

**First draft. Comments welcome.**

## **DEPOSITOR BEHAVIOR AND MARKET DISCIPLINE IN COLOMBIA**

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### **ABSTRACT**

This empirical study examines how the public makes decisions to place deposits among different banks and over time in the Colombian banking system. Recent studies suggest that in several Latin American countries, depositors exhibit significant responsiveness to performance indicators. With our specification, we set out to control for a more comprehensive set of risk/return factors, and thus conduct a stronger test for market discipline. We incorporate variables reflecting return to deposits (interest rate, noninterest services provided, etc.) as well as those reflecting risk (non-performing loans, capital-to-asset ratio, etc). This specification allows us to answer two types of questions of particular interest in rapidly evolving and liberalizing financial systems: (1) How do banks gain or lose market share? Which specific return or risk factors are the most important in explaining a bank's deposit growth? (2) How well do depositors discriminate between well and poorly managed banks? Using semi-annual data for 1985-1999 we find evidence that the rate of growth of deposits is related to a wide range of proxies for a bank's probability of default. Furthermore, there is evidence that depositors' choices effectively discipline banks; following "fundamental-driven" deposit losses, banks tend to respond by improving their capitalization and coverage ratios. Finally, banks with strong fundamentals appear to benefit from lower interest costs. This allows us to conclude that in the case of Colombia, market discipline is strong and that moral hazard stemming from deposit insurance is limited, perhaps a consequence of certain design features of the insurance scheme.

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## I. Introduction

Following a liberalization program in the early 1990s, a significant number of new banking institutions, both domestic and foreign, entered the Colombian market and quickly acquired market share (Barajas, Steiner, and Salazar, 1999). After several years of extremely high growth and profitability, the banking system began to exhibit fragility and distress toward the end of the decade, in part as a result of deteriorating macroeconomic performance. Numerous banking as well as non-banking institutions have encountered mounting non-performing loans and diminishing solvency. From a policy perspective it is crucial to investigate whether depositor behavior has played a positive role during this period, imposing some degree of discipline during the early expansion and leading up to the more recent crisis.

The role depositors might play in imposing discipline to financial institutions has recently received significant attention in the literature, both for developed and developing countries. In all cases, particular attention has been devoted to the role played by deposit insurance. Insurance schemes are designed as a stabilizing mechanism in order to prevent problems at specific institutions from becoming systemic. However, they can create moral hazard, as depositors are less inclined to monitor financial institutions, which, in turn, become more prone to undertake higher risk operations. While a cross-country study by Demirguc-Kunt and Detragiache (1999) provides evidence that bank fragility increases as the insurance scheme becomes more extensive and explicit -- thereby suggesting that moral hazard dominates any stabilizing effect--, several case studies find support for the contention that depositors do in fact discipline banks, regardless of the specific characteristics of the deposit insurance scheme --implying that moral hazard is not very important.

In this paper we build upon the existing literature, using Colombia as a case study.<sup>2</sup> In most empirical studies, market discipline is tested by regressing the rate of growth of deposits and/or the rate of interest banks pay on deposits, against variables that proxy for a bank's probability of default, or bank "fundamentals". Market discipline is accepted if deposit growth diminishes (or if the interest rate on deposits increase) as the probability of default increases (bank fundamentals deteriorate). We improve upon this analysis in two major ways. First, we strengthen the market discipline tests by incorporating bank-specific variables that reflect the return to depositors and therefore should play a key role in depositors' choices among banks. Second, we take the analysis a step forward, by testing whether banks are effectively disciplined by depositor behavior; i.e., whether their fundamentals respond appropriately to depositors' signals.

We find strong evidence that the rate of growth of deposits depends on bank fundamentals and that, furthermore, banks respond to signals from depositors in a manner consistent with market discipline. Interestingly, the response from banks seems to be asymmetric, occurring only when they perceive they are being punished by depositors. This disciplining behavior does not appear to extend to the cases in which fundamentals are the weakest. That is to say, the most troubled banks tend to perpetuate their problems rather than to correct them.

These results suggest the existence of market discipline, with depositors taking into account bank fundamentals, sending signals to banks, who then adjust key fundamentals accordingly. Put differently, information relevant to the probability of default is taken into account, thus limiting moral hazard in spite of an explicit deposit insurance system. This may be due to some design features of Colombia's insurance

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<sup>2</sup> To our knowledge, the only market discipline test for Colombia undertaken to date is the quantity equation estimation contained in the Demirguc-Kunt and Huizinga (1999) cross-country study. In the OLS and "between" estimates, equity appears to contain some predictive power and has the correct sign, but the fit of the regression is relatively poor (0.03 in the OLS regressions, 0.13 in the between estimates).

scheme, which is compulsory, has co-insurance, is one in which premiums are risk-weighted, and in which coverage continuously declines in real terms.

The paper is divided into six sections, including this introduction. In the second section we spell out the basic analytical framework regarding depositor behavior in the presence of deposit insurance and summarize some results in the existing literature. In the third we describe the basic tests undertaken in previous studies on the subject, and propose some alternative specifications. In particular, we introduce the idea that actual disciplining cannot be detected exclusively through the behavior of depositors, as it is also important to assess how bank's actually react to the actions of depositors. In the fourth section we briefly describe Colombia's deposit insurance scheme, and compare some of its key features with those of other countries. We also present a case of a recent rumor-induced bank run, a good example that depositor's react not only in response to changes in fundamentals. Section five has three sets of econometric estimations. The first one looks at the determinants of the rate of growth of deposits, the second at the determinants of interest rates, and the third one at the reaction of bank's to changes in depositor behavior. In section six we conclude.

## II. Deposit insurance and depositor behavior

With the recent outbreak of high-profile financial and currency crises throughout the world and in emerging market economies in particular, the issue of proper regulation of the banking system has become critical to the policy discussion. On the one hand, 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 substantial economic benefits resulting in higher economic growth (Levine, 1997). On the other hand, it is also increasingly apparent that as financial systems are liberalized and rely more and more on market forces, they also 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 the instability of the system and minimize the probability of crisis.

One crucial aspect of banking system 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 disruptive and costly effects of the types of depositor runs that are endemic to a fractional reserve banking system. Of course, the cost of such a scheme is moral hazard, as insured depositors no longer have a strong incentive to monitor the behavior of banks where they hold their deposits, and thus banks will also have an incentive to assume greater risks. Therefore, the design of a deposit insurance scheme faces a tradeoff between the reduction of risk coming from bank runs and the additional risk induced by moral hazard.

