IMF Working Paper

WP/98/110   INTERNATIONAL MONETARY FUND

Western Hemisphere Department

Interest Spreads in Banking: Costs, Financial Taxation, Market Power, and Loan Quality in the Colombian Case 1974–96

Prepared by Adolfo Barajas, Roberto Steiner, and Natalia Salazar[1]

Authorized for distribution by Leonardo Cardemil

August 1998

Abstract

This paper examines the determinants of the high intermediation spread observed in the Colombian banking sector for over two decades. A reduced-form equation is estimated on the basis of a bank profit maximization model that permits a decomposition into operational costs, financial taxation, market power, and loan quality. Although the average spread did not change between the pre liberalization (1974-88) and post liberalization (1991-96) periods, its composition did, with market power being significantly reduced and the responsiveness to loan quality increased. Colombia's progress in reducing operational costs and financial taxation and improving loan quality, will determine whether it can narrow the spread.

Contents   Page

Figures

SUMMARY

After several decades of financial repression with some partial attempts at liberalization, Colombian policymakers set out to completely liberalize its financial system in the early 1990s, reducing financial taxation, privatizing certain state-owned banks, freeing interest rates, facilitating market entry and exit, and removing certain capital account restrictions. These measures were expected to increase the efficiency and competitiveness of financial intermediation, and, therefore, reducing interest rate spreads, historically high by international standards, was an implicit objective.

The paper uses New Empirical Industrial Organization, an approach based on bank profit maximization, which models interest spreads as a function of operational costs, financial taxation, market power, and loan quality. Aggregate banking data for the pre liberalization period (1974-88) and aggregate and panel data on 22 banks with monthly observations during the post liberalization period (1991-96) are used to estimate the model. The paper then analyzes the determinants of interest spreads in the two periods and draws conclusions about the effects of liberalization.

The results are mixed. Liberalization appears to have increased banking sector competition--significantly lowering market power--and reduced financial taxation from its highest levels of the late 1970s. However, financial taxation is still high by international standards, and operational costs have been slow to decline. In addition, banks now appear to be more responsive to changes in loan quality, perhaps an indication of an improvement in banking supervision and/or reporting. Finally, the paper finds significant differences between the behavior of private and state-owned banks in the post liberalization period. Private banks consistently have lower spreads and operational costs and better loan quality, appear to possess some degree of market power, and are subject to lower average financial taxation. Although state-owned banks do not appear to have market power, their spreads are higher as a result of having much larger operational costs and poorer loan quality.

I. INTRODUCTION

A key variable in the financial system is the spread between lending and deposit interest rates. When it is too large, it is generally regarded as a considerable impediment to the expansion and development of financial intermediation, as it discourages potential savers with low returns on deposits and limits financing for potential borrowers, thus reducing feasible investment opportunities and therefore the growth potential of the economy.

Financial systems in developing countries have been shown to exhibit significantly and persistently larger intermediation spreads on average than those in developed countries (Hanson & de Rezende Rocha, 1986). These high spreads have frequently been attributed to such factors as high operating costs, financial taxation or repression, lack of competition, and high inflation rates. However, with some notable exceptions[2], there has been a scarcity of direct tests of the relevance of these factors, and a lack of a consistent theoretical banking model on which to base the statistical analysis. In this paper we adopt a "New Empirical Industrial Organization" (Bresnahan, 1989) approach which has been used to examine competitiveness in banking[3], and we apply it specifically to the determination of the intermediation spread, allowing for certain peculiar characteristics of banking systems in developing countries.

Colombia provides an interesting case study. During the seventies and eighties intermediation spreads traditionally were high, both compared to world levels (Clavijo, 1991) and to those in Latin America (Morris, 1990). The financial system appeared to be highly repressed, inefficient, and non-competitive, as banks were subject to high rates of financial taxation and exhibited high operating costs and a high degree of concentration and state ownership (Barajas, 1996). Starting in the early nineties, however, Colombian policymakers embarked on an ambitious and far-reaching economic reform program, and took several actions aimed at redefining the structure and operation of the financial system[4]. They eased entry restrictions, relaxed the specialization of intermediaries by moving towards a multi-

---

[2]See Fuentes & Baasch (1997) in the case of Chile, Randall (1998) in the case of the Eastern Caribbean countries, Catao (1998) in the case of Argentina, and Yu (1995) in the case of Canada.

[3]See Shaffer (1989) and (1993) for applications to the U.S. and Canada, respectively, Hannan & Liang (1993) for an application local deposit markets in the U.S., Suominen (1994) for an application to Finnish banking, Gruben & McComb (1996) as applied to Mexico, and Gruben & Koo (1997) as applied to Argentina.

[4]The economic reform program is summarized in Lora (1991).

banking scheme, reduced financial taxation by eliminating mandatory investments and simplifying reserve requirements, phased out directed credit programs, undertook substantial privatization of financial institutions, and strengthened prudential norms. These measures sought to increase financial intermediation and facilitate efficiency, competitiveness, and stability of the domestic financial system, and to increase private participation, both domestic and foreign.

However, as has occurred in previous instances of financial reform in Colombia, these measures were reversed to some degree as a result of changes in the direction of macroeconomic policy. In particular, policymakers decided to attempt to sterilize the buildup of international reserves between 1989 and 1995 with restrictive monetary policy and exchange controls, at times increasing reserve requirements, imposing direct controls on credit expansion and taxes on foreign borrowing. Therefore, a tradeoff emerged between the longer-term goals of the financial reform program and the short-term objectives of the macroeconomic stabilization policy.

Consequently, bank intermediation spreads, overhead costs, and financial taxation have remained high during the nineties. As a percentage of total assets, the interest spread averaged 6-8 percent over the 1988-1995 period, compared to 2-3 percent in industrialized countries, while overhead expenses in relation to total assets averaged 7-8 percent, compared to 2-3 percent in industrialized countries and 6 percent on average in Latin America (Table 1)[5]. With regard to financial taxation, policymakers were able to reduce reserve requirements and forced investments from their late-seventies peak levels of around 50 percent of total bank deposits to about 20 percent by the end of the eighties, but the early nineties saw a renewed increase, to 32 percent, and in recent years this ratio remains around 20 percent (Table 2).

It is evident that considerable financial deepening has taken place in Colombia, as shown by the growth of broad money in relation to GDP, particularly between 1992 and 1996, when this ratio increased from 30 to almost 40 percent (Figure 1). Substantial privatization has also taken place during the nineties, with the share of private banks in total assets increasing from 45 to 79 percent, and their share in capital rising from 62 to 81 percent (Table 3). However, what is not directly apparent is how much progress has been made in increasing

---

[5]It has been suggested that certain non-managerial factors external to the banking firm (such as high security and/or transportation costs) may contribute to the high observed overhead expenses in Colombia. While the study by Suescún & Misas (1996) showed evidence of significant managerial x-inefficiency in banks, there is certainly scope for additional work to investigate to how important the non-managerial factors may be.

efficiency and competitiveness of financial institutions. Since these factors are expected to be reflected in the banking intermediation spread, the study of spreads will allow us to assess the progress made in these areas.

As we will show, intermediation spreads can be broken down into different components relating to bank costs, market power, and loan quality. In order to assess the relative importance of each factor and to evaluate whether the (incomplete) financial liberalization policies have been successful in reducing intermediation spreads, we will use a theoretical framework based on profit-maximizing bank behavior, which will then serve as the basis for the econometric analysis.

