Depositor Behavior and Market Discipline in Colombia

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Abstract

This study examines how depositors choose among different banks and over time in Colombia, focusing on whether they discipline bank behavior. By controlling for a more comprehensive set of risk/return factors, the study improves upon conventional market discipline tests. Panel data estimations for 1985-99 show that depositors prefer banks with stronger fundamentals, and that banks tend to improve their fundamentals after being "punished" by depositors. Banks with stronger fundamentals benefit from lower interest costs and higher lending rates. Market (or "regulatory") discipline therefore appears to exist in Colombia, perhaps thanks to certain key design features of the deposit insurance scheme.

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I. INTRODUCTION

With the recent outbreak of high-profile financial and currency crises throughout the world, the issue of proper regulation of the banking system has become critical to the policy discussion. Although it is recognized that less government interference and hence greater operation of market forces are conducive to more rapid development of the financial system which, in turn, tends to generate higher economic growth (Levine, 1997), it is also increasingly apparent that as financial systems are liberalized, they become more vulnerable and subject to greater instability (Demirguc-Kunt and Detragiache, 1998; Caprio and Honohan, 1999). For this reason, regulation and supervision of financial institutions must be stronger and more carefully designed in order to reduce instability and minimize the probability of crisis.

One crucial issue in banking regulation is whether the government should provide a safety net for depositors, and if so, what form it should take. Starting with the classic work by Diamond and Dybvig (1983), there is a strong argument in favor of establishing a liquidity insurance scheme for depositors in order to prevent the costly effects of the types of runs that are endemic to a fractional reserve banking system. Of course, one drawback of such a scheme is moral hazard, as insured depositors no longer have a strong incentive to monitor the behavior of banks, which then have an incentive to assume greater risks. Therefore, the design of an insurance scheme faces a tradeoff between the reduction of risk coming from bank runs and the additional risk induced by moral hazard.

Recently there has been significant interest in examining how depositors choose among different banks, and whether this choice reflects market discipline, whereby depositors would effectively monitor bank management and reward well-managed banks

while punishing those poorly managed. If depositor behavior is found to be consistent with market discipline, then this suggests that there is limited moral hazard, an indication that depositors do not perceive their deposits to be fully protected.

In this paper we use Colombia as a case study to explore depositor behavior and market discipline, and to address an apparent contradiction that has arisen in the literature. On the one hand, cross-country analysis (Demirguc-Kunt and Detragiache, 1999) finds that countries with explicit and more extensive deposit insurance tend to be more fragile and, hence, more prone to banking crises, which is consistent with insurance leading to an increase in moral hazard and a breakdown in market discipline. On the other hand, individual country studies have been generally supportive of market discipline, even in cases of explicit and relatively extensive deposit insurance.

Although some explanations related to the design of the insurance system may account partially for the results of the country studies, we argue that the tests conducted to date have tended to be relatively weak and perhaps have biased the results in favor of finding market discipline. Thus, we set out to strengthen the traditional market discipline test by including a set of controls that may reflect more completely the set of criteria used by depositors to choose one bank over another. Also, as argued by Calomiris and Powell (2000), a true test for market discipline should also involve a second step in which it is determined whether banks respond to the signals provided by depositors. We also build on this idea, showing how this test may be developed further.

Colombia constitutes an interesting case study for analyzing discipline and depositor behavior. Throughout our period of analysis (1985-99) it had an explicit insurance system, with several features that might limit moral hazard, but others that may increase it. Anecdotal evidence of a deposit run on a sound bank in mid-1999 raises

questions about the incentives of depositors and the quality of the information they use to assess bank performance. Thus, whether depositors discipline their banks is an open question. Furthermore, throughout the 1990s Colombia underwent rapid change, including a liberalization program that opened the financial system to competition. A significant number of new banks, both foreign and domestic, entered the market and quickly acquired market share (Barajas, Steiner, and Salazar, 2000). However, after several years of high growth and profitability, the banking system began to show signs of fragility and distress toward the end of the decade, as numerous financial institutions encountered mounting non-performing loans and diminishing solvency. Therefore, it is crucial to understand depositor behavior during the initial expansion, when new banks entered the market, and whether depositors played a positive role in disciplining banks.

Our empirical analysis finds strong evidence that deposit growth depends on bank performance fundamentals, even after strengthening the test by incorporating a more complete set of bank-specific controls. We also find that banks do respond to signals from depositors in a manner consistent with market discipline. This response seems to be asymmetric, occurring only when banks perceive they are being punished by depositors, and does not appear to extend to the cases in which fundamentals are the weakest.

Thus, moral hazard appears to be limited, in spite of having an explicit insurance system. This may be due to some design features of Colombia's insurance scheme, which is compulsory, has co-insurance and risk-weighted premiums, and offers relatively small coverage. We also suggest that the observed appropriate response of banks could also be the result of effective regulatory oversight rather than market discipline per se. It may be the case that banks are simply adjusting their fundamentals in order to comply with the regulations, rather than as a response to deposit outflows.

The paper is divided into six sections, including the introduction. In the second we review the literature regarding depositor behavior in the presence of deposit insurance. In the third section we describe Colombia's insurance scheme. In the fourth we present our estimation approach, building upon the standard tests for market discipline. We also discuss the idea that disciplining cannot be detected solely through the behavior of depositors, as it is also important to assess how banks react to the actions of depositors. In the fifth section we undertake two sets of econometric estimations. The first one looks at the determinants of the rate of growth of deposits, the second at the reaction of banks to changes in depositor behavior. In the sixth section we conclude.

II. DEPOSIT INSURANCE AND DEPOSITOR BEHAVIOR

When deciding on a deposit insurance system, policymakers face a tradeoff between two types of risk: (1) the risk of non-fundamental or inefficient deposit runs (Diamond and Dybvig, 1983), vs. (2) moral hazard. If policymakers believe that runs are not a significant source of instability[i], and that moral hazard is the predominant risk, then they should eliminate deposit insurance, as in the case of New Zealand, where depositor protection is explicitly denied and the system relies entirely on market discipline and transparency (García, 1999 and 2000). If, on the contrary, policymakers believe that deposit runs are dangerous and likely, and that moral hazard is not significant, then they should choose a full explicit guarantee. In practice, both extremes are rare, with the majority of countries adopting some limited form of insurance, and therefore assuming a certain level of moral hazard in exchange for greater protection against bank runs. They

also may incorporate certain design features into the scheme that limit the propensity for moral hazard and thus risk-taking by banks (Demirguc-Kunt and Huizinga, 1999).