In order to solve this question, policymakers must decide which of the two risks above is greater. For instance, if they believe that deposit runs are not a significant source of instability<sup>3</sup>, and that moral hazard is therefore the predominant risk, then they should opt to eliminate deposit insurance, as in the extreme case of New Zealand, where depositor protection is explicitly denied and therefore the system relies entirely on market discipline and transparency (García, 1999 and 2000). If, on the contrary, policymakers believe that deposit runs are extremely dangerous and likely, and that moral hazard is not significant, then they should choose the opposite extreme, a full explicit guarantee. In practice, both extremes are very rare, with the majority of countries in the world adopting some limited form of deposit insurance, and therefore assuming a certain level of additional 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 deposit insurance systems. Using the capacity to predict financial crisis as the prime criterion, the authors ask the following question: if the extent and coverage of deposit insurance increases, what happens to bank fragility? Based on a sample of 61 countries for 1980-97, they find that bank fragility increases as the deposit 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.

Given this strong empirical evidence showing moral hazard arising from deposit insurance, one should also expect to find evidence of weakening market discipline prior to banking crises, particularly in countries where deposit insurance is explicit and more extensive. In other words, if it is true that deposit insurance tends to increase fragility, one key mechanism through which this occurs should be a loosening of depositors' monitoring of bank performance or, a breakdown in discipline in the market for bank deposits.

However, this generally has not been the case. With a few exceptions, recent empirical studies of depositor behavior have given support for the presence of market discipline prior to banking crisis in different countries and with varying types of deposit insurance systems. Using panel data estimation on individual bank balance sheet information, several studies examine market discipline by testing whether a significant relationship arises between depositor behavior and bank fundamentals. Park and Peristiani (1998) show evidence of market discipline in the U.S. thrift industry throughout the 1980s, as depositors were shown to demand a higher interest rate and deposit growth was shown to be lower as banks' activities became riskier. Regarding developing countries, Martínez Pería and Schmukler (1999) consider the banking systems

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<sup>3</sup> Or that these runs are efficient, in the sense that they fully reflect the fundamentals of the banks (see

of Argentina, Chile, and Mexico, and find support for market discipline in all three cases, as the level of deposits was significantly related to bank fundamentals, once controlling for systemic and macroeconomic variables also affecting demand for deposits. This result is shown to hold even in the case of small, insured depositors. Schumacher (1996, 2000) finds evidence of market discipline in Argentina during the 1994-1995 “Tequila” crisis. Finally, Moore (1997) finds depositor growth to be significantly linked to bank fundamentals in Argentina during the 1990s<sup>4</sup>.

Considering the theoretical backing for moral hazard when deposit insurance is in place, this strong support for market discipline is somewhat puzzling. In fact, it has been argued that, even in the absence of *explicit* deposit insurance, depositors and bank managers may often tend to behave *as if* their deposits were insured, expecting a rescue if their bank were to experience serious difficulties. However, the Park-Peristiani and Martínez Pería-Schmukler results suggest the opposite, that even though deposits are *explicitly* insured, depositors behave *as if* they were not, refusing to trust the deposit guarantee fully. Furthermore, from the Demirguc Kunt-Detragiache (1999) study, the Mexican and Chilean deposit insurance systems exhibit some of the characteristics making them even more prone to fragility and hence, to moral hazard<sup>5</sup>: 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, and in Chile by being funded entirely by the government. 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

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Freixas and Rochet, 1997).

<sup>4</sup> It must be noted that the Moore (1997) study also finds the banking system in Mexico to exhibit *lack* of market discipline, as bank fundamentals do not explain deposit growth during the 1990s. However, the sample period is relatively small (only 16 observations) and the specification does not include many relevant systemic and macroeconomic variables (such as those used by Martínez Pería & Schmukler, 1999), so the test cannot be considered a strong finding of lack of market discipline.

<sup>5</sup> Demirguc-Kunt and Detragiache (1999) express these factors as dummy variables explaining the probability of banking crises. For example, if a deposit insurance system is explicit, the respective dummy variable takes on a value of one. Since this variable is shown to be a significant predictor of financial crisis, then a country with explicit deposit insurance is more likely to exhibit moral hazard.

arrangement practically rules out any scope for the central bank to serve as a lender of last resort.

What accounts for the empirical results supporting market discipline, even in the presence of extensive safety nets for depositors? We offer three possible explanations. First, if the above individual country tests have been properly specified, then they would suggest that the moral hazard problem in depositor behavior is not very important. Quite the opposite, lack of credibility of any safety net would lead depositors to discipline bank behavior regardless of the existence of deposit insurance. 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. The recent cross-country study by Demirguc-Kunt and Huizinga (1999) conducts market discipline tests for a number of developed and developing countries, and then pools the bank and country-specific data in order to test whether there is an impact of deposit insurance on market discipline. They find some evidence that the existence of deposit insurance lowers the responsiveness of deposit interest rates to changes in bank liquidity, an indication that market discipline is weakened. However, the study was not successful in finding significant market discipline effects in regressions explaining the growth of deposits. Therefore, if market discipline does exist, then it is most likely operating through the level of interest rates rather than through the demand for deposits.

A third possibility is that the individual country tests are not sufficiently strong, and therefore are incorrectly finding evidence of market discipline. This is what we intend to explore in the present study, with particular reference to the case of Colombia, by incorporating variables that reflect the direct 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 discussed in Calomiris and Powell (2000), even if there is evidence that depositors choose banks according to their performance or fundamentals, it does not necessarily follow that market discipline exists. It must also be true that banks are effectively “disciplined”, in that they react to the signals provided by depositors by improving their fundamentals in response to previous deposit withdrawals. Calomiris and Powell suggest an indirect test based on the behavior of deposit interest rates, and we build upon it by testing the direct response of individual fundamental variables to what we define as “fundamental” deposit withdrawals.

### III. Extending the tests for market discipline

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):

$$r_{it} = \mathbf{a}_0 + \hat{p}_{t+1,i} \mathbf{a}_1 + z_{it} \mathbf{a}_2 + \mathbf{e}_{it} \quad (1)$$

$$D_{it} = \mathbf{b}_0 + \hat{p}_{t+1,i} \mathbf{b}_1 + w_{it} \mathbf{b}_2 + v_{it} \quad (2)$$

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  $\hat{p}_{t+1,i}$ ; it represents the risk or expected loss assumed by depositors. Finally, the equations include vectors of other 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  $\mathbf{a}_i$  and/or  $\mathbf{b}_i$ . If depositors demand a higher interest rate from banks with a higher probability of default (i.e., higher risk), then  $\mathbf{a}_i$  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  $\mathbf{b}_i$  should be negative and significant, also signaling the existence of market discipline.

Two issues arise in the specification of equations (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 this probability using a logit model as a function of bank performance indicators or fundamentals (percentage of bad loans, profitability, equity ratios, portfolio composition, operational costs, among others) and using the estimated probability directly as an explanatory variable in equations (1) and (2). While this appears to be an adequate procedure, it may not always be possible to estimate the probability accurately, especially in a period when there are not many actual observations of 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 may be providing the strongest signals to depositors that banks are in fact taking on high risks. Therefore, it may make sense to include the bank fundamentals themselves as explanatory variables in the market discipline equations (1) and (2), and to test for market discipline by testing for their joint significance.