One must note that there is a possible tradeoff involved when analyzing spreads. While a high level is generally indicative of inefficiency, excessive risk-taking, or lack of competition within the banking sector, it is also true that high spreads can contribute to high bank earnings which, if channeled into the capital base of the system, may promote safety and stability in the system. This is particularly relevant in the case of developing countries, where the existence of an implicit government bailout commitment has frequently led to a moral hazard situation in the financial system. It is not entirely clear which is preferable from a social standpoint; a banking system with low spreads and (consequently) low capital which may require a government-funded bailout, or a system with high spreads and a high capital base that may not require a bailout[6]. Section IV presents evidence that sheds light on the probable uses of high spreads in the Colombian case, and will confirm that the above tradeoff clearly applies here; while high spreads indicate certain shortcomings of the liberalization policies, they also appear to have facilitated a well-needed capitalization process during the present decade.

The paper is divided into five sections. The first is descriptive and presents the stylized facts, based on measurements of the spread and related indicators and their evolution by groups of banks. Section II examines a few key statistical relationships and offers a motivation for the theoretical model developed in Section III and for the econometric analysis shown in Section IV. Section V summarizes the findings and discusses the principal conclusions and policy implications.

---

[6]This also can be viewed as an issue of bank franchise value, which has been shown to be a key factor limiting moral hazard and excessive risk-taking (Caprio & Summers, 1993; Hellman, Murdock, and Stiglitz, 1998). To the extent that high spreads arising from market power reflect a high franchise value, the likelihood of a bank crisis may be smaller than in the case of a competitive system with lower spreads.

II. INTEREST RATE SPREADS IN COLOMBIA, 1974-1996

Based on the available balance sheet and profit-loss information, we constructed two separate databases, a quarterly series of the aggregate banking system for the pre-liberalization 1974-1988 period, and a monthly series with individual bank data covering the post-liberalization 1991-1996 period. The break in the data corresponds to a transition period during which financial intermediaries adapted to a new accounting standard. The intermediation spread (m) is defined as the difference between the average rate charged on loans[7] (i_l) minus the average rate paid on deposits (i_d), and is shown in Figures 2a and 2b[8]. In the pre-liberalization period the spread ranged between 16 and 32 percentage points, increasing steadily from 1974 up to its peak level in late 1979 and then falling again gradually until 1988, where it reached just under 19 percentage points. In the post-liberalization period, the spread declined steadily from an initial level of about 25 in 1991 to 19 percentage points in 1996.

A. A Closer Look at Intermediation Spreads and
Related Banking Indicators in 1991-1996

The average intermediation spread m may be compared to a spread obtained from survey lending and deposit rates reported by banks weekly to the Colombian Banking Superintendency, a measure we define as m_s, equal to the difference between the average rate charged on loans on the last week of each month (i_{ls}) and the average rate paid on three-month time deposits during the last week of each month (i_{ds}). While the average spread (m)

---

[7]The average lending rate is an "ex post" rate, calculated as interest received/performing loans. To the extent that many nonperforming loans may have been contracted at higher "ex ante" rates, this measure will tend to understate the contracted or ex ante lending rate, and therefore the spread. Also, to the extent that banks have participated in directed credit programs at subsidized interest rates, we adjusted the average lending rate by the share of directed credit in total credit and by its average interest rate, so as to obtain a "market" lending rate". This adjustment was relevant primarily for the pre-liberalization period, when directed credit represented between up to 16 percent of total bank credit and its lending rate was close to zero in real terms.

[8] For the post-liberalization period we calculated m using a weighted average of 30 banks comprising virtually the entire banking system. For both periods we annualized the respective monthly or quarterly flows, and took the stocks of loans and deposits at their monthly or quarterly level.

fell by about 6 percentage points between 1991 and 1996, with most of the fall occurring before 1994, the survey spread (m_s) remained relatively constant at around 10 percentage points throughout the period (Figure 2b).

In order to observe in greater detail the differences between these two measures, we analyzed the time series properties of both spreads using the Hodrick & Prescott method of decomposition into trend and seasonal components[9]. Using the Hodrick & Prescott suggested β value for monthly time series, we decomposed interest rates and spreads into trend and seasonal components. As expected, the trend component is clearly declining for the average spread m, but is relatively flat for the survey spread m_s. The decline in the average spread reflects a clear upward trend in the average deposit rate and a possible slight downward trend in the implicit lending rate, while both survey interest rates exhibit very similar U-shaped behavior in their trend components.

Throughout the 1991-1996 period Colombian interest rates were high in real terms and, once accounting for observed devaluation, high relative to the U.S.. On average, the deposit rate i_d was 14 percent, the lending rate was around 36 percent, and the rate on 3-month time deposits (i_{ds}) was 28 percent, compared to an average inflation rate of 23 percent and an average rate of nominal devaluation of 13 percent.

Figure 4 shows several indicators that may be related to interest spreads: the nonperforming loan ratio, the average reserve ratio, the ratio of administrative costs to assets, and the ratio of demand deposits to total deposits. It should be noted that the average reserve ratio is not strictly a policy variable; since it is an average of different reserve requirements over all types of deposits, it also depends on the composition of the public's demand for different deposits. The observed decline in the average reserve ratio, from 33 percent in 1992 to less than 20 percent in 1996, was the result of both a reduction in reserve requirements and

---

[9]For a series y_t the procedure consists of finding a trend component μ_t and a seasonal component ($y_t - \mu_t$) which minimize the following sum of squares:

$$(1/T)\sum_t (y_t - \mu_t)^2 + (\beta/T)\sum_t [(\mu_{t+1} - \mu_t) - (\mu_t - \mu_{t-1})]^2$$

where β is a predetermined constant which represents the "cost" of introducing fluctuations into the trend component. If β approaches zero, then the sum of squares is minimized with y_t equal to μ_t. If β approaches infinity, then the sum of squares is minimized with a linear trend. Hodrick and Prescott suggest alternative values for β depending on whether monthly, quarterly, or annual data are being used. See Enders (1995) for a detailed description of this methodology.

a shift in deposits away from demand deposits and toward savings and time deposits. The average percentage of nonperforming loans was relatively constant at 5-7 percent, with the exception of a brief upsurge in 1992[10], and administrative costs did not show a clear upward or downward trend, fluctuating between 4 and 6.5 percent of total bank assets.

Figure 4 also sheds some light on the differing behavior between average and survey interest spreads. Although interest rates on time deposits did not increase substantially throughout the period, the share of demand deposits declined from 45 to 30 percent, thus increasing the average interest cost of bank deposits. This recomposition in deposits reflects significant changes in the money demand and the possible presence of financial innovations undertaken by the banking system as well as competition from non-bank financial intermediaries.

B. Private Versus State-Owned Banks in 1991-1996

From Figure 5, one can see that average spreads exhibit a downward trend for both state and private banks. State banks had a consistently higher spread throughout the period, as a result of charging slightly more on loans and paying significantly less on deposits, which in turn may reflect the state banks' relatively higher percentage of nonperforming loans and higher ratio of demand deposits to total deposits, as seen in Figure 6. The higher observed percentage of demand deposits for state banks stems from the fact that these banks tend to manage the funds used by the government to carry out spending. Therefore, the recomposition toward interest-bearing deposits has been slower for these institutions. State banks also tended to maintain a greater amount of reserves relative to total deposits, and had higher labor costs in relation to their total assets. Although overall bank productivity increased throughout the nineties, as measured by the real value of loans per employee or per number of branches, it was consistently lower for state banks than for private banks.