In the end, which type of risk dominates? A recent study (Demirguc-Kunt and Detragiache, 1999) sought to answer this question for a broad sample of countries exhibiting varying extents of coverage in their insurance systems. Using the capacity to predict financial crisis as the prime criterion, the authors investigate what happens to bank fragility when the extent and coverage of insurance increases. Based on a sample of 61 countries for 1980–97, they find that bank fragility increases as the insurance scheme becomes more explicit and extensive, an indication that moral hazard may be dominating over whatever stabilizing effects deposit insurance has on the risk of bank runs[ii].

However, recent empirical studies of depositor behavior in individual countries have given support for the opposite result: the presence of market discipline in countries with varying types of insurance systems. Using panel data estimation on bank balance sheet information, these studies examine market discipline by testing whether a significant relationship arises between depositor behavior and bank performance and management indicators, or "fundamentals." Park and Peristiani (1998) show evidence of market discipline in the U.S. thrift industry throughout the 1980s, as depositors demanded a higher interest rate and deposit growth was lower for banks with riskier activities. Martínez Pería and Schmukler (1999) consider the banking systems of Argentina, Chile, and Mexico, and find support for market discipline in all three countries, even in the case of small, insured depositors. Schumacher (1996, 2000) finds evidence of market discipline in Argentina during the 1994–95 "Tequila" crisis. Finally, for Argentina during the 1990s, Moore (1997) finds depositor growth to be linked to bank

fundamentals[iii] and Calomiris and Powell (2000) find deposit interest rates as well as deposit growth to be related to bank fundamentals.

Considering the theoretical and cross-country empirical backing for moral hazard when deposit insurance is in place, this strong support for market discipline in country studies is puzzling. In fact, it has been argued that, even in the absence of explicit insurance, depositors and managers may tend to behave as if their deposits were insured, expecting a rescue if their bank were to experience difficulties. However, the results from country studies suggest the opposite, that even though deposits are explicitly insured, depositors behave as if they were not. Furthermore, from the Demirguc Kunt-Detragiache (1999) study, the Mexican and Chilean insurance systems exhibit some of the characteristics making them more prone to fragility and hence, to moral hazard: both systems are explicit and un-funded but callable, they cover foreign-currency deposits, and are government-managed. Additional risk elements are introduced in Mexico by having unlimited coverage. Argentina, on the other hand, appears to be a case in which market discipline would be more plausible, as there is no explicit safety net for depositors, and the currency board arrangement practically rules out any scope for the central bank to serve as a lender of last resort.

There are three possible explanations that may account for the empirical results supporting market discipline even in the presence of extensive safety nets for depositors. First, if the tests have been properly specified, then they would suggest that the moral hazard problem in depositor behavior is not very important. This may be because deposit insurance is not credible, or because it is designed in such a way to limit moral hazard. However, this conflicts with the cross-country results indicating greater fragility, and it is not clear how fragility can increase if market discipline is left intact.

A second possibility is that deposit insurance reduces but does not eliminate market discipline. A cross-country study by Demirguc-Kunt and Huizinga (1999) conducts market discipline tests for several countries, and then pools the bank and country-specific data in order to test whether insurance has an impact on market discipline. They find evidence that insurance lowers the responsiveness of deposit interest rates to changes in bank liquidity, an indication that market discipline is weakened.

Although these explanations may partly account for why market discipline is not rejected in countries with deposit insurance, we consider a third possibility as well: that the country tests may be biased in favor of finding market discipline. We explore this in the present study, with reference to Colombia, by strengthening the test and incorporating control variables that reflect the return to depositors as well as other non-fundamental characteristics which may lead depositors to prefer a certain type of bank over another.

Finally, as argued in Calomiris and Powell (2000), for market discipline to exist it is not enough that depositors choose banks according to their fundamentals. It must also be true that banks react appropriately, by adjusting fundamentals in response to signals provided by depositors. Calomiris and Powell propose a test based on the behavior of deposit interest rates, which we build upon it by testing the direct response of fundamentals to what we define as "fundamental" deposit losses.

III. DEPOSIT INSURANCE IN COLOMBIA

Following the financial crisis of the early 1980s, the financial institutions guarantee fund (Fogafin) was created in 1985. One of its key obligations was to develop a deposit insurance scheme, whose main features are[iv] (see Table 1):

(i) A guarantee that depositors will receive their funds when a financial institution intervened by the banking superintendency is unable honor its obligations. All financial institutions registered in Fogafin and under the tutelage of the Banking Superintendency are required to purchase deposit insurance.

(ii) Insured liabilities are demand deposits, CD's, savings accounts, UPAC accounts[v], receipts payable, tax collection services and capitalization titles. Fogafin covers 75% of the amount deposited up to a maximum coverage of col$10 million (about US$ 4,350) per account. In each institution, and regardless of the number of accounts, one person is only insured up to col$10 million, while accounts in different institutions are insured separately. Insurance only covers deposits payable in Colombia, and regarding interest-earning liabilities, it covers principal, monetary correction and regular interests. As Table 1 shows, almost all accounts – just under 98% in 1999 – are smaller than the maximum coverage and are thus fully covered. However, given that there is a small number of very large accounts, overall coverage is much smaller, only 35% of total deposits in 1999, a percentage that has been declining steadily, since the coverage limit is fixed in nominal terms while annual inflation has been between 10 and 15%.[vi]

(iii) Yearly premiums amount to 0.3% of all liabilities, but at the end of each year 50% of premiums paid are reimbursed if the financial institution receives an "Investment Grade" by a specialized grading agency, and 25% if it receives a "Good Grade."

In Table 2 we compare the main characteristics of the Colombian scheme with those of several industrialized countries and a world average (Beck, 2000). According to the Demirguc-Kunt and Huizinga (1999) analysis, several features of Colombia's deposit insurance would increase the likelihood of moral hazard: the system is explicit, funded, and managed by the government. Other features may work in the opposite direction: the

coverage limit is relatively small and declining in real terms, the scheme is privately funded, membership is compulsory, there is co-insurance by depositors, and premiums are risk-adjusted. Whether or not insurance has prevented depositors from exerting market discipline is an open question, one that has to be addressed empirically.

IV. EXTENDING THE TESTS FOR MARKET DISCIPLINE

In this section we present our estimation approach, describing first how we extend the conventional test for market discipline on the depositor side, and then how we develop a more direct test for the behavior of banks in response to depositors' signals.