A second specification issue is what to include as the control variables  $z$  and  $w$ , which are expected to exert influence on depositor behavior. In the following sections we will examine the control variables used for each of the equations.

#### *Quantity equation: $w$ variables*

The above specification allows for the incorporation of two types of control variables in each of the regressions: bank-specific and system-wide variables. Most

studies tend to concentrate on system-wide controls, that is, macroeconomic variables that vary over time but not across banks. These may be captured alternatively by using period effects or time dummies in a panel data estimation.

Park and Peristiani (1998) include two macro variables indicating overall size of the market<sup>6</sup> (state-wide deposit growth), and bank-specific controls relating to market share and size (total assets), and a number of regulatory dummy variables. Demirguc-Kunt and Huizinga (1999) include two controls in their individual country estimations: bank overhead (the non-interest cost to asset ratio) and size (deflated by the GDP deflator). Martínez Pería and Schmukler (1999) include two sets of controls: systemic and macroeconomic variables, both of which vary over time but not across individual banks<sup>7</sup>. The principal systemic variable chosen was the cash (outside banks) to deposit ratio, capturing overall preference for bank deposits, and as a measure for contagion. The macroeconomic variables they included were: the ratio of international reserves to M2, the stock market index, and the external interest rate differential, the latter to control for the expected rate of devaluation.

The main shortcoming of the specifications used in these studies is that, while they may control for the effects of some aggregate factors, they do not incorporate additional individual bank variables that should play a key role in deposit demand, in particular the return to deposits. While risk is properly accounted for by the bank fundamental variables (capturing the probability of default), there is no incorporation of the returns to depositors. These returns may be viewed in a broad sense, encompassing both direct financial return (the interest rate) as well as benefits in terms of easing transaction costs, to the extent that bank deposits are used for payments purposes. Therefore, a full specification of deposit demand should incorporate these return variables.

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<sup>6</sup> In the case of U.S. Savings and Loan institutions, the relevant market is the respective state.

<sup>7</sup> They also control for individual bank size, but do not include it within the set of bank fundamental variables, since it is not considered to be directly linked to riskiness.

By not including these explanatory variables, 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 – all bank specific variables do not explain deposit levels – then there is no explanation for why depositors choose one bank over another or why deposits may grow more rapidly in one type of bank than in another. In this sense, the test may be considered too weak; if only bank fundamentals are permitted to explain how deposits vary from bank to bank, then the hypothesis of market discipline will tend to be accepted more often than is true. We propose strengthening the market discipline test by incorporating return variable  $x$ :

$$D_{it} = \mathbf{b}_0 + \hat{p}_{t+1,i} \mathbf{b}_1 + w_{it} \mathbf{b}_2 + x_{it} \mathbf{b}_3 + v_{it} \quad (2')$$

The return variables include the interest paid on deposits  $i_d$  (bank-specific), while the level of bank transaction services is proxied by the number of branch offices (*BRANCH*). Also, dummy variables indicating whether a bank is state-owned or private, or foreign or domestically owned, are also included to indicate whether depositors have a preference for these types of institutions. Note that we also control for bank size (*ASSETS*). While bank size may affect the probability of default owing to a regulatory “too big to fail” effect, we do not consider it a fundamental variable, since it does not reflect strictly how well an individual bank is being managed.

#### *The price (interest rate) equation*

Although there is an extensive literature estimating the price equation in the U.S. (see Flannery, 1998), there have been relatively few applications to emerging market economies. Notable exceptions are the case of Argentina (Schumacher, 2000 and Calomiris and Powell, 2000), and the cross-country study by Demirguc-Kunt and Huizinga (1999). The latter study conducts individual country estimations for several

emerging market economies, but excludes many others for lack of information on deposit interest rates. For example, it does not conduct this test for Colombia, Chile, or Brazil.

For other Latin American economies, the results are not strongly supportive of market discipline. While Schumacher (2000) and Calomiris and Powell (2000) find significant sensitivity of Argentine banks' cost of funds to their level of risk, the Demirguc-Kunt and Huizinga (1999) results show rather weak sensitivity of deposit rates to bank risk factors in Argentina, Bolivia, Mexico, Panamá, and Perú. This study estimates equation (1) by specifying three bank risk factors assumed to underlie the probability of failure  $p$ : equity (equity to assets), liquidity (liquid assets to total assets), and profitability (before tax profits to assets); and two bank-specific controls  $z$ : overhead (overhead costs to assets) and short-term debt (short-term to total interest paying debt). A significant negative coefficient on each of the risk factors is interpreted as evidence of market power. For example, if equity increases, then the lower bank risk should be reflected in a reduction in the deposit rate. Rarely are all three risk variables significant<sup>8</sup>, and it is unclear whether they are *jointly* significant. Liquidity appears to be the strongest performer, yet it is unclear whether this is truly a key risk factor, that is, whether it is a good predictor of bank failure.

In the cross-country regression, Demirguc-Kunt and Huizinga use the above specification plus dummy variables reflecting different aspects of the deposit insurance scheme, and country-specific macroeconomic variables included as additional controls (growth, inflation, the yield on government securities, and per capita income). Again, the liquidity variable is the only risk factor explaining declines in the deposit interest rate. Furthermore, the existence of deposit insurance is shown to reduce (but not eliminate) this effect, thus suggesting that market discipline may be weakened by deposit insurance but not eliminated.

We will refine the above analysis, by examining the risk variables more closely, and including additional bank-specific controls, as in our deposit growth equation. Regarding the risk variables, we will focus our attention on those that have a proven track record in predicting bank failure (see the discussion below). While it may be the case that liquidity is a prime determinant of bank failure (or success), it would be useful to test the above equation with other determinants as well, given that equity and profitability do not seem to matter to depositors. As for bank-specific controls, we would extend the list to include *BRANCH* and *ASSETS* to measure to what extent depositors may be trading off interest for other benefits of holding deposits<sup>9</sup> or to what extent banks may possess market power, and bank-type dummies (state-owned or foreign-owned) which may reflect depositors' perceptions of risk through reputation. Finally, we will capture time-varying shocks to all banks either through period effects or through macroeconomic indicators, the most critical of which would be the interest rate on alternative assets. In this regard, it must be noted that the government security yield rate received overwhelming support as having a positive effect on deposit interest rates in the Demirguc-Kunt and Huizinga cross-country regressions.

#### *Response of banks to disciplining behavior by depositors*

As discussed earlier, whether depositors are sensitive to bank fundamentals is only the first step in determining whether there is market discipline. A second step should involve understanding whether banks respond positively to the signals provided by depositors. For the case of Argentina, Calomiris and Powell (2000) explore this issue by testing whether there is a tendency for individual banks' 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 interest rates may fall again (i.e., improving their fundamentals). The authors not only

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<sup>8</sup> One exception is Perú, where the "between estimates" show all three risk factors significantly bringing interest rates down.