III. INTERMEDIATION SPREADS IN 1991-1996: SOME SIMPLE STATISTICS

In this section we present two simple statistical tests, one showing the degree of cross-section versus time variability, and another showing a positive correlation between the percentage of nonperforming loans and the size of the intermediation spread. These, along with the descriptive statistics presented in the previous section, will help motivate the derivation and estimation of a simple model of bank behavior in which the intermediation

---

[10] Part of the observed peak in 1992 is due to a statistical quirk; a large state bank with a particularly high nonperforming loan ratio entered the sample in May, 1992. Our aggregate regressions therefore are run on the 1992:05 - 1996:08 sample.

spread is a function of costs (including financial taxation), credit risk, and, possibly, market power.

A. Cross-section versus Time Variability

Table 4 presents variation coefficients for the implicit lending and deposit interest rates (used to calculate m), the percentage of nonperforming loans, and the ratio of administrative costs to total assets. The cross-bank coefficient is obtained by computing a single average observation over time for each bank, and the time variation coefficient is obtained by computing an aggregate banking sector average for each time period. It appears that cross-bank variability is larger than time variability in general for all four variables shown. Variability in interest rates appears to be relatively small--and greater for deposit rates than for lending rates, reflecting the differences in deposit composition between private and state-owned banks--while loan quality variability is quite large across banks. This result suggests that a panel data approach to the empirical modeling would be useful in capturing this type of cross-section variability.

B. Correlation between Loan Quality and the Intermediation Spread

We conducted a simple exercise to examine the possible relation between bank spreads and loan quality. First, we computed the average percentage of non-performing loans for the banking system and plotted it against the intermediation spread in Figure 7, where there is evidence of a positive correlation between the two. This suggests that banks may be transferring to their customers (either borrowers or depositors) a portion of the additional costs of a deterioration in loan quality.

This result was reinforced by Granger-causality tests on these two variables. The upper panel of Table 5 shows that the null hypothesis of a unit root cannot be rejected at a 5% level for the percentage of nonperforming loans (NPL) and the spread (m)[11]. Therefore, the Granger causality tests were conducted on the first differences of the variables. The lower panel of Table 5 shows that the null hypothesis of lack of causality going from the percentage of nonperforming loans to the spread was rejected at a 1 percent level. On the other hand, lack of causality in the opposite direction was not rejected, thus suggesting that loan quality is an

---

[11] Separate analysis not reported here shows that lending and deposit rates both exhibit a unit root and are cointegrated for the banking system as a whole, for state-owned banks, and for private banks. Therefore, bivariate regressions between the two are free of spurious correlation problems arising in non-cointegrated I(1) variables. These results are available upon request.

important determinant of the intermediation spread in Colombia, and since two-way causality was ruled out, loan quality also appears to be exogenous to the spread[12].

To summarize the results of this section, we found that intermediation spreads in Colombia tended to vary considerably across banks, that deteriorations in loan quality were positively correlated with spreads, and that causality appeared to go from loan quality to the spread. These results suggest that spreads in Colombia should be analyzed with a model that incorporates the effect of loan quality, and that panel data techniques would be useful to account for cross-section heterogeneity.

IV. A SIMPLE BANK INTERMEDIATION MODEL

We begin with an intermediation model to represent bank behavior, based on the Shaffer (1989, 1993) analysis of market power in the Canadian and U.S. banking systems, but which incorporates a specific balance sheet relationship between deposits and loans and explicitly derives a condition for the bank intermediation spread[13]. Each bank j produces an output, namely loans (L_j) and uses two inputs, labor and deposits (D_j). In addition to loans, on the asset side the bank is also required to hold a certain amount of reserves (R_j) with the central bank. Liabilities are made up of deposits plus an exogenous residual, "other net liabilities" (ONL_j). Therefore, for a given required reserve ratio (ε_j)[14], the balance sheet condition for each bank is:

---

[12] Exogeneity of loan quality with respect to the spread was further supported by regression analysis of NPL. In equations with NPL as the dependent variable and which included as regressors the monthly index of industrial production, a survey index of business climate, and the one-period lagged value of NPL, the lending rate was not a significant explanatory variable.

[13] This type of model was used earlier by Barajas (1996) to analyze the aggregate banking system during the 1974-1988 period. An individual bank-level framework for Colombia was used by Montes & Carrasquilla (1986) and later updated by Carvajal & Zarate (1996), but was based on accounting identities rather than on a behavioral model.

[14] Two comments must be made. First, although the required reserve ratio is a policy variable which is imposed equally on all banks, the average reserve ratio, ε, varies from bank to bank since the required reserve ratio varies by type of deposit and each bank has a different composition of deposits. Second, in the pre-liberalization period R and ε also contain forced investments which frequently amounted to over 10 percent of bank deposits.

$$L_j + R_j = D_j + ONL_j \Rightarrow L_j - D_j (1 - \varepsilon_j) - ONL_j = 0 \tag{1}$$

Banks receive revenues from the interest on loans and must pay the interest costs of deposits as well as the real resource costs--mostly wages--of engaging in financial intermediation. They maximize profits (U_j) which are defined as the difference between financial revenues and (financial and nonfinancial) costs:

$$U_j = i_l L_j - i_d D_j - C(L_j, w, x) \tag{2}$$

where i_l and i_d are the lending and deposit interest rates, respectively, w is the wage rate, and x is a vector of other variables that affect marginal nonfinancial costs. In this simple formulation there is no uncertainty and the banks choose their level of output in order to maximize profits. The first-order condition for profit maximization is[15]:

$$\frac{\partial U_j}{\partial L_j} = i_l + L_j \left(\frac{\partial i_l}{\partial L_j} \right) - i_d \frac{\partial D_j}{\partial L_j} - D_j \frac{\partial i_d}{\partial L_j} - C_l = o \tag{3}$$

where C_l is the marginal nonfinancial cost of producing loans. From the balance sheet condition we obtain a relationship between loans and deposits which shows how credit growth is constrained by the amount of reserves banks must hold: $\dfrac{\partial D_j}{\partial L_j} = \dfrac{1}{1 - \varepsilon_j}$. Therefore, the first order condition can be written as:

---

[15]One significant difference between this formulation and that of Shaffer is that the latter includes interest costs within the aggregate cost function C, while we include only nonfinancial costs and opt to separate financial costs from the cost function. Since there is no clear consensus on whether financial costs should be included or not (see for example Dick (1996) and Suescún & Misas (1996)), excluding them proved more convenient in order to obtain a clear expression for the interest spread. Furthermore, separating interest costs from the operational cost function could potentially allow one to test whether market power exists on the deposit side as well.

$$i_l - \frac{i_d}{1 - \varepsilon_j} = -L_j \left(\frac{\partial i_l}{\partial L_j} \right) + [D_j \frac{\partial i_d}{\partial D_j}) \,] \frac{1}{(1 - \varepsilon_j)} + C_l \qquad (4)$$

The term on the left-hand side may be called the "net spread", equal to the difference between the lending rate and the deposit rate adjusted by the level of financial taxation. Therefore, the right-hand side of the equation contains factors additional to financial taxation which drive a wedge between deposit and lending rates, in particular, market power and nonfinancial costs of intermediation. In this framework a bank possesses market power to the extent that its output decisions affect interest rates, as indicated by the terms $\delta i_l / \delta L_j$ and $\delta i_d / \delta D_j$. Market power will be affected by the industry-wide price elasticity of demand, the market share of bank j, and the response of other banks to changes in bank j output. If industry demand is infinitely elastic, or the bank is very small, or if reactions by other banks offset its output decisions, then the bank will not possess market power. Equation (4) can be rewritten to reflect these different effects:

$$i_l - \frac{i_d}{1 - \varepsilon_j} = -L \frac{L_j}{L} \left(\frac{\partial i_l}{\partial L} \frac{\partial L}{\partial L_j} \right) + D \frac{D_j}{D} \left(\frac{\partial i_d}{\partial D} \frac{\partial D}{\partial D_j} \right) \frac{1}{(1 - \varepsilon_j)} + C_l$$

$$i_l - \frac{i_d}{1 - \varepsilon_j} = -L(sl_j rl_j) \left(\frac{\partial i_l}{\partial L} \right) + D(sd_j rd_j) \left(\frac{\partial i_d}{\partial D} \right) + C_l \qquad (5)$$

where sl_j and sd_j represent the market shares of bank j in loans and deposits, respectively, and rl_j and rd_j represent the response of total banking system loans and deposits to changes in output by bank j.