A. Depositor response to fundamental and non-fundamental variables

As developed in Park and Peristiani (1998), there are two ways in which market discipline may be tested in the market for bank deposits: through the price (the interest rate) or through quantities (level, or growth of deposits):

$$r_{ti} = \alpha_0 + \hat{p}_{t+1,i}\alpha_1 + z_{ti}\alpha_2 + \varepsilon_{ti} \qquad (1)$$

$$D_{ti} = \beta_0 + \hat{p}_{t+1,i}\beta_1 + w_{ti}\beta_2 + \nu_{ti} \qquad (2)$$

The variables r and D represent the deposit interest rate and the level of deposits, respectively, and sub-indices t and i denote the time and individual bank dimensions, respectively. The expected probability of default or failure of bank i in the following

period is defined as $\hat{p}_{t+1,i}$. Finally, the equations include vectors of control variables which may have an effect on the deposit rate (z) or on the level of deposits (w). In short, equations (1) and (2) test for the existence of market discipline by testing for the significance of α_1 and/or β_1. If depositors demand a higher interest rate from banks with a higher probability of default, then α_1 will be positive and significant, and one may conclude that depositors are exerting discipline over banks. Likewise, if depositors tend to demand fewer deposits from riskier banks, then β_1 should be negative and significant.

Two issues arise in the specification of (1) and (2). First, there is the question of how to measure the probability of default p. Park and Peristiani (1998) follow a two-step procedure, estimating it by using a logit model as a function of performance indicators and using the estimated probability as an explanatory variable in (1) and (2). While this procedure appears to be reasonable, it may not always be possible to estimate the probability accurately, especially if there are not many actual bank failures. Also, as Martínez Pería and Schmukler (1999) point out, by including the probability of default directly, it is not possible to determine which of the bank indicators is providing the strongest signals to depositors regarding riskiness. Therefore, it may make sense to include the fundamentals themselves in equations (1) and (2), and to test for market discipline by testing for their joint significance.

A second issue is what to include as controls z and w. Park and Peristiani (1998) include two macro variables indicating overall size of the market, bank-specific controls relating to market share and size, and regulatory dummy variables. Demirguc-Kunt and Huizinga (1999) include two controls in their individual country estimations: bank overhead and size. Martínez Pería and Schmukler (1999) include two sets of controls:

systemic and macro variables, both of which vary over time but not across banks. The systemic variable is the cash to deposit ratio, capturing overall preference for deposits. Finally, Calomiris and Powell (2000) include period effects as time-varying controls.

While the specifications used in these studies may control for the effects of economy-wide factors, they do not incorporate other individual bank variables that should play a role, in particular the return to deposits. While risk is partially accounted for by fundamental variables, the tests do not incorporate the returns to depositors nor other bank-specific variables that may be related to perceived risk to depositors.

By not including these additional controls, the above studies do not provide a satisfactory alternative hypothesis regarding depositor behavior in the absence of market discipline. That is, if market discipline is rejected, there is no explanation for why depositors choose one bank over another or why deposits may grow more rapidly in one bank than in another. In this sense, the test may be considered too weak, and the hypothesis of market discipline will tend to be accepted more often than is true. We propose strengthening the test by incorporating return variables x and other bank-specific variables y in addition to fundamental variables ($FUND$) and macro controls z and w:

$$r_{ti} = \alpha_0 + FUND_{ti}\alpha_1 + z_t\alpha_2 + x_{ti}\alpha_3 + y_{ti}\alpha_4 + \varepsilon_{ti} \qquad (1')$$

$$D_{ti} = \beta_0 + FUND_{ti}\beta_1 + w_t\beta_2 + x_{ti}\beta_3 + y_{ti}\beta_4 + \nu_{ti} \qquad (2')$$

To capture the return to depositors we include the interest paid on deposits r (bank-specific) in the deposit equation, and we proxy the level of transaction services by the number of branches (*BRANCH*). We include a dummy variable for state ownership (*STATE*) to test whether depositors perceive that state-owned banks are safer; and for

foreign ownership (*FOREIGN*) to test whether these banks possess any advantages in terms of reputation. As in some studies, we also control for bank size (*ASSETS*) to test whether depositors respond to a "too big to fail" effect.

B. Response of banks to disciplining behavior by depositors

Whether depositors are sensitive to bank fundamentals is only the first step in determining whether there is market discipline. A second step should involve assessing whether banks respond appropriately to the signals provided by depositors. Calomiris and Powell (2000) explore this issue by testing whether there is a tendency for deposit rates to revert to their mean, a behavior consistent with market discipline; if interest rates rise too much (i.e., fundamentals fall out of line) then banks must take corrective action to ensure that they may fall again. They accept the hypothesis of mean reversion for Argentina.

We develop the test further, along three major lines. First, we test directly whether bank fundamentals react to changes in deposits. Second, since changes in deposits may also be caused by non-fundamental variables, we zero in on those changes that are attributable exclusively to a bank's fundamentals. Third, we allow for a possible asymmetry in the response. Market discipline implies that a bank should improve its fundamentals following a deposit withdrawal, but it does not necessarily imply that a bank should let its fundamentals deteriorate if deposits are growing rapidly.

V. ESTIMATION RESULTS

We ran regressions using semi-annual data for 1985–1999 based on individual bank balance sheets and income statements, which yield a set of bank-specific variables defined below. Except for some dummy variables, all have both a time (t) and a cross-section dimension (i), which we suppress for notational simplicity. The fundamental variables that explain the probability of default are defined as follows[vii]:

NPL = non-performing loans/total loans

NPLASS = non-performing loans/assets

PROV = loan loss provisions/assets

KASS = capital/assets

COVGE = *KASS* + *PROV* – *NPLASS*

ROE = return on equity

LIQ = total reserves/assets

We test whether depositors react to changes in fundamentals. In particular, they should react negatively to increases in non-performing loans (*NPL* and *NPLASS*), and positively to increases in provisions (*PROV*), in the capital-asset ratio (*KASS*), in the coverage of non-performing loans (*COVGE*), and in the return-to-equity (*ROE*).

Though most of the literature considers higher liquidity as an indication of a lower probability of default, we allow for differences in depositors' assessment of liquidity depending on the business cycle. In particular, while in "bad times" holding liquid assets might make a bank less vulnerable and depositors more confident, in "normal times" higher liquidity implies a lower return on assets, with little offsetting positive effect. We classify each time observation as being "normal" or "bad times"

according to real GDP growth rate in relation to its trend growth rate during 1970–1996[viii], and produce a time-varying dummy variable, *BADTIMES*. The product of this variable with *LIQ* results in *BTLIQ*, which captures the possible asymmetric effect. If our priors are correct, depositors should view liquidity negatively, except during "bad times."

As we discussed in Section IV, we control for other non-fundamental variables. Total real assets (*ASSETS*) allow us to test whether depositors believe that larger banks are "too big to fail", and therefore that deposits held there are safer. Our two controls for the return to deposits are the number of branches (*BRANCH*), and the deposit interest rate (*r*). We expect the number of branches to reflect the quality of payments services offered by banks[ix]. We measure the interest rate implicitly, as the ratio of interest paid to the average stock of deposits over a given six-month period.