<sup>9</sup> The ratio of overhead costs to assets, used by Demirguc-Kunt and Huizinga, is a rather crude measure of these services.

accept the hypothesis of mean reversion but also provide evidence that the speed at which interest rates revert to their mean has increased, attributable to improvements in accounting and supervision standards.

We develop the test further, along three major lines. First, rather than focusing exclusively on interest rates as the dependent variable, we test directly whether bank *fundamentals* react to changes in deposits. Second, since changes in deposits may be caused by non-fundamental as well as fundamental variables, we zero in on those changes that are attributable to an individual bank's performance fundamentals in relation to those of other banks. Therefore, we define a "fundamental" deposit growth as the key explanatory variable for bank response. Third, we allow for a possible asymmetry in this response. Market discipline implies that a bank should improve its fundamentals following a deposit withdrawal, but it does not necessarily follow that a bank should let its fundamentals deteriorate if deposits are growing rapidly. Therefore, we allow for the possibility that banks only respond on the downside.

#### IV. Deposit insurance in Colombia and a case of a non-fundamental bank run

Following the financial crisis of the early 1980s, FOGAFIN (Fondo de Garantías de Instituciones Financieras, for Financial Institutions Guarantee Fund) was created in 1985 (Law 117). One of the several obligations of its Board of Directors was to develop a deposit insurance scheme, whose *current* main features are (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 to them. All financial institutions registered in FOGAFIN and under the tutelage of the Banking Superintendency are required to purchase deposit insurance: commercial banks, savings and loans (CAV's), financial corporations, commercial finance companies, leasing companies and capitalization societies.

(ii) Insured liabilities are demand deposits, CD's, savings accounts, UPAC accounts<sup>10</sup>, receipts payable, tax collection services and capitalization titles. FOGAFIN will cover 75% of the amount deposited up to a maximum coverage of col\$10'000.000 per accounts, regardless of the number of persons owning the account. In each institution, and regardless of the number of accounts, one person is only insured up to col\$10.000.000, while accounts in different institutions are insured separately. Insurance only covers deposits payable in Colombia, and regarding interest-earning liabilities, insurance covers principal, monetary correction and regular interests.

(iii) Yearly premiums amount to 0.3% of all liabilities (and 0.3% of reserves in the case of capitalization societies), paid quarterly and are differential among institutions, through a system of reimbursements based on efficiency and solvency indicators. At the end of each year, financial institutions are reimbursed 50% of premiums paid if their CDs and Time Savings Deposits have been granted "Investment Grade" by a specialized grading institution, and 25% if they have been awarded a "Good Grade."<sup>11</sup>

One particular issue to be highlighted is the effective coverage of the scheme. The bottom portion of Table 1 describes qualitative and quantitative aspects of deposit insurance coverage in Colombia. Almost all financial system accounts – just under 98% in 1999 – are smaller than the maximum coverage of col\$10 million and are thus fully covered<sup>12</sup>. Also, almost all accounts –just over 98% in 1999 – were of types covered by the insurance scheme. However, in terms of value overall coverage much smaller – 35% in 1999 – owing to the existence of a small number of extremely large accounts. Furthermore, this percentage has been declining continuously throughout the nineties

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<sup>10</sup> UPAC, or "constant purchasing power", accounts were created in the early seventies as a means to ensure that depositors would receive a positive real return. Their yield thus incorporates an inflationary or "monetary" correction component plus a "regular" or pure interest component.

<sup>11</sup> In the event that several grading institutions grade a financial institution, FOGAFIN will take into account the lowest grading. Financial institutions are not entitled to reimbursement if during the previous year they have received guarantee capital from FOGAFIN or special credit from the central bank.

reflecting the fact that the coverage limit has been fixed in nominal terms while annual inflation has been between 10 and 15%. Therefore, over time we may expect value coverage to continue to decline as well as the percentage of accounts under the coverage limit.

The effective coverage can also be analyzed on an ex post basis. In Table 2 we can observe actual payments undertaken by FOGAFIN in 1996-2000, following a period of enormous financial distress. Payments are expressed as a percentage of insured liabilities. The enormous variance among different institutions has several possible explanations, including the different composition of deposits (by size and type) across institutions. In one case, deposit insurance covered as little as 4% of an institution's liabilities, while in another it covered almost 53%.

In Table 3, taken from Beck (2000), we have added a column for Colombia in order to compare across countries some key characteristics of the deposit insurance scheme. According to the Demirguc-Kunt and Huizinga (1999) analysis, there appear to be several features of Colombian deposit insurance that would increase the likelihood of moral hazard: the system is explicit, funded, and managed by the government. On the other hand, there are features that may work in the opposite direction: there is a coverage limit (set in nominal terms and therefore continuously declining in real terms), membership is compulsory, there is co-insurance by depositors (25% of the amount covered), and premiums are risk-adjusted (through the system of reimbursements). Whether or not deposit insurance has prevented depositors from exerting market discipline in Colombia is therefore an open question, one that has to be addressed empirically.

On a more anecdotal level, an incident in mid-1999 involving a deposit run on a relatively sound bank raises questions on both sides of the market discipline/moral hazard

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<sup>12</sup> Of course, excluding the deductible amount of 25%.

question. On May 26<sup>th</sup>, an unfounded rumor that a large private bank was on the brink of bankruptcy was spread through the internet. This provoked a depositor panic, and in one day this bank's deposits fell by 5% of total liabilities in net terms, with an even larger gross loss as some government entities that had withdrawn their deposits early in the day returned them late in the afternoon. The net deposit loss was covered, in almost equal parts, through credit from the central bank, other financial institutions, and real sector corporations. Deposits gradually came back, but were not fully restored until the end of October. The person who spread the rumor was eventually caught and charged with provoking an economic panic.

This incident illustrates on the one hand, the willingness of the public to move quickly and withdraw their deposits in response to perceived increased risk of bankruptcy. This suggests that depositor risk has not been completely eliminated by the insurance scheme, and therefore depositors have an incentive to monitor banks. On the other hand, the large response to unfounded and even blatantly incorrect news suggests that depositors do not have very reliable information, and this may prevent them from monitoring bank behavior effectively. In other words, it may be the case that depositors have the incentive but not the means to impose market discipline.