A. Shaffer Estimation Approach

In the Shaffer approach, banks are assumed to be price takers in the input markets, so the estimation of (5) involves only the market power on bank output, and is estimated jointly with a demand equation that provides the relevant slope parameters. Shaffer specifies demand for bank output (in our case, loans) as a linear function of its price (i_l), income (Y), and the price of substitutes (z_l), with certain interaction terms:

$$L = a_0 + a_1 i_l + a_2 Y + a_3 z_l + a_4 i_l Y + a_5 i_l z_l \qquad (6)$$

Marginal costs are assumed to be a linear function of output, the wage rate (w), and other variables (x) that may shift the marginal cost curve:

$$C_l = b_0 + b_1 L + b_2 w + b_3 x \tag{7}$$

When we substitute the demand and marginal cost function parameters in (6) and (7) into the spread equation (5), and assuming that banks are price takers in the deposit market, we may rewrite the profit-maximizing spread condition as the following regression equation:

$$i_l - \frac{i_d}{1 - \varepsilon_j} = -L\lambda \left(\frac{1}{a_1 + a_4 Y + a_5 z_l} \right) + b_0 + b_1 L + b_2 w + b_3 x \tag{5a}$$

Equations (6) and (5a) may then be estimated jointly for the aggregate banking system, yielding estimates of all demand and marginal cost parameters, and of average market power in the banking system (λ). Note that λ is equal to the market share times the response indicator $\lambda = s_l r l_j = \dfrac{L_j}{L} \dfrac{\partial L}{\partial L_j}$, , and is equal to zero in the case of perfect competition, to the inverse of the number of banks (1/N) in the case of a Cournot oligopoly, and is equal to unity in the case of collusion. In order to identify λ, either a_4 or a_5 must be nonzero, and in order to obtain a downward sloping demand curve for loans, the estimated values of $a_1 + a_4 Y + a_5 z_l$ must be positive.

It can be shown how one can relax the Shaffer assumption[16] that banks are price takers in the deposit market, thus requiring the estimation of a demand function for deposits.

---

[16]This assumption was also maintained in applications of the Shaffer analysis to Mexico and Argentina by Gruben & McComb(1996) and Gruben & Koo (1997), respectively. This assumption seemed reasonable in the Colombian case, as banks face natural competition from other financial intermediaries that offer similar types of deposits, but may have a certain amount of market power on the lending side where they do not face as clear a challenge. As Shaffer points out, if the deposit market is not perfectly competitive, then a finding of market power is still valid, but may be misattributed to the loan market.

Suominen (1994)[17], followed this type of approach, by modeling a demand function analogous to that of loans, as a function of income, the deposit interest rate (i_d), the price of substitutes (z_d), and several interaction terms. For simplicity, we will maintain the assumption of a perfectly competitive market for bank deposits.

B. An Alternative Specification

We derive a second, slightly more restrictive specification but which does not require joint estimation with the demand function. Equation (4) may be rewritten in terms of the lending interest rate:

$$i_l \left(1 + \frac{L_j}{i_l} \frac{\partial i_l}{\partial L_j} \right) = \frac{i_d}{1 - \varepsilon_j} \left(1 + \frac{D_j}{i_j} \frac{\partial i_d}{\partial D_j} \right) + C_l$$

$$i_l \left(1 + \frac{\theta_l}{\eta_l} \right) = \frac{i_d}{1 - \varepsilon} \left(1 + \frac{\theta_d}{n_d} \right) + C_l \qquad \text{(4a)}$$

$$i_l = \frac{i_d \left(\dfrac{\phi_d}{\phi_l} \right)}{1 - \varepsilon} + \frac{C_l}{\phi_l}$$

where we define $\theta_l = ml_j rl_j$, $\theta_d = md_j rd_j$ and $\eta_l = \dfrac{\partial L}{\partial i_l} \dfrac{i_l}{L}$, $\eta_d = \dfrac{\partial D}{\partial i_d} \dfrac{i_d}{D}$ are the interest

elasticities of demand for deposits and loans, and we define $\phi = 1 + \dfrac{\theta}{\eta}$. Therefore, equation

(4a) defines a profit-maximizing relationship between the lending interest rate, the deposit rate (adjusted by the rate of financial taxation), and marginal costs. This then becomes the following regression equation for the lending rate:

---

[17]Suominen models the banking firm as a producer of two outputs, deposits and loans, but provides no balance sheet link between the two. Barajas (1996) uses a two-product formulation that incorporates the balance sheet link but does not rely on joint estimation with the demand function(s).

$$i_l = d_0 + d_1 \frac{i_d}{1 - \varepsilon} + d_2 w + d_3 x$$

$$d_0 = \frac{b_0}{\phi_l}, d_1 = \frac{\phi_d}{\phi_l}, d_2 = \frac{b_2}{\phi_l}, d_3 = \frac{b_3}{\phi_l}$$

(5b)

In this single-equation specification it is no longer possible to separate the effects of market power from the loan and deposit markets; d_l summarizes the effect of both, and will be equal to unity unless market power exists in at least one of the two markets. If both markets for deposits and loans are perfectly competitive, then $\theta_l = \theta_d = 0 \rightarrow \phi_l = \phi_d = 1$ and the interest rate charged on loans will be equal to the marginal cost of producing loans and

deposits, i.e., $i_l = C_l + \frac{i_d}{(1 - \varepsilon_j)}$. If, on the contrary, we assume that one of the markets is

perfectly competitive, then the above regression equation will estimate the degree of market power in the remaining market. Hannan & Liang (1993) use a similar to approach to U.S. banks, and assume the loan side to be perfectly competitive and therefore set out to estimate market power on the deposit side.

V. ESTIMATION RESULTS

For the econometric analysis, we used banking system data for the 1974-1988 (quarterly) and 1992:05 - 1996:08 (monthly) periods for the aggregate system, and a panel of 22 banks for the 1991:03 - 1996:08 period[18]. We estimated the single-equation specification described in equation (5b) and, in the later period, we estimated the system equation specification described in (5a)[19]. The wage variable was constructed as the ratio of total labor

---

[18]For 21 banks, information was available from 1991:03 but for the aggregate system estimations we opted for the shorter time period since the additional bank (for which information was available only from 1992:05 onward) was particularly large.

[19]The lack of success in estimating a reliable demand function for loans in the pre-liberalization period limited our ability to apply the system approach for comparative purposes between the two periods. The difficulties arose in obtaining satisfactory indicators for a price of substitutes of bank loans, which hindered the identification of λ.

costs to employment[20], the scale variable L was the average monthly stock of loans, and the income variable used Y was the monthly index of industrial production. Wages, loans and deposits were taken in real terms, by deflating the nominal values by the CPI. The price of substitutes of bank output z_i was the interest rate on 90-day Central Bank bills[21].