In addition, we control for macroeconomic shocks that affect all banks equally, such as GDP growth and interest rates on government securities, either by using macro controls explicitly or by incorporating period effects. Finally, we included dummy variables in order to distinguish between private and state-owned banks (*STATE*) and between domestic and foreign-owned institutions (*FOR*).

Our regression analysis was done using a sample encompassing virtually the entire banking system (25-33 banks, depending on the period), excluding a few smaller and newer banks for which there was missing information. We allowed for different bank-specific intercepts by using fixed effects (*FE*) and random effects (*RE*) estimation, and chose which to report according to the Hausman test. Differences in bank-specific effects were overwhelmingly accepted, as were common period effects.

A. Estimations for depositor behavior

We focus our analysis on the deposit growth equation[x], the results of which are shown in Tables 3A and 3B. As expected, deposit growth depends positively and significantly on the interest rate and on the number of branches, thus showing that return is an important factor in choosing among banks. In all estimations bank size appears with a positive coefficient, in line with the "too big to fail" argument. However, this coefficient is significant only in about half of the estimations[xi].

Regarding the fundamental variables, estimations in Table 3A include each one individually, while those in Table 3B include two or more fundamentals at a time. The results reported in Table 3A give evidence of market discipline. Though deposit growth is not sensitive to the level of non-performing loans (*NPL*) nor to the return to equity (*ROE*)[xii], it does depend, and with the expected sign, on the other three fundamental variables. In particular, deposits grow faster in banks with a higher capital base (*KASS*) and in banks where non-performing loans are better covered by both capital and provisions (*COVGE*). As for liquidity, our results give support to our suspicion that depositors' attitudes toward liquidity differ according to the macroeconomic environment. In normal times depositors tend to have a negative view of liquidity, while during an economic downturn their view of liquidity changes, presumably as liquidity better equips the bank to withstand a deposit outflow.

Since cross-sectional differences across banks are captured by bank-specific intercepts in the FE estimations, the dummy variables for bank ownership reflect only *changes* in ownership over time for individual banks: privatization of state-owned banks and foreign acquisition of domestically-owned banks[xiii]. The estimations in Table 3A

show some evidence of a deposit loss stemming from privatization, but no discernible change following acquisition by foreign investors. Thus the positive coefficient on *STATE* indicates that, other things constant, depositors perceived that a privatized bank was more likely to default than its state-owned predecessor, presumably because the government would be more likely to bail out the latter in case of distress.

Most of the above results carry on to Table 3B, where we include more than one fundamental variable at a time. Regarding the "too big to fail argument", we always obtain a positive coefficient for the level of assets, but it is significant, and at the 90% level, in only one regression. The results on a bank's interest rate and the number of branches continue to hold and have the expected signs, as do the results on changes in ownership, with privatization lowering deposit growth but foreign acquisition of domestic banks having no effect. Depositors appear to be sensitive to fundamentals, which is supported by the overwhelming joint significance of these variables. Individually, however, not all fundamentals appear to matter. Once again the percentage of non-performing loans and the return-on-equity do not appear to have any effect on deposit growth, while the coverage ratio does. When we decompose this variable into its three components: *PROV*, *KASS*, and the ratio of non-performing loans to assets (*NPLASS*), we find that the first two have the expected positive sign and are significant at the 95% level, whereas *NPLASS* has the expected negative sign but is not significant[xiv].

In all regressions a higher level of liquidity (*LIQ*) is associated with lower growth of deposits during normal times, while *BTLIQ* is associated with a higher growth of deposits. In the final column of Table 3B we test for the linear restriction that the sum of the two coefficients is equal to zero, which is not rejected. Thus, our reading on this is as follows. In "normal times" the negative effects of a high level of liquidity (i.e. a low

return on assets) dominate the positive (i.e. the bank will more easily accommodate a deposit withdrawal), but in "bad times" depositors perceive that the level of liquidity is irrelevant – the negative and the positive effects offset each other.

In order to capture cross-sectional differences according to ownership, we ran OLS regressions without bank-specific intercepts. Since all other results were similar to those obtained in the FE estimations, in Table 4 we report only the coefficients for *STATE* and *FOR*. Our results give some support to the hypothesis that depositors prefer state-owned banks, possibly due to a greater perceived probability of bailout. The strongest evidence comes from specifications where we exclude non-performing loans and incorporate macro controls[xv]. On the other hand, there does not appear to be a preference for foreign-owned banks; their ability to attract deposits is solely linked to their fundamentals and the return they offer depositors[xvi].

B. Extensions to the estimations for depositor behavior

We now examine three extensions to our analysis. First, we address the possible endogeneity between deposit interest rates and fundamentals (in fact, in the following section deposit interest rates are shown to respond to prior changes in fundamentals), employing a 2SLS procedure. We include as instruments for the deposit interest rate the lending rate, the required reserve ratio and the ratio of noninterest expenses to assets (which reflects the bank's product mix and its level of efficiency), and then enter the predicted value for the deposit interest rate as a regressor in the deposit growth equation. We report the 2SLS results for equation (9), the most parsimonious specification, summarizing the fundamentals in three variables: *COVGE*, *LIQ*, and *BTLIQ*. The

previous results hold; the interest rate and number of branches are positively and significantly related to deposit growth, the respective fundamentals are significant in the expected direction, and there is a drop in deposit growth as a result of privatization.

These results confirm the importance of return for depositors' choices. Although it could be argued that the deposit rate also reflects bank riskiness (and indeed, as we will show in Section V.C., riskier banks do tend to set higher rates on deposits), the positive coefficient on the deposit interest rate, both in FE and 2SLS estimations, implies that the return effect is dominating over any risk effect that may be present[xvii].

Secondly, we examine whether market discipline has changed over time. Given that coverage has been declining in real terms, and that depositors may have undergone a learning process in which their assessment of banks performance has improved, we might expect to observe an increase in market discipline over time. When we include interaction terms between a time variable and each of the fundamentals, we find that depositor sensitivity has increased for those fundamentals which performed best in the previous regressions, *COVGE*, *KASS*, and *PROV* (Table 5). For *NPLASS* , which did not perform well in the previous estimations, we find that depositor sensitivity has declined over time. Finally, for *LIQ* and *ROE* we do not detect any significant change.

Thirdly, we re-ran the regressions using macro controls rather than common period effects, the detailed results of which are available upon request. While the main results reported in Tables 3A and B still hold, this is not the case for the liquidity variables, which change sign. Two macro controls performed well in all regressions: the growth of aggregate bank deposits and the real interest rate on government paper. A third variable, a financial liberalization dummy for 1991, was positive and significant in some

equations, suggesting that liberalization may have increased the attractiveness of bank deposits in general, above and beyond the return or risk characteristics of banks.