## V. Estimations

We perform estimations on semi-annual data for 1985-1999 based on individual bank balance sheets and income statements, which yield a set of bank-specific variables which are 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<sup>13</sup>:

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<sup>13</sup> González-Hermosillo (1999) provides an estimation of the probability of bank failure during the 1982-1985 Colombian banking crises, much in the same manner as in the Park and Peristiani study of the U.S. savings and loan market. In particular, González-Hermosillo 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. Both bank failures and bank distress were explained to a large extent by such

$NPL$  = 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

$LIQUIDITY$  = total reserves/assets

Based on the analytical framework discussed above, we want to test whether depositors react to changes in (the proxies of) a bank's probability of default. In particular, depositors 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 empirical literature considers higher liquidity as an indication of a lower probability of default, in this paper we offer a slightly different interpretation. We allow for differences in the importance of a bank's holding of liquid assets depending on the business cycle. In particular, while in "bad times" (i.e., a sharp recession) 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 the real growth rate in relation to its trend growth rate for the 1970-1996 period<sup>14</sup>, and produce a time-varying dummy variable,  $BADTIMES$ . The product of this variable with  $LIQ$  results in  $BTLIQ$ , which captures whether there are indeed different

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bank fundamental variables as non-performing loans, the deposit-asset ratio (measuring liquidity risk), deposit and lending interest rates, and the net income-asset ratio (indicating profitability).

<sup>14</sup> The trend growth rate for Colombian 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 (i.e., below 3.1 percent) as "bad times". This yielded 9 of 30 observations classified as "bad times".

effects of liquidity during “bad times”. If our priors are correct, depositors should view liquidity negatively, except during “bad times.”

We control for other variables that might affect both the rate of growth of deposits and the level of interest rates. Total real assets (*ASSETS*) allow us to incorporate the effect of bank size. If after controlling for all other variables deposits grow faster (or interest rates are lower) in larger banks, this may indicate that depositors believe that these banks are “too big to fail”, and therefore that deposits held there are safer. As we discussed earlier, we include two controls for the return to deposits: the number of branches (*BRANCH*), and (in the deposit growth equation) the deposit interest rate ( $i_D$ ). We expect the number of branches to reflect the quality of payments services offered by the banks; all else constant, deposits should grow faster in those banks that lower transaction costs or offer more payments services by providing more branches. We measure the interest rate implicitly from the balance sheets and income statements, as the ratio of interest paid to the average stock of deposits over a given six-month period<sup>15</sup>.

In addition, we want to control for the effect of macroeconomic shocks that affect all banks equally, such as changes in GDP growth and interest rates on government securities. As we discuss below, our best results were obtained using period effects, but our estimations using specific macroeconomic controls yielded similar overall results. Finally, we have 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 semi-annual panel data for the 1985-1999 period, with a sample encompassing virtually the entire commercial banking system (25-33 banks, depending on the period), excluding only a few smaller banks for which there was missing information. We allowed for different bank-specific intercepts by using

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<sup>15</sup> In future estimations, we intend to use a more detailed, monthly data set available for the more recent post-1990 period. This will allow us to use the more precise marginal posted interest rates rather than those obtained implicitly from the balance sheet and income statements.

fixed effects (*FE*) and random effects (*RE*) estimation, and chose which to report according to the Hausman test. In all cases differences in bank-specific intercepts were overwhelmingly accepted, as was the existence of common period effects. Tables 4A and 4B show the results of the panel data estimation for the real growth of deposits (*DRD*), using time or period effects.<sup>16</sup>

### *Deposit growth equation*

As we expected, deposit growth depends positively and significantly on the rate of interest 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, giving support to the “too big to fail” argument. However, this coefficient is significant only in about half of the estimations.

With respect to the dummy variables that account for ownership, whether banks are foreign or domestically owned seems to make no difference, thus showing that foreign banks do not appear to possess any reputational advantages in attracting deposits. However, in several estimations state-owned banks exhibit a significantly higher rate of growth of deposits. Since we are already controlling for fundamental variables capturing quality of bank management, we interpret the positive coefficient on *STATE* as an indication that, other things constant, depositors perceive state-owned banks as less likely to default, presumably because they are perceived as more likely to be bailed out by the government in case of distress.

Regarding the fundamental variables, Table 4A includes estimations in which they are introduced one by one, and Table 4B shows the estimations when more than one are included at a time. The results reported in Table 4A give evidence of market

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<sup>16</sup> Estimations using macro controls are available upon request. Although most results reported in Tables 4A and 4B still hold, this is not the case for the liquidity variables *LIQ* and *BTLIQ*, which continue to be significant, but with a counterintuitive sign.

discipline. Though deposit growth does not appear to depend on the level of non-performing loans (*NPL*) nor on the return to equity (*ROE*)<sup>17</sup>, 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 in which 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, as reflected in the negative significant coefficient of *LIQ*. During an economic downturn, on the other hand, depositors' view of liquidity changes, presumably as the bank becomes better equipped to withstand a draining of resources. This is shown by the positive coefficient of *BTLIQ*.

Most of these results carry on to Table 4B, where now 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, although the coefficient is only significant, and at the 90% level, in one of the regressions. The results on a bank's interest rates and the number of branches continue to hold and have the expected signs. Regarding ownership, once again we observe that the rate of growth of deposits is higher for state-owned banks, and this coefficient is statistically significant in two out of the four specifications. Again, whether a bank is domestically or foreign-owned seems to have no effect on the rate of growth of deposits.

Turning to the variables that approximate a bank's probability of default, once again the percentage of non-performing loans and the return-on-equity (*ROE*) do not appear to have any effect on depositor behavior. On the other hand, the coverage ratio (*COVGE*), which a previous study (González-Hermosillo, 1999) found to be a good leading indicator for bank failure, does have a positive and significant effect on the rate of growth of deposits. When we decompose this variable into its three components:

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<sup>17</sup> This is a common result in the country studies surveyed.

provisions (*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 statistically significant.

Finally, in all four regressions a higher level of liquidity (*LIQ*) is associated in a statistically significant manner with a lower rate of growth of deposits during normal times, while *BTLIQ* is associated with the a higher rate of growth of deposits. In the final column of Table 4B we test for the linear restriction that the sum of the coefficients on *LIQ* and on *BTLIQ* is equal to zero, which is not rejected. Thus, our final reading on the matter is as follows. In “normal times” (i.e. when the rate of growth of GDP is not considerably below trend), the bad news coming out of a high level of liquidity (i.e. a low return on assets) dominates the good news (i.e. the bank will more easily accommodate a deposit withdrawal). On the other hand, in “bad times” depositors perceive that the level of liquidity is irrelevant -- the negative effect associated with a low return on assets appears to be offset by the positive effect stemming from a better ability to cope with a deposit withdrawal.

#### *The interest rate equation*

We also estimated the equation for the interest rate on deposits, the results of which are shown in Table 5. As was discussed above, this interest rate is measured implicitly, and therefore is only an approximate and average measure of a bank’s interest rate behavior. The implicit interest rate is highly dependent on the types of deposits held by a bank (a significant portion of which are demand deposits, which do not pay interest), and, by the same token, if deposits are of a long-term maturity, it is a deficient proxy for a bank’s marginal response to a change in the attitudes of depositors. Our future work will focus on taking advantage of a shorter monthly database currently being constructed in which we be able to use more direct measures of marginal and shorter term interest rates.