Finally, in order to incorporate the possible effects of changes in loan quality, the percentage of nonperforming loans was included in the spread equation, reflecting two possible responses by banks. First, as a shift variable x, nonperforming loans would reflect the extent to which bank managers increase operational expenses in response to deteriorations in loan quality[22]. Second, in the spread equation the effect of nonperforming loans may express a risk premium charged by banks in response to the financial costs of foregone interest revenue. Thus, if at least one of these responses is present in the Colombian case, we would expect increases in the percentage of nonperforming loans to widen the interest spread.

A. Aggregate Estimation

The aggregate single equation results are shown in Table 6. The first column shows the results for the pre-liberalization period, and the remaining columns display the results for the post-liberalization period, for the banking system as a whole and for private and state-owned banks separately. The fit of all regressions is relatively close, serial correlation of the error term up to lag 4 is ruled out at a 5 percent level, and all coefficients have the expected sign. Real wages, due to their relatively high correlation with the scale variable (real loans), appear not to be significant--when the scale variable is excluded, wages become significant.

---

[20]We were only able to construct a wage variable in the post-liberalization sample, since no banking sector employment data was available prior to 1990.

[21]Shaffer (1993) used a similar variable for the U.S., a 3-month treasury bill, and Gruben & McComb (1996) used a 28-day treasury bill in the case of Mexico. We also ran the regressions using a money market or interbank interest rate as the price of a substitute, but it did not perform as well as the central bank bill rate, possibly as a result of its high volatility.

[22]Berger & De Young (1997) find evidence of a positive relationship between banks' operational costs in the U.S. and the percentage of nonperforming loans, which appear to reflect two hypotheses: (1) a "bad luck" hypothesis whereby exogenous increases (decreases) in bad loans lead to increases (decreases) in costs as banks must intensify their monitoring, and undertake additional expenses for working out or selling off these loans, (2) a "bad management" hypothesis whereby a deterioration in managerial efficiency--shown by an increase in operational costs--causes an increase in bad loans, as the ability to screen loans and manage credit risk also deteriorates.

One salient result is that market power appears to have declined between the two periods. The estimated market power parameter, d_l, is 1.29 in the pre-liberalization sample and is significantly greater than unity with almost complete certainty[23]. In the post-liberalization period, on the other hand, the estimated parameter declines to 1.12, and is not significantly different from unity, thus indicating competitive behavior overall[24]. However, when we disaggregate private and state banks, we find that market power is still significant for private banks, who tend to charge a 23 percent markup over marginal financial costs, while state banks behave as price takers in the loan market in the sense that their intermediation spread just covers marginal costs.

The results also show a prevalence of economies of scale in both periods, with the exception of state banks in the post-liberalization period. The general result is consistent with the findings of studies adopting a cost function approach to economies of scale and efficiency in the Colombian banking sector (Bernal & Herrera, 1983; Suescún, 1987; Acosta & Villegas, 1989; Ferrufino, 1991; and Suescún & Misas, 1996).

Nonperforming loans are a significant factor contributing to the widening of interest spreads in both periods, as an indication of additional resources that banks must commit to deal with bad loan problems. Furthermore, banks' sensitivity to changes in nonperforming loans appears to have increased considerably from the pre to the post-liberalization period; the estimated coefficient increases from 0.16 to about 1.0[25]. This change could signal a heightened awareness on the part of bank managers regarding credit risk, and/or it could reflect an

---

[23]The probability of the Wald test for perfect competition is equal to zero at four digits. This is also true for a test comparing this parameter to the value estimated in the earlier subperiod, 1.29.

[24]This result contrasts with one presented in a previous version of this paper (Steiner, et. al., 1997), where the hypothesis of market power in the 1992-1996 period was not rejected for the banking system as a whole. Regressions were run using a linearized version of the spread equation (5b), and with a preliminary data set. Once several improvements were made to the data (adjusting for certain excessive volatility in estimates of individual bank interest rates) and regressions were run using the exact functional form of the spread equation, the finding of significant market power remained only for the private banks.

[25]It could be argued that since the lending rate reflects the cost in terms of foregone earnings of nonperforming loans, the effect of loan quality on the spread should tend to increase if the lending rate increases. However, given that the lending rate remained essentially constant on average between the two periods (at 35 percent) the increase in the estimated parameter does not seem to be due to an increase in the foregone earnings cost of nonperforming loans.

improved reporting of nonperforming loans. Since the earlier period included the mid-1980s financial crisis, prior to which banking behavior most likely contained a significant element of moral hazard, the change in the second period may also reflect a decline in moral hazard, itself an indication of success in the manner in which policymakers dealt with the crisis[26] and in the measures undertaken in the early nineties to tighten prudential regulation and strengthen bank supervision.

Finally, liberalization of interest rates appears to have increased the spread through its effect on intermediation costs. Prior to 1980, all bank deposit interest rates were subject to policy-imposed ceilings, often at very low real levels. The estimation results show a significant widening of the spread (by approximately 4 percentage points) following the liberalization of the interest rate on time deposits in the first quarter of 1980. As banks were now able to compete for deposits with other financial intermediaries, the subsequent rapid increase in these deposits appears to have led to increases in banks' marginal costs.

B. System and Panel Data Estimation in the Post-Liberalization Period

The single equation results for the aggregate banking system are confirmed when estimating the spread using a system approach. We estimated the spread equation (5a) jointly with a demand function for loans (6), using a Full Information Maximum Likelihood (FIML) procedure, providing initial values from preliminary 3SLS estimations. As discussed earlier, in this specification the net spread becomes the dependent variable and market power arises if the λ coefficient is significantly greater than zero. As the top panel of Table 7 shows, competitive behavior again cannot be ruled out for the banking system as a whole. The other coefficient estimates are similar to their single-equation values, although the coefficient on real wages is larger (1.47 versus 1.14) and is now significant at a 1 percent level.

The results of single-equation panel data regressions provided additional insight into the heterogeneity of behavior across banks. When we ran a simple pooled OLS regression which restricted all coefficients to be equal across banks, but which allowed for a change in intercept between private and state banks, the coefficients on total loans, the nonperforming loan ratio, and on the state bank dummy variable were significant and had the expected sign,

---

[26]While it is likely that the pre-crisis years were marked by the perception of an implicit deposit insurance--a situation conducive to moral hazard--the handling of the Colombian crisis has been considered largely successful in providing adequate signals to bank managers. Stockholders of failing institutions were forced to assume significant losses, one bank was closed, and parties responsible for reckless management were prosecuted (Clavijo, 1992; Rojas-Suárez & Weisbrod, 1996).

but the fit of the regression was relatively poor and showed considerable evidence of autocorrelation (see Table 7, second panel). Indeed, we used a χ^2 test on the equality of coefficients across banks and overwhelmingly rejected the null hypothesis both for the banking system as a whole and for private banks separately. Therefore, we estimated the spread equation using a Random Coefficients Model (RCM), a GLS method which allows for changes in all coefficients across banks, and treats each coefficient as a random drawing from the same probability distribution (see Judge, et. al., 1985).

The final two panels of Table 7 report the average coefficient values for the RCM on the banking system as a whole, and for private banks, respectively. All coefficients have the expected sign, and again all but the wage rate are significant at least at a 95 percent level. The estimated values of both the intercept and the coefficient of the scale variable (real loans) are considerably larger than in the aggregate case, reflecting the much smaller values for the scale variable at the individual bank level[27]. The estimated effect of nonperforming loans on interest spreads appears to be smaller than in the aggregate case (0.77 versus 0.99), and the results tend to give greater support to the finding of competition; the estimated values of the market power parameter are smaller than in the aggregate estimation, and now competitive behavior cannot be rejected in the case of private banks[28].