C. Response of banks to changes in deposit growth

In the previous sections we showed that depositor behavior appears to be broadly consistent with market discipline; depositors prefer banks with stronger fundamentals. Now we turn to the question of whether banks respond once depositors have revealed their preferences. Thus, we measure to what extent bank fundamentals change in response to past changes in deposits, and we zero in on the component of deposit growth that is directly attributable to an individual bank's fundamentals, which we term the "fundamental" deposit growth, (*DRDFUND*). We define *DRDFUND* as the real growth of deposits explained by fundamental variables from regression (8) in Table 3B. Note that this variable is bank-specific, but below we drop the *i* subscript for simplicity.

$$DRDFUND_t = -0.547\,NPLASS_{t-1} + 1.427\,PROV_{t-1} + 2.396\,KASS_{t-1} - 0.416\,LIQ_{t-1} + 0.617\,BTLIQ_{t-1}$$

The first test consists of regressing each fundamental variable on lagged *DRDFUND*, to determine whether this period's fundamentals are sensitive to depositors' preference for strong fundamentals in the previous period. If market discipline holds, we should expect negative coefficients on *DRDFUND* in the equations for *KASS*, *COVGE*, *PROV*, and *LIQ*, and a positive coefficient in the case of *NPLA*. For instance, if depositors punished a bank last period for weak fundamentals (*DRDFUND* falls), then the bank should react today by improving its fundamentals, increasing the capital base or

reducing the level of non-performing loans. The results of this test are not encouraging, as shown in the top portion of Table 6. Only *PROV* behaves in a manner consistent with market discipline, where a previous deterioration leads to an increase today in provisions.

One explanation for this behavior might be that banks respond asymmetrically to signals by depositors. On the upside it may be that a virtuous cycle is encountered whereby an improvement in fundamentals leads to further improvements, whereas on the downside bank managers do not allow a vicious cycle to ultimately doom the bank, so they react by improving fundamentals. In a second group of tests we allow for this asymmetry. We consider two types of deposit losses, one in absolute and one in relative terms. The first occurs when the fundamental deposit growth rate of a bank is negative, so it defines an absolute loss of deposits owing to weak fundamentals. The second defines a deposit loss as any situation when a bank exhibits a fundamental growth rate below the system's average. We define two dummy's, for each bank *i* and period *t*:

$$DLOSS1_{it} = \begin{cases} 1, DRDFUND_{it} < 0 \\ 0, otherwise \end{cases} \qquad DLOSS2_{it} = \begin{cases} 1, DRDFUND_{it} < \overline{DRDFUND}_t \\ 0, otherwise \end{cases}$$

These variables reflect two extremes[xviii]. In the total sample of 709 observations, *DLOSS1* defines only 15 cases as having been of fundamental deposit losses, therefore it captures only the most extreme cases of individual banks being out of line in their fundamentals. On the other hand, *DLOSS2* encompasses a much greater number of observations (420), in which individual banks were simply exhibiting sub-par fundamentals in relation to the rest of the banking sector.

We now test the response of the fundamental variables to deposit losses. In the case of *DLOSS1*, two changes occur with the respect to the symmetric estimation, as

shown in the second portion of Table 6. First, the capital-asset ratio is now unresponsive to deposit losses, rather than being responsive in the wrong direction. Second, liquidity has the correct sign and now approaches significance. Therefore, in these most extreme cases, banks that suffer the strongest deposit withdrawals appear to be unlikely to respond in any desirable way other than by increasing their loan loss provisions. Their level of nonperforming loans deteriorates even more and coverage falls further, reflecting a type of vicious cycle of deteriorating fundamentals.

For *DLOSS2*, bank behavior appears to be more consistent with market discipline. Banks now tend to improve their coverage and capital-asset ratios when depositors have discriminated against them in the previous period, they continue to adjust their provisions upward, but do not appear to adjust nonperforming loans or liquidity levels[xix].

In another set of tests, we investigate whether banks also adjusted their interest rates following fundamental-driven changes in deposits. We might expect a negative relationship for deposit interest rates, as banks could try to stem the deposit outflow without having to improve their fundamentals. The results show that deposit rates do exhibit the expected behavior symmetrically; not only do they increase in response to a deposit loss, but they also tend to fall when fundamentals are above-par and deposits are growing rapidly. Furthermore, the asymmetric estimation does not seem to hold. A final exercise used *DLOSS2* itself rather than its cross-product with *DRDFUND* and found that, on average, banks that suffered from sub-par fundamentals tended to pay higher interest rates, although these rates did not depend on the magnitude of the deposit loss.

In the last two columns of Table 6 we analyze the response of bank lending rates to changes in fundamental deposit growth, as lending rates may signal a bank's level of risk-taking. If a bank's fundamentals deteriorate and it suffers a deposit loss, it may

either increase risk to recover profits (i.e., "gamble for resurrection") or it may reduce risk to improve its fundamentals. We find that lending rates only react in the case of moderate deposit losses, where they are adjusted downward possibly in an attempt to lower risk. This prudent behavior comes at the cost of lower profits, since we found earlier that the deposit interest rates of these banks tended to be higher on average.

VI. CONCLUSIONS

In this study we have asked two questions: (1) What determines depositor behavior? and (2) do banks respond correctly to depositor's signals regarding their performance? With regard to the first, our estimations for real deposit growth showed that Colombian depositors respond to both risk and return factors. Banks attract deposits either by offering high interest rates (return), better liquidity services (number of branches), or by exhibiting strong fundamentals, which presumably lowers the risk of default. Furthermore, state banks appear to have an inherent advantage in attracting deposits, but foreign banks, although they have been successful in attracting deposits, do not appear to possess a reputational advantage, as their deposit growth was explained solely by the return they offer and their fundamentals. Finally, there appears to be some evidence of a "too big to fail" perception by depositors.

Fundamentals matter to depositors. Coverage and two of its components, the capital-asset ratio and loan-loss provisions, tend to exert a positive influence on deposit growth, and the joint significance of fundamental variables was overwhelmingly accepted. However, neither profitability nor nonperforming loans appear to be associated with depositors' perceived risk of losses. The poor performance of the profitability

variable is a common finding in the literature, but it remains puzzling that a bank's nonperforming loans do not seem to affect deposit demand. Finally, we showed that depositors' attitudes toward liquidity varied depending on the macroeconomic environment. During normal times, greater liquidity was associated with less active intermediation, but with little benefit in terms of lower risk of default. Only in difficult or "bad times" did the benefits of greater liquidity become apparent.

