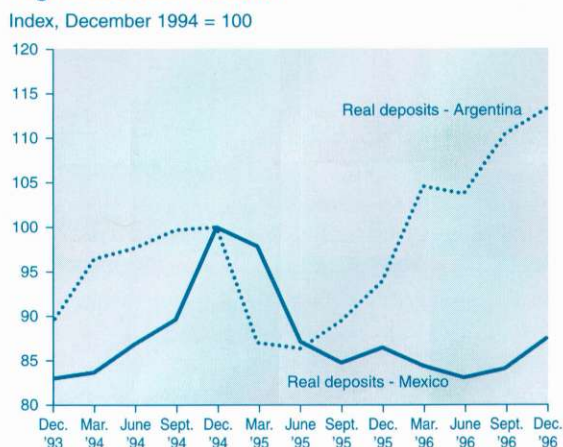
As interest rates rose during the peso crisis, bank deposits fell, consistent with a reduction in the supply of bank deposits. Chart 2 shows what happened to the inflation-adjusted amount of deposits in Argentina and Mexico.¹⁸ From December 1994 to June 1995, inflation-adjusted deposits fell by 13.6 percent in Argentina and by 12.9 percent in Mexico. Despite the similarity in the percentages, the reductions occurred in different ways. In Mexico, the nominal value of deposits actually increased by 15.8

Chart 1
Deposit Rates in Mexico and Argentina



SOURCES: Miguel A. Broda and Associates, "Carta Económica"; INEGI databases.

Chart 2
Inflation-Adjusted Bank Deposits in Argentina and Mexico



SOURCES: Comisión Nacional Bancaria, "Boletín Estadístico de Banca Múltiple," various issues; INEGI database; Salomon Brothers; Central Bank of Argentina; author's calculations.

percent between December 1994 and June 1995, but a 32.9 percent increase in the price level eroded their real value. In Argentina, however, prices rose only 1.1 percent, so the decline in the real value of deposits reflects an approximately equal drop in their nominal value.¹⁹

The analysis of deposit flows at individual banks below considers those that occurred between December 1994 and June 1995. As Chart 2 shows, in both Argentina and Mexico the aggregate value of deposits reached quarterly peaks in December 1994. By June 1995, the worst of the slide in the inflation-adjusted value of deposits was over in both countries. Thus, considering the changes in deposits that occurred at individual banks during this period captures the worst of the crisis in terms of the decline in the inflation-adjusted value of deposits.

BANK FINANCIAL CONDITION AND DEPOSIT FLOWS DURING THE PESO CRISIS

Although both Argentina and Mexico have extended government assistance to their banking systems, the degree to which that assistance has supplanted free market forces in shaping banking outcomes remains an empirical issue. To the extent that depositors view the government guarantees of their deposits as incomplete, there is an incentive for depositors to reduce their exposure to relatively weak banks when the banking system is under stress. Thus, evidence on the link between deposit flows and financial condition at individual banks can shed

¹⁶ Carrizosa, Leipziger, and Shah (1996).

¹⁷ See Caprio, et al. (1996) for more on the constraints a currency board imposes on the lender-of-last-resort function.

¹⁸ Throughout this article, "deposits" in Mexican banks refers to *captación directa*, or direct funding. Direct funding predominantly consists of deposits but includes certain repurchase agreements and bankers' acceptances.

¹⁹ The difference in inflation in Mexico and Argentina during the peso crisis reflects the variation in monetary policies in the two countries.

light on the role of free market forces in shaping banking outcomes.

Before proceeding with the empirical analysis, some caveats are worth noting. There are potential pitfalls in making international comparisons based on accounting data.²⁰ Also, differences in the link between deposit growth and individual bank strength in the two countries could stem from factors other than differences in supervisory policies.²¹ Mexico was directly affected by the crisis, while Argentina was only affected indirectly through spillover effects, as mentioned in the box. The spillover effects from the crisis, however, had the potential to disrupt an affected country's banking system significantly through higher interest rates and deposit outflows, among other factors. Moreover, the similarity in the decline in inflation-adjusted deposits in Mexico and Argentina suggests that the crisis stressed both banking systems intensely.