To summarize, the aggregate regression results show evidence of two crucial changes in the behavior of interest spreads between the pre and post-liberalization periods in Colombia: an increase in competition and a greater responsiveness of spreads to changes in loan quality. The estimates of marginal nonfinancial costs of intermediation exhibit some degree of scale economies in both periods, and the first period shows a significant cost effect brought on by the increased competition for deposits following the liberalization of time deposit rates in early 1980. Finally, panel data analysis in the post-liberalization period

---

[27]In other words, total loans of an individual bank are much smaller than those of the aggregate system. For example, a banking industry coefficient of -0.1 (as in the FIML result) is equivalent--in terms of its effect on the interest spread--to a coefficient of -2.0 for a bank with a 5 percent market share.

[28]Since one essential difference between the aggregate estimation and the panel data regression is that the former procedure implicitly assigns weights to individual banks according to size, the contrasting results on market power indicate that the aggregate results may be driven by several larger private banks that possess market power, while on average most smaller banks behave competitively, consistent with a von Stackelberg type of market structure. Spiller & Favaro (1984) use this type of framework to study the impact of changes in banking regulations in Uruguay in 1977-1980 period.

revealed significant heterogeneity in the spread equation parameters across banks, and tended to give greater support to the hypothesis of competitive behavior and to the relative importance of operational costs versus loan quality.

C. Decomposition of the Spread

In order to measure the main determinants of interest spreads in the two periods, we used the regressions reported in columns (1) and (4) of Table 6 and modified versions of the equations in columns (3) and (5)[29] to break down the estimated interest spreads into their different components: financial taxation, nonfinancial costs, nonperforming loans, and market power. As Table 8a shows, although both periods exhibited similar interest spreads on average--about 21 percentage points--the pre-liberalization period is characterized by a much higher variability. Between 1974 and 1980 the estimated spread nearly doubled (from 17 to 31 percentage points) as a result of increased financial and nonfinancial costs brought on to some degree by the interest rate liberalization of 1980, and by a sharp increase in financial taxation. The spread then declined gradually to 16 percentage points by the end of the period, as marginal costs and financial taxation fell to their levels of the early seventies. On average during the pre-liberalization period operating costs made up about 38 percent of the spread, financial taxation represented about 22 percent and market power accounted for 36 percent of the spread. Changes in loan quality had very little effect on marginal costs and therefore on the spread--they accounted for less than 4 percent of the spread.

Throughout the post-liberalization period, the estimated spread was more stable, and became more responsive to changes in loan quality. The spread declined by about 6 percentage points during this period, from 26 to 21 points, driven by reductions in financial taxation (1 ½ points) and marginal operational costs (1 ½ points), and loan quality (3 points). Marginal costs were larger in this period, and nonperforming loans tended to transmit an additional cost of about 6 percentage points to the spread. This partially offset the effect of greater competition, a reduction in the market power effect from almost 8 percentage points in the pre-liberalization period to zero in the post-liberalization period.

We also observe major differences between the behavior of estimated spreads for private and state banks in the post-liberalization period (Table 8b). Spreads of state banks were 5 percentage points higher on average, as a result of much higher marginal costs --roughly double those of private banks--and a much higher effect of loan quality on the spread. Private banks tended to charge a markup of about 6 percentage points as a result of

---

[29]Given that our results for these two regressions indicated that there was no market power, we re-estimated these equations imposing competitive behavior ($d_i=1$).

market power, but had much lower operational costs and significantly better loan quality. Finally, state banks were subject to higher rates of financial taxation, as a result of their greater dependence on demand deposits, for which the required reserve ratio is higher.

This exercise indicates that, despite the financial reforms of the early nineties the Colombian banking system continues to exhibit high spreads between lending and deposit rates. Although the banking system is far less repressed than it was in the early eighties (the absolute effect of financial taxation has been cut by half since 1980) and has recovered notably since the mid-eighties crisis (nonperforming loans have improved from their peak of 27 percent in the mid-eighties to about 6 percent in recent years), banks appear to be incurring greater costs and/or are imposing a significant risk premium on their customers in order to cover the costs of defaults. Furthermore, additional reductions in financial taxation may be needed; even with the steady decline throughout the nineties financial taxation in 1996 appeared to be *larger* than at end-1988 and still accounted for about 1/4 of the estimated spread. Finally, liberalization and market-opening policies adopted since 1989 have in fact appeared to generate greater competition among banks, although private banks may still be setting spreads significantly above marginal cost.

Operating costs have also been slow to decline even though we found some evidence of scale economies. As we showed earlier, during the nineties nonfinancial costs have remained relatively constant at 5 percent of total assets and have accounted for almost half of the intermediation spread for the banking system as a whole. Financial liberalization has not yet succeeded in bringing about major reductions in these costs which would eventually translate into lower spreads.

D. Spreads, Profitability, and Capitalization

As we discussed in the introduction, although high intermediation spreads tend to adversely affect the real sector of the economy, they also constitute a key mechanism through which the banking system generates profits and thereby protects itself against credit risk. The *use* of the high spreads thus becomes crucial; whether they are simply covering rampant operative inefficiency (as in the case of some state-owned banks) or generating profits that are then appropriated by the owners, or whether the spreads are generating profits that aid in strengthening and solidifying the banking system.

In the case of Colombia, a significant portion of the large observed spread (65 percent for state banks, 49 percent for private banks) was used to cover nonfinancial intermediation costs and the costs of required reserves in the nineties. However, the remaining portion, which reflected a compensation for nonperforming loans and the prevalence of market power, may have been used in part to capitalize and strengthen the banking system. Throughout the post-

liberalization period, bank profitability was high as a result of a rapid growth of credit with no visible deterioration in loan quality[30], and high intermediation spreads. There is evidence that these profits were increasingly channeled into the capital base of the banking system. Table 9 shows the process of capitalization, both in terms of an increase in the overall ratio of equity to risk-weighted assets[31] and of a decline in the number of banks failing to meet the minimum capital ratio. The last column of Table 9 shows how the return to equity declined from 1992 to 1996, but still remained at end-1996 above 20 percent, compared to 10 percent on average in industrialized countries.

Therefore, high intermediation spreads may signal relative inefficiency and lack of competition in the banking system, but may also indicate that banks are generating the profits needed to protect themselves against increases in credit risk[32]. However, lack of competition allows banks to maintain high spreads that cover their high intermediation costs and credit risk, thus providing little incentive to improve their operative efficiency or the quality of their loan portfolio. In the long run, if banks are to compete internationally, one would expect profits to come increasingly from improvements in both these areas, which would necessarily require a decline in intermediation spreads.

VI. Conclusions

We have provided evidence of the main determinants of intermediation spreads both analytically and empirically with reference to the Colombian banking system from 1974 to 1996. Section I showed how the spread initially increased sharply between 1974 and 1980, then fell gradually in the late eighties and again throughout the nineties. A closer look at the selected banking indicators in the nineties showed how loan quality remained stable and the

---

[30] Loan quality did not even appear to worsen in 1996, when economic growth decelerated from an average of 5.2 percent in 1992-1995 to 2.1 percent.

[31] For the banking system as a whole, Table 9 shows that the capital-to-asset ratio was 13.7 percent at the of 1996, while the legal requirement was 9 percent. For three of the largest banks, this ratio was above 15 percent.