As for the second question, we obtained evidence that banks responded to depositors' signals in a manner consistent with market discipline, as evidenced by the responsiveness of some of the fundamental variables that were relevant to depositors: coverage, capitalization, and provisions. Our results also gave support to the hypothesis that this response was asymmetric, occurring only when banks perceived that they were being punished by depositors. However, this disciplining behavior did not extend to the cases in which fundamentals were the weakest. Finally, we found that positive signals from depositors tended to allow banks to lower their interest costs subsequently and that, on average, banks that received negative signals from depositors tended to have higher interest costs and lower interest receipts, thus suffering a profit squeeze as a result of attempting to contain the deposit outflow and reduce the level of risk.

These results support the existence of market discipline in Colombia, as depositors take into account bank fundamentals, and send signals to the banks, who adjust their behavior accordingly. Moral hazard appears to be limited, even though there is an explicit deposit insurance system, perhaps because of one or several design features, such as its compulsory nature, co-insurance, risk-weighted premiums, and/or the existence of a relatively low coverage limit. Furthermore, the steady decline in coverage

in real terms is consistent with the observed increase over time in depositors' sensitivity to fundamentals, an indication that market discipline may be increasing.

Our results also have implications regarding the nature of market discipline in Colombia, in particular with regard to the behavior of loan-loss provisions. Indeed, we found this to be the only fundamental variable that responded symmetrically (and in the expected direction) to depositors' signals. This finding is consistent with the level of provisions being largely an automatic or "endogenous" response of banks seeking to comply with regulation. While depositor behavior may play an important role in disciplining banks, there may also be an element of "regulatory discipline".

Finally, although depositor behavior appears to exhibit market discipline and moral hazard seems to be limited, there still are two causes for concern. First, it is unclear why nonperforming loans do not play an important part either in depositors' decisions nor in banks' responses, especially when this variable has a proven track record in predicting bank failures. A possible explanation for this is related to regulatory discipline; since loan-loss provisioning was strengthened in the aftermath of the 1980s crisis, increases in non-performing loans throughout our sample period were more likely to be adequately covered, and therefore provided less of a signal of bank insolvency than was the case before the crisis. Second, our findings of a preference for state-owned banks and a possible "too big to fail" mentality on the part of depositors are a sign that market discipline is still imperfect, and that some degree of moral hazard remains.

Table 1. Colombia's Deposit Insurance Scheme

	1994	1995	1996	1997	1998	1999
Characteristics:						
Premium (% of insured deposits)	0,15	0,15	0,15	0,15	0,15	0,30
Refund for "Investment Grade"					50%	300%
Refund for "Good Grade"					25%	25%
Coverage limit (col$mill)	10	10	10	10	10	10
Deductible	25%	25%	25%	25%	25%	25%
Coverage indicators:						
	(Percentage of total financial system)					
Eligibility						
By size: Number of accounts smaller than the coverage limit	98,61%	98,33%	98,00%	97,79%	97,58%	97,87%
By value: Total insured deposits	48,16%	45,07%	41,51%	40,19%	37,72%	34,63%

Source: Superintendencia Bancaria de Colombia

Table 2. Cross-country comparison of deposit insurance schemes

	Germany	EU[a]	US	World average (68 countries)	Colombia
Coverage limit	30% of equity	ECU$20000	US$100000	3 times per capita GDP	col$10 million[b]
Coinsurance	No	10%	No	Yes, in 17	25%
Foreign currency deposits covered	Yes	Can be excluded	Yes	Yes, in 48	n.a.[c]
Interbank deposits Covered	No	No	Yes	Yes, in 18	No
Funding	Funded, but additional funds callable	Not regulated	Funded	Funded, in 58 cases	Funded
Sources of Funding	Banks only	Not regulated	Joint	Private: 15 Joint: 51 Public: 1	Private
Management	Private	Not regulated	Public	Private: 11 Joint: 24 Public: 33	Public
Membership	Voluntary	Compulsory	Compulsory	Compulsory in 55 cases	Compulsory
Risk adjusted Premiums	Yes	Not regulated	Yes	Yes, in 21 cases	Yes

Notes:

[a] Minimum requirements.

[b] As of July 2000, this is around USD4600, or 2 to 3 times per capita GDP.

[c] Colombia's financial system does not allow for foreign currency deposits.

Source: Beck (2000).

TABLE 3A. DETERMINANTS OF THE RATE OF GROWTH OF REAL DEPOSITS (*DRD*)
(Period and bank-specific effects, semi-annual data, 1985(1)-1999(2))

	(1)	(2)	(3)	(4)	(5)
Estimation method:	FE	FE	FE	FE	FE
Constant	-0.126 (2.28)**	-0.436 (8.541)**	-0.139 (2.571)**	-0.332 (6.675)**	-0.100 (1.577)
Return on deposits					
r	0.694 (2.774)**	1.184 (5.421)**	0.763 (3.025)**	0.996 (4.510)**	0.687 (2.753)**
BRANCH	0.677E-03 (1.584)	0.609E-03 (1.646)*	0.646E-03 (1.512)	0.673E-03 (1.788)*	0.712E-03 (1.670)*
Probability of default: bank size and lagged fundamentals					
ASSETS	3.52E-08 (1.802)*	2.93E-08 (1.738)*	0.340E-07 (1.748)*	0.346E-07 (2.013)**	0.313E-07 (1.597)
NPL(-1)	-0.138 (1.020)				
KASS (-1)		2.332 (14.742)**			
COVGE(-1)				1.963 (13.666)**	
LIQ(-1)					-0.503 (-1.962)**
BTLIQ(-1)					0.897 (2.308)**
ROE(-1)			-0.017 (1.485)		
Sector dummies					
STATE	.026 (0.461)	.099 (2.116)**	.009 (0.179)	0.117 (2.437)**	.017 (0.319)
FOR	.007 (0.138)	-0.025 (0.561)	0.007 (0.139)	-0.048 (-1.049)	.016 (0.313)
Hypothesis tests					
Bank effects	105.87	99.19	106.02	97.41	110.37
p-value	0.00	0.00	0.00	0.00	0.00
Period effects	119.34	183.27	121.78	186.11	116.12
p-value	0.00	0.00	0.00	0.00	0.00
Hausmann test	27.02	23.24	23.55	29.31	31.67
p-value	0.00	0.00	0.00	0.00	0.00
No. of observations	709	709	709	709	709
R^2	0.293	0.470	0.294	0.451	0.299

t-ratios in parentheses; (*) significant at 90%; (**) significant at 95%

TABLE 3B. DETERMINANTS OF THE RATE OF GROWTH OF REAL DEPOSITS (*DRD*
(Period and bank-specific effects, semi-annual data, 1985(1)-1999(2))