While keeping these caveats in mind, the empirical work proceeds to examine the link between deposit flows and bank characteristics. Various financial characteristics could play a role in shaping depositors' perceptions of the soundness of their banks. A natural candidate would be some measure of banks' capital adequacy, given the traditional view of capital as protecting debt holders.²² Other potential financial characteristics include measures of asset quality, such as the ratio of past-due loans to total assets. In any case, detailed analyses using numerous financial measures are not practical because only sixteen banks in Mexico are suitable for regression analysis over the relevant period.²³

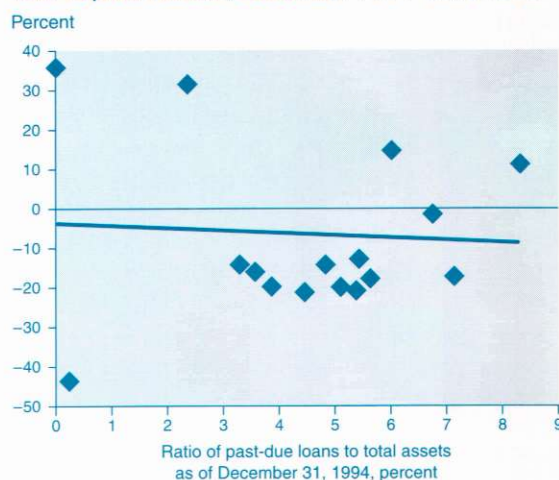
Mexico

Chart 3 shows the connection between deposit flows and financial condition at individual Mexican banks. A casual inspection of the chart reveals the lack of a relationship between the ratio of past-due loans to total assets and deposit growth. Moreover, the slope of the regression line is not statistically different from zero. Hence, depositors did not systematically discriminate among banks in terms of their past due loan-to-asset ratio in choosing where to hold deposits.²⁴

The following regression confirms and extends the results from Chart 3:

$$\begin{aligned}
 DEPGRO = & 59.3 + .473 PDL/TA - .888 EQ/TA \\
 & (79.0) (3.83) \quad (3.51) \\
 & - 8.38 TA - .386 DEP/L, \\
 & (6.57) \quad (.662),
 \end{aligned}$$

Chart 3
Deposit Growth and Asset Quality in Mexico
Real Deposit Growth, December 1994–June 1995



SOURCES: Comisión Nacional Bancaria, "Boletín Estadístico de Banca Múltiple"; INEGI database; author's calculations.

where *DEPGRO* is the percentage change in inflation-adjusted deposits between December 1994 and June 1995; *PDL/TA* is past-due loans as a percentage of total assets, included to measure the quality of the asset portfolio; *EQ/TA* is equity capital as a percentage of total assets, included to measure the ability to maintain solvency in case of financial losses; *TA* is the logarithm of total assets in millions of Mexican pesos, included to control for the potential influence of bank size on depositor behavior; and *DEP/L* is deposits as a percentage of total liabilities, included to control for the potential influence of liability composition on depositor behavior. All explanatory variables are as of December 1994. There are sixteen observations. Standard errors are shown in parentheses.

None of the explanatory variables is individually significant at the 10 percent level. The variables are also not jointly significant at the 10 percent level. Thus, the evidence does not support the notion that the financial variables in the regression influenced deposit flows.²⁵ Given that deposit flows were unrelated to bank financial condition, the evidence is consistent with depositors behaving as if they perceived the insurance coverage of their deposits as completely shielding them from risk associated with their bank's financial condition.

Argentina

Results for Argentina differ noticeably from those for Mexico. Chart 4 reveals that higher ratios of past-due loans to total assets are associated with greater declines in deposits.

²⁰ To the extent that accounting systems differ across countries, the data may not be directly comparable. Analyzing the countries separately may ameliorate this problem. Suppose, for example, that the accounting measures of past-due loans differ in two countries but are linear functions of the same underlying, fundamental measure. Examining statistical significance in regressions of deposit flows on past-due loans in the two countries would be meaningful despite the differences in accounting systems. Conducting a statistical test for the equality of slope coefficients in the countries would remain problematic.