In the analytical framework discussed above, it was argued that depositors discipline banks by withdrawing deposits as the probability of default increases. Of course, it could well be the case that as the probability of default increases, we do not observe a decline in the rate of growth of deposits, only because banks compensate the increased probability of default with a hike in the interest rate paid on deposits. That being the case, depositors discipline banks either by withdrawing deposits or by demanding higher interest rates on deposits as “fundamentals” deteriorate. One should not necessarily expect to observe both a fall in deposits and an increase in interest rates as a result of an increase in the likelihood of default. Thus, since we have just shown that market discipline is not rejected for a key subset of fundamental variables in the deposit growth equation, we should not expect to observe any particular relationship between interest rates and these fundamentals, as all market discipline may be operating through the quantity of deposits.

In the interest rate equation, the results for non-fundamental variables are mixed. As shown in Table 5, we find additional support for the “too big to fail” argument, since, after controlling for all other variables, larger banks appear to be able to attract deposits at a lower interest rate. Again we find that whether a bank is private or state-owned matters, and whether it is domestic or foreign-owned does not. Once again, we interpret this result as evidence that, other things constant, state-owned banks have an advantage over private institutions, presumably because depositors perceive that, in case of distress, the former will stand a greater chance of being bailed out by the government. The result on *BRANCH*, however, is puzzling, since we expect the number of branches to be a good proxy for services rendered by banks to their clients, services that should substitute, rather than complement, the interest rate paid on deposits.

Regarding our fundamental variables, we also obtain mixed and sometimes contradictory results. The capital-asset ratio, the coverage ratio, and the level of liquidity

all perform in a manner consistent with market discipline, that is, significantly lowering the interest rate that banks need to pay to attract deposits. However, other fundamental variables do not fare as well. Increases in provisions or profitability, or improvements in loan quality (declines in nonperforming loans) are shown to *increase* the interest rate that depositors demand from banks. Furthermore, the distinction between liquidity in “normal times” and in “bad times” (*BTLIQ*) does not seem to be relevant in the case of interest rates.

#### *Response of banks to changes in deposit growth*

In the previous two sections we showed that depositor behavior appears to be broadly consistent with market discipline, particularly as seen in the deposit growth regressions; depositors tend to prefer banks with stronger fundamentals such as the level of capitalization and loan-loss provisions. 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 4B. Note that this variable is bank-specific, but below we drop the *i* subscript for simplicity.

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

The first test therefore consists of regressing each of the fundamental variables on lagged *DRDFUND*, to determine whether this period’s fundamentals are sensitive to depositors’ preference for 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 it

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 very encouraging, however, as shown in the top portion of Table 6. Only *PROV* clearly appears to behave in a manner consistent with market discipline, where a previous deterioration leads to an increase today in provisions. Liquidity responds with the expected sign but the coefficient is not statistically significant. All other variables appear to exhibit the opposite behavior: if fundamentals deteriorate (improve) in the previous period, and therefore depositors withdraw (increase) deposits, then today fundamentals tend to deteriorate (improve) even more.

One possibility for this behavior is that banks may respond asymmetrically to signals by depositors. On the upside it may be the case that a virtuous cycle is observed whereby an initial improvement in fundamentals leads to further improvements in future periods, whereas on the downside a bank manager would not allow a vicious cycle to ultimately doom the bank, so he would be likely to react by improving the fundamentals. Thus, in a second group of tests we allow for this type of asymmetry, whereby the bank only reacts when it perceives a deposit *loss*, stemming from weak fundamentals.

We define two types of deposit losses, one in absolute and one in relative terms. The first refers to a situation in which the fundamental deposit growth rate of a given bank is negative, so it defines an absolute loss of deposits owing to weak fundamentals. The second defines a deposit loss as any situation in which a bank exhibits a fundamental growth rate below the banking sector average, thus indicating that this bank could increase deposits by moving its fundamentals closer to the sector average. Formally, two dummy variables for each bank *i* and period *t* are defined and shown below:

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

We must note that these variables constitute two extremes in how we may define deposit losses<sup>18</sup>. In the total sample of 709 observations, *DLOSS1* defines only 15 observations as having been of fundamental deposit losses, therefore it captures only the extreme cases of individual banks being most 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 only, using the two extreme cases. In the case of *DLOSS1*, the more extreme observations of weak fundamentals, two minor changes in results occur with the respect to the symmetric estimation, as shown in the second portion of Table 6. First, the capital-asset ratio is now simply unresponsive to deposit losses, rather than being responsive in the wrong direction. Second, liquidity has the correct sign and now approaches statistical significance, with a p-value of just over 10 percent. Therefore, in these most extreme cases, the 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 the coverage falls even more, reflecting a type of vicious cycle of deteriorating fundamentals.

For *DLOSS2*, a wider sample including less extreme cases of deposit losses, bank behavior appears to be more consistent with market discipline. Banks now tend to improve their coverage and capital-asset ratio when depositors have discriminated against them in the previous period, they continue to adjust their provisions upward, but do not appear to adjust their nonperforming loans or their liquidity levels.

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<sup>18</sup> We also conducted tests on two intermediate definitions: when deposit growth is below the sector average minus two standard deviations, and when it fell below the average minus one standard deviation. We excluded their results from Table 6 since the two extremes (*DLOSS1* and *DLOSS2*) illustrated the main properties of this type of analysis.

A final set of tests investigated whether, in addition to changes in fundamental variables, banks adjusted their interest rates following fundamental-driven changes in deposit demand. We would expect a negative relationship; banks would react to a previous deposit loss by increasing interest rates. In this way, they could counteract the (absolute or relative) deposit outflow without having to resort to improving their fundamentals. In other words, in a broad sense they could attract deposits either by lowering risk (i.e., improving fundamentals) or by increasing return (the interest rate). We estimate the interest rate equation describe in Table 5 but replace all fundamental variables with *DRDFUND* as well as its cross-product with each of the deposit loss variables. The results show that interest rates do exhibit the expected behavior symmetrically, thus suggesting that interest rates not only increase in response to a deposit loss, but also tend to be lowered when the fundamentals are above-par and deposits are growing rapidly. Furthermore, the asymmetric estimation does not seem to hold, thus indicating that the adjustment seems to be occurring primarily on the upside. However, a final exercise estimated the interest equation using *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.