	(6)	(7)	(8) [a]	(9) [b]
Estimation method:	FE	FE	FE	FE-2SLS
Constant	-0.273 (4.745)**	-0.419 (6.891)**	-0.400 (6.549)**	-0.133 (1.222)
Return on deposits				
r	0.947 (4.253)**	1.154 (5.228)**	1.126 (5.136)**	1.019 (4.336)**
BRANCH	0.732E-03 (1.947)*	0.645E-03 (1.746)*	6.83E-04 (1.858)*	0.001 (4.514)**
Probability of default: bank size and lagged fundamentals				
ASSETS	0.302E-07 (1.753)*	0.249E-07 (1.467)	0.240E-07 (1.420)	-0.836 (1.222)
NPL(-1)		0.166 (1.391)		
NPLASS(-1)			-0.547 (1.402)	
PROV(-1)			1.427 (2.587)**	
KASS (-1)		2,404 (14.657)**	2.396 (14.882)**	
COVGE(-1)	1.980 (13.609)**			1.919 (12.871)**
LIQ(-1)	-0.605 (2.672)**	-0.430 (1.926)*	-0.416 (1.852)*	-0.852 (3.079)**
BTLIQ(-1)	0.702 (2.049)**	0.614 (1.822)*	0.617 (1.839)*	0.740 (2.156)**
ROE(-1)	0.005 (0.500)	0.012 (1.197)		
Sector dummies				
STATE	0.133 (2.747)**	0.086 (1.727)*	0.076 (1.540)	0.092 (1.740)*
FOR	-0.044 (0.961)	-0.014 (0.307)	-0.023 (0.513)	-0.042 (0.922)
Hypothesis tests				
Bank effects	102.15	103.54	100.76	
p-value	0.00	0.00	0.00	
Period effects	179.29	172.36	180.32	
p-value	0.00	0.00	0.00	
Hausmann test	36.67	24.93	37.37	
p-value	0.00	0.01	0.00	
Joint significance of fundamentals				
F-statistic	49.15	45.66	47.01	
p-value	0.00	0.00	0.00	
No. of observations	709	709	709	709
R^2	0.458	0.478	0.458	0.456

t-ratios in parentheses; (*) significant at 90%, (**) significant at 95%

Notes:

[a] Also ran this specification restricting the coefficients for LIQ and BTLIQ to be equal in absolute value. This restriction yields an F-statistic of 0.4408 and a p-value of 0.503.

[b] Two-stage least squares estimation using the lending rate, the required reserve ratio, and the ratio of noninterest expenses to assets as instruments for the deposit interest rate.

Table 4. OLS Regressions for Differences Across Groups of Banks
Dependent variable: Real deposit growth (*DRD*)

Specification:	(6)	(7)	(8)	(9)
Estimations without period effects or macro controls				
STATE	0.038	-0.001	0.001	0.038
	(1.544)	(0.050)	(0.031)	(1.545)
FOR	-0.007	-0.007	-0.007	-0.007
	(0.378)	(0.375)	(0.358)	(0.375)
Estimations with macro controls[a]				
STATE	0.049	-0.002	0.003	0.050
	(2.031)**	(0.082)	(0.130)	(2.052)**
FOR	-0.009	-0.008	-0.008	-0.009
	(0.444)	(0.425)	(0.431)	(0.482)

t-ratios in parentheses; (*) significant at 90%, (**) significant at 95%.
Note:
[a] Macro controls included: overall deposit growth (*AGGDRD*), the real interest rate on government paper (*RGINT*), and a dummy variable for the 1990 financial liberalization (*LIB*).

Table 5. Changes Over Time in the Responsiveness to Bank Fundamentals:
Rate of Growth of Real Deposits (DRD)[a]
(Period and bank-specific effects, semi-annual data, 1985(1)-1999(2))

Specification	(6)	(7)	(8)	(9)
Estimation method:	FE	FE	FE	FE
Probability of default: bank lagged fundamentals				
NPL(-1)		0.428 (2.237)**		
*NPL(-1)*Time*		-0.042 (2.171)**		
NPLASS(-1)			0.935 (1.528)	
*NPLASS(-1)*Time*			-0.132 (3.031)**	
PROV(-1)			-0.357 (0.364)	
*PROV(-1)*Time*			0.128 (2.109)**	
KASS (-1)		1.775 (4.084)**	1.558 (3.310)**	
*KASS (-1)*Time*		0.036 (1.608)[b]	0.047 (1.893)*	
COVGE(-1)	0.560 (1.822)*			-0.934 (1.979)**
*COVGE(-1)*Time*	0.088 (5.275)**			1.124 (6.455)**
LIQ(-1)	-0.214 (0.530)	-0.298 (0.741)	-0.245 (0.613)	0.374 (0.571)
*LIQ(-1)*Time*	-0.003 (0.143)	0.009 (0.403)	0.003 (0.162)	-0.223 (0.929)
ROE(-1)	0.008 (0.458)	0.013 (0.688)		
*ROE(-1)*Time*	-0.001 (0.086)	0.000 (0.212)		
Bank effects	109.451	112.595	116.596	109.883
p-value	0.000	0.00	0.00	0.00
Period effects	185.999	171.513	178.862	187.422
p-value	0.000	0.00	0.00	0.00
Hausmann test	26.100	19.3	20.69	24.18
p-value	0.006	0.114	0.079	0.004
No. of obs.	709	709	709	709
R2	0.478	0.487	0.493	0.488

t-ratios in parentheses; (*) significant at 90%, (**) significant at 95%

[a] For simplicity we present only the coefficients for the fundamentals.
[b] Significant at 89%.

Table 6. Response of Banks to Fundamental Growth of Deposits
(Period and bank-specific effects, semi-annual data, 1985(2)-1999(2))