[32]Yu (1995) found a similar positive relationship between bank intermediation spreads in Canada and the capital-to-asset ratio. The approach there was different, however, in that the capital ratio was treated as an exogenous and policy-determined variable, and therefore entered the equations as a *determinant* of the spread. In our case, given that observed capital ratios greatly exceeded the legal minimum, it seemed more reasonable to consider this variable as an endogenous decision variable by the banking firm, and to treat it as a *use* of the profits engendered by the banking activity.

reserve ratio fell gradually, and how spreads, nonfinancial costs, and nonperforming loans all were consistently higher and average productivity lower for state banks. In Section II we showed how variability in interest rates and other indicators across banks tended to be greater than variability over time, and we found a positive relationship--possible one-way causality-- between the spread and loan quality.

In Section III we developed a simple behavioral model for the banking firm which we then estimated in Section IV using aggregate data for both periods and panel data on 22 banks for the post-liberalization period. The estimation results indicated that the Colombian banking system on the whole was not competitive throughout the seventies and eighties, charging for loans an average markup of 29 percent over marginal costs, but became significantly more competitive during the nineties, although there was some evidence that private banks continued to possess some degree of market power. Furthermore, we showed that the spread was positively related to changes in loan quality, and much more so in the post-liberalization period. While the effects of this variable on the spread were driven to a large degree by the high ratio of nonperforming loans of state banks, the greater responsiveness of private banks could be indicative of an improvement in reporting and/or a more prudent behavior towards risk. This was consistent with the vigorous capitalization process that occurred between 1992 and 1996, far exceeding the legal requirements.

Although reductions in financial taxation/repression have been and will continue to be a key component of any successful liberalization and modernization of Colombia's banking system, further progress needs to be made in increasing efficiency. The measures that have been undertaken so far--the privatizations and the greater opening of the market to both domestic and foreign capital--have not yet been successful on this front, although there was evidence of increased competition. Perhaps major changes in efficiency and nonfinancial costs will only come over time, as foreign participation intensifies[33] and the unrestricted flow of foreign capital is maintained. It is unfortunate that, although direct foreign investment was permitted several years ago, strict penalties on private foreign borrowing were imposed subsequently[34]. This type of measures is not only questionable from a macroeconomic standpoint, but clearly goes against the objective of achieving a more efficient and competitive financial system capable of operating with lower intermediation spreads.

---

[33]Claessens, et. al (1997) analyze a sample of 80 countries to show how significant gains in efficiency and in spread reduction are derived from foreign entry into banking.

[34] It is interesting to note that this measure--an increase in required reserves on private foreign borrowing--was applauded by the bankers themselves, thus suggesting that their effective market power had been enhanced (see El Espectador, pg 6B, May 22, 1997).

Table 1. Bank Intermediation Spreads and Overhead Costs
in Colombia as Compared to Latin American
and Industrialized Countries: Average 1988-1995

	Net Interest Margin/ Total Assets	Overhead/ Total Assets
	(percentage)	
Colombia		
Domestic banks	6.2	8.0
Foreign-owned banks	7.6	6.9
Latin America		
Domestic banks	5.8	6.1
Foreign-owned banks	7.4	6.3
Industrial Economies		
Domestic banks	2.8	2.6
Foreign-owned banks	2.3	2.3

Claessens, et.al. (1997)

Table 2. Indicators of Financial Taxation, Selected Periods
(end-of-quarter percentages)

Quarter	Reserve Requirements & Forced Investments/ Total Deposits	Average Tax Rate on Deposits 1/
Pre-liberalization period		
1974:1	43.4	41.7
1979:3	49.5	74.9
1984:4	29.9	20.9
1988:4	26.5	20.6
Post-liberalization period		
1991:1	25.8	34.8
1992:2	32.4	47.9
1994:2	28.6	40.0
1996:3	19.0	23.4

1/ Defined as the additional cost of deposits from reserve requirements and
forced investments. In the post-liberalization period, in which forced
investments and remunerated reserves are close to zero, the tax rate is equal
to $1/(1-e)-1$, where e is the average reserve ratio. In the pre-liberalization
period, the measure includes forced investments as well, and is adjusted by
the rate of remuneration of both required reserves and forced investments.
A detailed description of this measure is contained in Barajas (1996).

Table 3. Private and State-Owned Banks in Colombia
Distribution of Assets and Capital, 1991-1996

	1991 June		1994 December		1996 June	
	Assets	Capital	Assets	Capital	Assets	Capital
1.State-Owned Banks	55.0	38.6	22.1	20.6	20.6	19.3
2.Private banks	45.0	61.5	77.9	79.4	79.4	80.7
of which: Foreign	7.6	9.7	8.6	10.0	9.7	10.7

Source: Colombian Bankers' Association and estimates by the authors.

Table 4. Variation Over Time and Across Individual Banks

	Over Time	Across Banks
Implicit average deposit rate *id* variation coefficient	0.17	0.30
Implicit lending rate *il* variation coefficient	0.07	0.20
Percentage of nonperforming loans *NPL* variation coefficient	0.16	0.57
Administrative costs/Total assets variation coefficient	0.07	0.22

Source: Estimates by the authors based on Colombian Bankers'
Association data.

Table 5. Statistical Tests on Loan Quality and the Intermediation Spread, 1992:05-1996:08

Augmented Dickey-Fuller Test

Variable	Definition	Statistic	Critical value at a 5% level of significance	Constant (C) and/or Trend (T)	No. of lags
NPL	Percentage of nonperforming loans	-2.65	-2.92	C	1
dNPL		-4.58	-2.60		3
m	Intermediation spread	-2.52	-3.50	C,T	2
dm		-4.44	-1.95		3

Granger Causality Test

	Null Hypothesis	No. of obs	No. of lags	F-statistic	Prob.
a.	d(m) does not cause d(NPL)	52	4	0.17	0.95
	d(npl) does not cause d(m)	52	4	4.49	0.00
b.	d(m) does not cause d(NPL)	52	1	2.06	0.16
	d(NPL) does not cause d(m)	52	1	14.56	0.00

Table 6. Aggregate Estimation of the Spread Equation

Single Equation Specification: $il=d0+d1(id/1-e)+d2L+d3w+d4NPL$

	(1)	(2)	(3)	(4)	(5)
	Banking System			Private	State-owned
	TSLS	TSLS		TSLS	TSLS
	1974-1988 1/	1992-1996		1992-1996	1992-1996
Constant term: d0	0.23	10.94	8.94	11.85	3.91
	(15.93)**	(7.04)**	(4.36)**	(5.62)**	(1.61)
Market power: d1	1.29	1.12	1.09	1.23	0.86
	(22.51)**	(13.01)**	(12.67)**	(15.63)**	(7.15)**
Real loans: d2	-0.01	-0.17	-0.22	-0.46	1.15
	(9.59)**	(2.99)**	(3.37)**	(5.55)**	(2.61)*
Real wage rate: d3			1.14	0.58	0.53
			(1.45)	(0.62)	(1.28)
Nonperforming loans: d4	0.16	1.00	0.99	0.86	1.15
	(3.06)**	(5.48)**	(5.58)**	(3.43)**	(8.49)**
Dummy variable for 1980.2: d5	0.04				
	(6.26)**				
R2	0.94	0.88	0.89	0.90	0.81
Durbin-Watson	2.10	1.96	1.82	2.15	1.54
Tests					
Wald test for market power					
Ho: Perfect competition, d1=1					
X^2	25.35	1.90	1.11	8.60	1.32
Probability	0.00	0.17	0.30	0.00	0.25
LM test for serial correlation up to lag 4					
Ho: white noise error term					
F	1.84	2.48	2.51	1.32	0.21
Probability	0.17	0.058	0.055	0.86	0.93
Observations	60	52	52	52	52

1/ Contains AR terms to eliminate autocorrelation of order 1,3, and 4.