## VI. Conclusions

In this study we have asked two broad types of questions: (1) What determines depositor behavior? and (2) do banks respond correctly to signals provided by depositors regarding the quality of management? With regard to the first question, we have found the strongest answers from the estimations for real deposit growth, which showed that Colombian depositors respond to both risk and return factors. Banks attract deposits either by offering high interest rates (return), providing a large number of branches (return), or by exhibiting strong fundamentals, which presumably lowers the risk of default. Furthermore, state banks appear to have an inherent advantage in attracting

deposits, possibly due to depositors' expectation that policymakers will not allow these institutions to fail. On the other hand, although foreign banks have been highly successful in attracting deposits in recent years, they do not appear to have any advantage in terms of reputation, as their deposit growth is explained entirely by the return they offer and their fundamentals. Finally, there appears to be some limited evidence of a "too big to fail" perception by depositors, most noticeably in the interest rate equation, where larger banks were able to pay a lower interest rate.

Not all fundamentals appear to matter to depositors, however. While coverage, and two of its components, the capital-asset ratio and loan-loss provisions, tend to exert a positive influence on the growth of deposits, neither profitability (as measured by the return to equity), nor nonperforming loans, nor liquidity ratios appear to be associated with declines in depositors' perceived risk of losses. As we discussed earlier, 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 depositor's attitudes toward liquidity varied depending on whether the macroeconomic environment was normal, or one of particularly low growth. During normal times, greater liquidity was associated with a low level of intermediation activities, with very 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 their fundamental variables (namely coverage, capitalization, and provisions). Our results also gave support to the hypothesis that this response was asymmetric, occurring only when the banks perceived that they were being punished by depositors. However, this disciplining behavior did not appear to extend to the cases in which fundamentals were the weakest, as these banks tended to perpetuate their problems rather than try to correct them. 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 than the rest of the banking system.

These results point to the existence of market discipline in Colombia, as depositors take into account bank fundamentals, send signals to the banks, who then adjust their behavior accordingly. In other words, information relevant to the probability of default is being taken into account, and thus moral hazard is limited, even though there is an explicit deposit insurance system throughout our sample period. This may be due to one or several design features, such as its compulsory nature, or the co-insurance, risk-weighted premiums, and the existence of a coverage limit that is continuously declining in real terms. With regard to the latter variable, we note that the recent cross-country study by Demirguc-Kunt and Detragiache (1999) finds evidence that the less extensive the coverage, the less moral hazard and greater market discipline is observed.

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 correct direction) to depositors' signals. This finding is consistent with the level of provisions being largely an automatic or "endogenous" response of banks in order to comply with regulation. While this in no way detracts from the fact that depositor behavior helps discipline banks, it highlights the fact that, following a reaction from depositors, the bank "fundamentals" that are affected most are those closely linked to regulation. Note that a "fundamental" over which regulation has little or nothing to say - for example NPLA - does not respond to changes in depositor behavior. Thus market discipline in Colombia may be driven by regulation to a significant degree<sup>19</sup>.

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<sup>19</sup> In future work, also based on more detailed monthly bank data, we will investigate to what extent depositor behavior is driven by large government deposits in the banking system, perhaps another instance of "government-driven" market discipline.

Finally, although depositor behavior appears to exhibit market discipline and moral hazard seems to be limited, there still are two principal causes for concern. First, it is unclear why nonperforming loans do not play an important part neither in depositors' decisions nor in banks' responses, especially when this indicator has proven to be a very good leading indicator in predicting defaults, both in Colombia's mid-eighties crisis as well as in other countries (González-Hermosillo, 1999). Second, market discipline is certainly weakened by the preference for state-owned banks and a possible "too big to fail" mentality on the part of depositors, and indication that some degree of moral hazard still remains.

**Table 1. COLOMBIA'S DEPOSIT INSURANCE SCHEME**

	1994	1995	1996	1997	1998	1999
<i>Characteristics:</i>						
Premium (% of insured deposits)	0.0015	0.0015	0.0015	0.0015	0.0015	0.003
Refund for "Investment Grade"					50%	50%
Refund for "Good Grade"					25%	25%
Coverage limit (col\$mill)	10	10	10	10	10	10
Deductible	25%	25%	25%	25%	25%	25%
<i>Coverage indicators:</i>						
	(Percentage of total financial system)					
<i>Eligibility</i>						
By size: Number of accounts smaller than the coverage limit	98.61%	98.33%	98.00%	97.79%	97.58%	97.87%
By type: Number of eligible accounts		98.56%	92.70%	95.15%	97.95%	98.12%
<i>Value covered</i>						
Total insured deposits	48.16%	45.07%	41.51%	40.19%	37.72%	34.63%

Source: Superintendencia Bancaria de Colombia

**Table 2. Colombia: Actual Insurance Payments to Depositors (1996-2000)**

Intervened Institution	Amount paid/Insured liabilities
<b>COMMERCIAL BANKS</b>	
BANCO SELFIN S.A	9.9%
BANCO ANDINO	5.9%
BANCO PACIFICO S. A.	5.7%
<b>FINANCIAL CORPORATIONS</b>	
CORFIPACIFICO	10.6%
<b>COMMERCIAL FINANCE COMPANIES</b>	
LA FORTALEZA S.A.	40.6%
BERMUDEZ Y VALENZUELA S.A.	32.8%
C.F.C.PACIFICO	19.6%
FINDESARROLLO	16.7%
<b>LEASING COMPANIES</b>	
LEASING SELFIN S.A	20.0%
LEASING FINANCIERA CAUCA S.A. (FINANCAUCA)	16.2%
LEASING PATRIMONIO	9.2%
FINANCIERA ARFIN	4.4%
<b>CAPITALIZATION SOCIETIES</b>	
CAPITALIZADORA GRANCOLOMBIANA	52.8%

Source: Fogafin

**Table 3. Cross-country comparison of deposit insurance schemes**

	Germany	EU*	US	World average (68 countries)	Colombia
Coverage limit	30% of equity	ECU\$20000	US\$100000	3 times per capita GDP	col\$10 million**
Coinsurance	No	10%	No	Yes, in 17	25%
Foreign currency deposits covered	Yes	Can be excluded	Yes	Yes, in 48	n.a.***
Inter-bank 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

\* Minimum requirements.

\*\* As of July 2000, this is around USD4600, or 2 to 3 times per capita GDP.

\*\*\* Colombia's financial system does not allow for foreign currency deposits.

Source: Beck (2000).