	Response in fundamental variables					Response in deposit rate [a]		Response in lending rate [b]	
	COVGE	*KASS*	*PROV*	*NPLA*	*LIQ*	*r*	r^2	r_L	r_L^2
No. of observations:	678	678	678	678	678	678	678	678	678
Symmetric response									
Estimation method:	RE	RE	RE	RE	FE	FE		FE	
DRDFUND(-1)	0.215	0.162	-0.038	-0.143	-0.114	-0.041		-0.005	
	(14.592)**	(13.228)**	(4.135)**	(6.145)**	(0.829)	(3.400)**		(0.317)	
Constant	0.0274	0.061	0.028	0.124	0.139	0.161		0.365	
	(3.880)**	(11.932)**	(6.920)**	(9.225)**	(45.42)**	(24.903)**		(40.227)**	
Hausman test p-value	0.623	0.672	0.792	0.514	0.006	0.001		0.000	
R2	0.003	0.003	0.025	0.090	0.691	0.702		0.638	
Asymmetric response: Banks only respond to deposit "losses"									
Case 1: Banks only respond when their fundamental deposit growth is negative									
Estimation method:	RE	RE	FE	FE	RE	FE	FE	FE	FE
*DRDFUND(-1)*DLOSS1(-1)*	0.404	0.078	-0.407	-1.160	-0.133	0.048	-0.001	0.005	-0.019
	(5.167)**	(1.19)	(9.505)**	(11.035)**	(1.566)	(0.872)	(0.005)	(0.069)	(1.319)
Constant	0.074	0.096	0.0185	0.0862	0.125	0.153	0.153	0.364	0.364
	(5.167)**	(14.092)**	(18.503)**	(35.12)**	(15.206)**	(25.176)**	(25.123)**	(43.057)**	(43.119)**
Hausman test p-value	0.110	0.576	0.000	0.000	0.272	0.001	0.001	0.000	0.000
R2	0.049	0.006	0.463	0.632	0.005	0.697	0.696	0.638	0.639
Case 2: Banks only respond when their fundamental deposit growth is below the banking sector average									
Estimation method:	RE	RE	FE	FE	FE	FE	FE	FE	FE
*DRDFUND(-1)*DLOSS2-(1)*	-0.091	-0.101	-0.032	-0.045	0.017	0.079	0.007	-0.074	-0.01
	(3.707)**	(5.093)**	(2.130)**	(1.211)	(0.831)	(0.448)	(2.253)**	(3.039)**	(2.382)**
Constant	0.080	0.103	0.022	0.093	0.135	0.153	0.149	0.370	0.37
	(10.392)**	(17.632)**	(13.851)**	(23.176)**	(63.312)**	(24.356)**	(23.253)**	(42.871)**	(41.777)**
Hausman test p-value	0.180	0.582	0.077	0.000	0.000	0.001	0.004	0.000	0.000
R2	0.022	0.051	0.389	0.560	0.691	0.696	0.699	0.643	0.641

t-ratios in parentheses; (*) significant at 90%; (**) significant at 95%

[a] Regressions included non-fundamental controls: *ASS* , *BRANCH* , *STATE*, *FOR*.

[b] In this case regressors are *DLOSS1* and *DLOSS2* rather than their products with *DRDFUND* .

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[i] Or that they are only of the efficient type, reflecting bank fundamentals (see Freixas and Rochet, 1997).

[ii] This result is particularly noteworthy if one considers that, in some countries, the establishment of an explicit insurance system may constitute a reduction in the perceived coverage, to the extent that the financial system had previously been operating under a more extensive *implicit* insurance. For example, Gropp and Vesala (2000) show that moral hazard was *reduced* after explicit deposit insurance was established in the EU, precisely because the previous implicit guarantee had been much larger.

[iii] Moore (1997) also rejects the existence of market discipline in the Mexican banking system. However, the sample period is small and the specification does not include many relevant systemic and macroeconomic variables, so the test cannot be considered strong.

[iv] These are the features in place throughout our sample period. In late 2000 two key changes were made to the insurance scheme: the maximum coverage was increased to col$20 million and, for purposes of premium reimbursement, Fogafin ratings were to be used instead of those of private ratings agencies.

[v] UPAC are "constant purchasing power" accounts. Their yield incorporates an inflationary or "monetary correction" component plus a "regular" or pure interest component.

[vi] Even in a period of significant financial distress, premiums collected have been more than enough to pay out depositors of banks closed or taken over by Fogafin. In 1999 premiums collected reached 0.1% of GDP, of which 38% was used for payments to depositors. In 2000 the latter percentage declined to 13%.

[vii] González-Hermosillo (1999) provides an estimation of the probability of bank failure during the 1982-1985 Colombian banking crisis. She proposes a "bank distress" variable, the coverage ratio (the ratio of equity plus loan reserves minus non-performing loans to total assets) as a good predictor of bank failures.

[viii] The trend growth rate for real GDP was 4.1 percent throughout this period. We defined periods where the growth rate was more than a full percentage point below this level as "bad times".

[ix] We understand that this is an imperfect measure of transaction services, but a more accurate variable, such as the number of ATM machines, is only available for a small number of semi-annual observations.

[x] We also estimated the interest rate equation (2') but do not report it here. The results are mixed. As we will show, the deposit growth equation (1') gives evidence of market discipline on the part of depositors, thus it is not necessary to conduct an additional test using equation (2'). Instead, we used an interest rate equation to determine the banks' response to depositors' signals, which we discuss in section V.C.

[xi] We obtained similar results by using market share of assets instead of assets themselves.

[xii] This is a common result in the country studies surveyed.

[xiii] The privatization process is discussed in detail in Barajas, Steiner, and Salazar (1999), and the process of entry/acquisition by foreign banks is discussed in Barajas, Steiner, and Salazar (2000).

[xiv] We also tested the significance of provisions net of nonperforming loans, or *COVGE1*. Its coefficient was positive in all regressions, but only significant when *KASS* was not included. Thus, from the viewpoint of depositors, the capital-asset ratio appears to contain the bulk of information regarding bank solvency.

[xv] It is not surprising that the significance of *STATE* is higher in regressions that exclude non-performing loans, given the positive correlation between the two. In estimations without macro controls and where non-performing loans are excluded, *STATE* approaches significance (a p-value of about 11%).

[xvi] In order to test whether only foreign banks with U.S. or European owners (as opposed to those from other Latin American countries) possessed a reputational advantage, we re-ran the regressions using the dummy variable *FORUSEUR*. However, the results were similar: these banks did not appear to have an inherent advantage over the rest of the banking system.

[xvii] If one assumes that there is no return effect, that the deposit interest rate only reflects riskiness, then there are two possibilities. First, that the deposit interest rate contains the same risk information that is signalled by the fundamental variables or, alternatively, that it contains additional risk information not included in the fundamental variables. To the extent that the instrumental variables are not correlated with the fundamentals, one would expect 2SLS estimation to yield a non-significant coefficient for the deposit interest rate in the first case, and a significant negative coefficient in the second. Given that our results yield a significant positive coefficient throughout, we conclude that there is a dominant return effect.

[xviii] We also conducted tests on two intermediate definitions of deposit losses: when deposit growth is below the sector average minus one and two standard deviations. We excluded their results from Table 6 since the two extremes (*DLOSS1* and *DLOSS2*) illustrated the main properties of this type of analysis.

[xix] We also tested the individual responses of the numerator and denominator of the KASS ratio. Using total deposits to control for scale, we found that the weakest banks did not adjust either capital or assets, but that sub-par banks tended to adjust capital rather than assets following a fundamental deposit loss.