²¹ Differences in the strength of the countries' banking systems at the onset of the crisis and differences in macroeconomic policies could also affect the results.

²² Rojas-Suárez and Weisbrod (1996) argue that suitable measures of capital may be unavailable for Latin American banks. Based on the rates offered on deposits, they conclude that bank liability holders in both Mexico and Argentina identified risky banks.

²³ The other banks in operation between December 1994 and June 1995 are unsuitable because they were in operation for only a short time before the onset of the peso crisis and thus had unseasoned asset portfolios and a developing depositor base.

²⁴ While the evidence shows depositors behaving independent of banks' financial condition, other creditors may have considered banks' financial condition. Bank of Mexico (1996) reports that weak banks faced higher rates in the interbank market, providing evidence of that market penalizing weak banks.

²⁵ However, with only sixteen observations, identifying effects statistically is difficult. These variables may have influenced deposit flows, but the small number of observations masks their influence.

Moreover, this tendency is statistically significant. Thus, the results are consistent with depositors discriminating among banks based on the quality of asset portfolios.

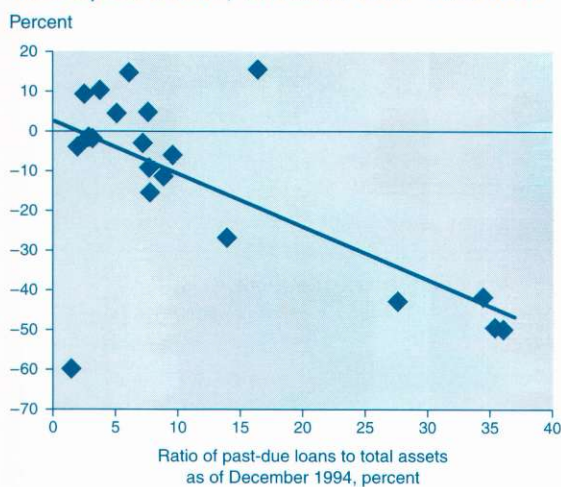
The following regression model shows the relationship between deposit flows and bank financial characteristics:

$$\begin{aligned}
 DEPGRO = & -122^* - 1.05 PDL/TA^\dagger \\
 & (64.5) \quad (.307) \\
 & + .821 EQ/TA^* + 2.98 TA \\
 & (.432) \quad (4.70) \\
 & + 1.07 DEP/L^\dagger, \\
 & (.256),
 \end{aligned}$$

where * and † denote statistical significance at the 10 percent and 1 percent levels, respectively. The model is identical to the one for Mexico, except that *TA* is the logarithm of total assets measured in millions of Argentinean pesos, and there are twenty observations instead of sixteen.²⁶

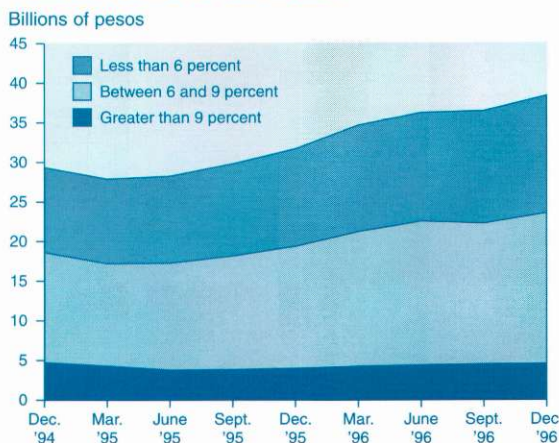
The results show that higher deposit growth is associated with lower ratios of past due loans to assets, higher ratios of capital to assets, and higher ratios of deposits to liabilities. The first two results are consistent with deposits moving to banks with greater intrinsic financial strength.²⁷ The last result may reflect the effect of the government's move to cut reserve requirements. Banks with a larger fraction of their liabilities coming from deposits would receive a greater boost to liquidity from the reduction in reserve requirements. The results support the view that depositors discriminated based on the financial condition of banks. Such

Chart 4
Deposit Growth and Asset Quality in Argentina
Real Deposit Growth, December 1994–June 1995



SOURCES: Central Bank of Argentina; author's calculations.