**TABLE 4A. 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)
<u>Return on deposits</u>					
$I_D$	0.694 (2.774)**	1.184 (5.421)**	0.763 (3.025)**	0.996 (4.510)**	0.687 (2.753)**
<i>BRANCH</i>	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)*
<u>Probability of default: bank size and lagged fundamentals</u>					
<i>ASSETS</i>	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)
<i>NPL(-1)</i>	-0.138 (1.020)				
<i>KASS (-1)</i>		2.332 (14.742)**			
<i>COVGE(-1)</i>				1.963 (13.666)**	
<i>LIQ(-1)</i>					-0.503 (-1.962)**
<i>BTLIQ(-1)</i>					0.897 (2.308)**
<i>ROE(-1)</i>			-0.017 (1.485)		
<u>Sector dummies</u>					
<i>STATE</i>	.026 (0.461)	.099 (2.116)**	.009 (0.179)	0.117 (2.437)**	.017 (0.319)
<i>FOR</i>	.007 (0.138)	-0.025 (0.561)	0.007 (0.139)	-0.048 (-1.049)	.016 (0.313)
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 obs.	709	709	709	709	709
R2	0.293	0.470	0.294	0.451	0.299

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

**TABLE 4B. 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)	(9) <sup>1</sup>
Estimation method:	FE	FE	FE	FE
Constant	-0.273 (4.745)**	-0.419 (6.891)**	-0.400 (6.549)**	-0.400 (6.549)**
<u>Return on deposits</u>				
$I_D$	0.947 (4.253)**	1.154 (5.228)**	1.126 (5.136)**	1,117 (5.107)**
<i>BRANCH</i>	0.732E-03 (1.947)*	0.645E-03 (1.746)*	6.83E-04 (1.858)*	0.684E-03 (1.859)**
<u>Probability of default: bank size and lagged fundamentals</u>				
<i>ASSETS</i>	0.302E-07 (1.753)*	0.249E-07 (1.467)	0.240E-07 (1.420)	0.232E-07 (1.378)
<i>NPL(-1)</i>		0.166 (1.391)		
<i>NPLASS(-1)</i>			-0.547 (1.402)	-0.562 (1.443)
<i>PROV(-1)</i>			1.427 (2.587)**	1,432 (2.596)**
<i>KASS (-1)</i>		2,404 (14.657)**	2,396 (14.882)**	2,399 (14.910)**
<i>COVGE(-1)</i>	1.980 (13.609)**			
<i>LIQ(-1)</i>	-0.605 (2.672)**	-0.430 (1.926)*	-0.416 (1.852)*	-0.447 (2.038)**
<i>BTLIQ(-1)</i>	0.702 (2.049)**	0.614 (1.822)*	0.617 (1.839)*	0.447 (2.038)**
<i>ROE(-1)</i>	0.005 (0.500)	0.012 (1.197)		
<u>Sector dummies</u>				
<i>STATE</i>	0.133 (2.747)**	0.086 (1.727)*	0.076 (1.540)	0.080 (1.615)
<i>FOR</i>	-0.044 (0.961)	-0.014 (0.307)	-0.023 (0.513)	-0.024 (0.535)
Bank effects	102.15	103.54	103.41	
p-value	0.00	0.00	0.00	
Period effects	179.29	172.36	179.39	
p-value	0.00	0.00	0.00	
Hausmann test	36.67	24.93	29.08	
p-value	0.00	0.01	0.00	
No. of obs.	709	709	709	709
R2	0.458	0.478	0.482	0.482

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

**TABLE 5. DETERMINANTS OF THE NOMINAL RATE OF INTEREST ( $i_D$ )**  
(Period and bank-specific effects, semi-annual data, 1985(1)-1999(2))

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Estimation method:	FE	FE	FE	FE	FE	FE	FE	FE	RE
Constant	0.156 (25.165)**	0.164 (25.040)**	0.151 (25.158)**	0.158 (25.123)**	0.164 (21.311)**	0.163 (20.668)**	0.174 (20.613)**	0.180 (21.357)**	0.188 (17.917)**
<i>BRANCH</i>	0.159E-03 (2.367)**	0.156E-03 (2.347)**	0.161E-03 (2.422)**	0.155E-03 (2.319)**	0.161E-03 (2.403)**	0.163E-03 (2.456)**	0.167E-03 (2.544)**	0.166E-03 (2.515)**	0.633E-04 (1.159)
Probability of default: bank size and lagged fundamentals									
<i>ASSETS</i>	-0.853E-08 (2.791)**	-0.840E-08 (2.781)**	-0.864E-08 (2.863)**	-0.875E-08 (2.879)**	-0.956E-08 (3.120)**	-0.925E-08 (3.051)**	-0.853E-08 (2.828)**	-0.869E-08 (2.872)**	-0.528E-08 (1.927)*
<i>NPL(-1)</i>	-0.029 (1.352)						-0.050 (2.342)**		
<i>NPLASS(-1)</i>								-0.220 (3.159)**	-0.217 (3.204)**
<i>PROV(-1)</i>								0.243 (2.460)**	0.236 (2.423)**
<i>KASS(-1)</i>		-0.107 (3.805)**					-0.098 (3.371)**	-0.111 (3.857)**	-0.118 (4.257)**
<i>COVGE(-1)</i>				-0.062 (2.446)**		-0.043 (1.682)*			
<i>LIQ(-1)</i>					-0.076 (1.875)*	-0.063 (1.573)	-0.075 (1.875)*	-0.086 (2.138)**	-0.122 (3.533)**
<i>BTLIQ(-1)</i>					-0.003 (0.046)	-0.004 (0.072)	0.009 (0.144)	0.009 (0.157)	0.071 (1.784)*
<i>ROE(-1)</i>			0.007 (3.839)**			0.006 (3.351)**	0.005 (3.022)**		
Sector dummies									
<i>STATE</i>	-0.022 (2.459)**	-0.030 (3.575)**	-0.027 (3.235)**	-0.029 (3.481)**	-0.023 (2.748)**	-0.027 (3.132)**	0.020 (2.252)**	-0.024 (2.706)**	-0.020 (2.401)**
<i>FOR</i>	0.002 (0.245)	0.005 (0.588)	0.005 (0.629)	0.005 (0.611)	0.003 (0.382)	0.006 (0.763)	0.004 (0.545)	0.002 (0.226)	0.007 (1.066)
Bank effects	443.34	449.63	442.26	438.95	378.38	390.56	410.63	402.70	402.70
p-value	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Period effects	256.56	267.29	274.75	268.97	223.04	228.47	220.53	225.60	225.60
p-value	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Hausmann test	17.48	14.67	19.45	16.27	15.54	16.32	14.66	12.02	12.02
p-value	0.00	0.01	0.00	0.01	0.02	0.04	0.10	0.21	0.22
No. of obs.	709	709	709	709	709	709	709	709	709
R2	0.692	0.698	0.698	0.694	0.694	0.701	0.707	0.705	0.287

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

**TABLE 6. RESPONSE OF BANKS TO FUNDAMENTAL-DRIVEN LOSSES IN DEPOSITS**  
(Period and bank-specific effects, semi-annual data, 1985(2)-1999(2))

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

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

<sup>1</sup> Regressions included non-fundamental controls: *ASS*, *BRANCH*, *STATE*, *FOR*.

<sup>2</sup> In this case regressors are *DLOSS1* and *DLOSS2* rather than their products with *DRDFUND*.

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