Chart 5
Deposits at the Top 20 Argentinean Banks
Grouped by December 1994 Ratios of Past-Due Loans to Total Assets



SOURCES: Central Bank of Argentina, author's calculations.

discrimination is consistent with depositors viewing the safety of their deposits as linked to the financial strength of their bank.

The results for Argentina show that greater financial strength was accompanied by more rapid deposit growth from December 1994 to June 1995. Did the deposits the stronger banks gained during this time flow back to the weaker banks after the worst of the crisis was over? To address this question, Chart 5 tracks deposits at the top twenty Argentinean banks from December 1994 to December 1996, with the banks grouped by their past-due loan-to-asset ratio as of December 1994. The banks with the poorest asset quality had \$4.7 billion in assets in December 1994 but never regained that level of deposits despite the strong growth in total Argentine deposits between December 1994 and December 1996. Banks in the medium- and high-asset-quality groups, however, had deposit growth of 37 and 38 percent, respectively, over that same period. Thus, the tendency for deposit growth to be higher at banks with higher asset quality increased their share of deposits between December 1994 and December 1996.

CONCLUSION: LETTING THE BANKING MARKET WORK

The evidence presented above shows Argentina and Mexico pursuing supervisory policies that produce differing results. Because Mexico supports its banks with extensive government guarantees, depositors behave as if the safety of their deposits is independent of their bank's condition. Although Argentina increased

²⁶ Using the twenty largest banks in Argentina creates a sample comparable to that for Mexico in terms of the size of both the sample and the banks. Moreover, as of December 1994, these banks accounted for 64 percent of Argentina's total banking assets, with the other 36 percent divided among the remaining 184 banks. If the remaining banks are included in the regression, the asset quality and capitalization variables are no longer significant. Thus, while the bulk of banking activity in Argentina is characterized by a significant link between bank financial condition and deposit flows, the evidence does not show that link extending to the entire population of banks.

²⁷ Conceptually, growth in deposits could occur either through depositors choosing to move their funds into a bank or from one bank acquiring another bank and its deposits. The banks in the sample, however, did not acquire any banks between December 1994 and June 1995, so the growth in deposits was not due to acquisitions.

its support of its banks during the Mexican peso crisis, depositors behave as if the safety of their deposits is linked to the condition of their bank. What is important about this distinction?

The quick answer is that depositors in Mexico are in a more favorable position than those in Argentina, because they are free from worry about the safety of their deposits. Such freedom has a cost, however. When depositors view the safety of their deposits as unrelated to the condition of their bank, they become willing to fund weak and strong banks equally. When this occurs, strong banks lose the funding advantage their strength would otherwise confer.

That funding advantage serves a useful purpose because stronger banks are those with a better record than their peers for sound lending decisions. If these banks continue making good decisions, then directing funds to the stronger banks will tend to result in the funds being used well. Banks with lending policies that result in repaid loans are directing capital to borrowers that are passing the market test for the worth of their projects.

When funds flow to weaker banks because of government guarantees, the market mechanism that would otherwise limit the size of those banks is subverted. Absent guarantees, banks with lending policies that produce unpaid loans and financial losses that erode the capital-to-asset ratio tend to have difficulty obtaining funding; if funding declines, so does the size of the bank. Thus, strong banks would tend to grow while weak banks would shrink, thereby allowing the industry to evolve toward strength. This process breaks down when guarantees allow weak and strong banks equal access to funding.

The cost of guarantees may also emerge more directly. If weak banks can grow by availing themselves of subsidized funding, they have the potential to produce increasing losses. Such losses would eventually result in a liability for taxpayers. In anticipation of such problems, the government can attempt to limit the losses by regulating the behavior of the insured banks. Attempting to limit the effects of extensive guarantees, however, may require an equally extensive—and expensive—regulatory system.

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