* (**) significant at a 95% (99%) level.

Table 7. Post-liberalization Period: System and Panel Data Estimation of the Spread Equation

System Estimation (FIML)
Period: 1992:05 - 1996:08

$il-id/(1-\varepsilon)=d0-\lambda.L(dil/dL)+d2L+d3w+d4NPL$

	Intercept: d0	Market Power: λ	Real loans: d2	Real wages: d3	Nonperforming loans: d4	State bank dummy	R^2	dw
	8.48	0.00	-0.11	1.47	1.09		0.89	1.72
	(3.65)**	(0.01)	(4.80)**	(3.18)**	(4.61)**			

Panel Data Estimations

$il=d0+d1(id/1-\varepsilon)+d2L+d3w+d4NPL$

	d0	d1	d2	d3	d4	State bank dummy	R^2	dw
Pooled OLS, Fixed Coefficients, with State Bank dummy Period: 1992:05 - 1996:08	24.87	0.47	-0.08	-0.23	0.46	1.27	0.21	0.29
	(31.49)**	(12.13)**	(4.47)**	(1.49)	(9.57)**	(2.53)*		

Random Coefficients

							Tests 1/	
							H_0: d1=1	H_0: Constant coefficients across banks
22 private and state banks 1991:03 - 1996:08 (1438 observations)	18.54	0.88	-1.62	0.30	0.77		3.94	5497.0
	(6.47)**	(14.54)**	(2.35)*	(0.97)	(5.46)**		0.05	0.00
19 private banks 1991:03 - 1996:08 (1254 observations)	19.38	0.94	-1.88	0.32	0.70		1.77	5087.1
	(6.62)**	(20.53)**	(2.45)*	(0.90)	(4.51)**		0.18	0.00

1/ Chi-squared statistic reported above, probability reported below.

* (**) significant at a 95% (99%) level.

Table 8a. Decomposition of Estimated Interest Spreads in Colombia
(Percentages)

	Estimated	Components of Spreads - Absolute Effects				Components of Spreads - Relative Effects			
	Spread	Financial Taxation	Operating Costs	Loan Quality	Market Power	Financial Taxation	Operating Costs	Loan Quality	Market Power
Pre-liberalization Period: 1974-1988									
Beginning: 1974.1	17.34	2.32	9.61	0.29	5.12	13.36	55.43	1.68	29.53
High point: 1980.2	30.90	9.68	10.86	0.37	9.99	31.33	35.14	1.19	32.34
End: 1988.4	16.03	3.32	4.82	0.69	7.20	20.73	30.08	4.29	44.90
Period Average	21.86	4.90	8.33	0.80	7.83	22.42	38.09	3.68	35.81
Post-liberalization Period: 1992-1996									
Beginning = high point: 1992.05	25.57	5.66	10.42	9.50	0.00	22.13	40.73	37.14	0.00
End: 1996.08	19.81	4.35	8.91	6.54	0.00	21.98	44.99	33.04	0.00
Period Average	20.89	5.40	9.45	6.04	0.00	25.84	45.23	28.93	0.00

Source: Calculations based on estimates from Table 6.

Table 8b. Decomposition of Estimated Interest Spreads in Colombia: Post-Liberalization Period
(Percentages)

	Estimated	Components of Spreads - Absolute Effects				Components of Spreads - Relative Effects			
	Spread	Financial Taxation	Operating Costs	Loan Quality	Market Power	Financial Taxation	Operating Costs	Loan Quality	Market Power
1. State Banks									
Beginning = high point: 1992.05	30.32	7.62	6.55	16.15	0.00	25.14	21.59	53.27	0.00
End: 1996.08	23.68	4.26	10.07	9.34	0.00	17.99	42.54	39.47	0.00
Period Average	24.60	6.90	9.02	8.67	0.00	28.07	36.69	35.24	0.00
2. Private Banks									
Beginning = high point: 1992.05	24.72	4.98	7.53	5.20	7.02	20.15	30.45	21.02	28.38
End: 1996.08	18.40	4.40	3.36	3.69	6.95	23.91	18.27	20.08	37.74
Period Average	19.96	4.92	4.80	3.71	6.53	24.63	24.03	18.60	32.75

Source: Calculations based on estimates from Table 6.

Table 9. Performance Indicators for the Colombian Banking System

Year	Real Growth Rates 1/		Equity/ Risk-weighted asets 2/	Number of banks below the minimum capital ratio	Return to Equity 2/
	Assets	Net Credit			
1992	5.98	16.25	12.30	1/25	55.25
1993	19.31	31.80	12.44	2/28	43.73
1994	8.68	14.62	14.64	0/29	37.65
1995	6.36	14.51	14.00	0/31	28.80
1996	-5.04	-6.88	13.69	2/31	21.80

1/ Does not include Caja Agraria and Caja Social de Ahorros.

2/ Does not include Caja Agraria - Total weighted average for the banking system.

Source: Colombian Bankers' Association, Banking Superintendency, Superbancaria
and estimates by the authors.

Figure 1: Financial Deepening: M2/GDP
(percentage)

Source: Banco de la Republica, DANE.
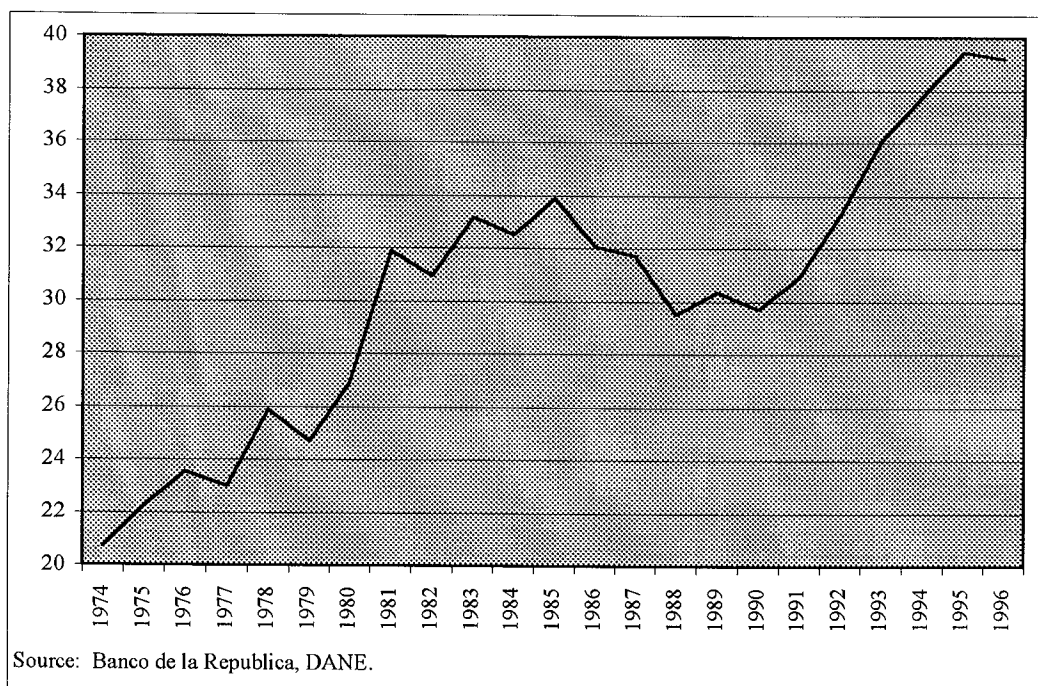
Figure 2a: The Intermediation Spread 1974-1988

Source: Banco de la Republica, estimates by the authors
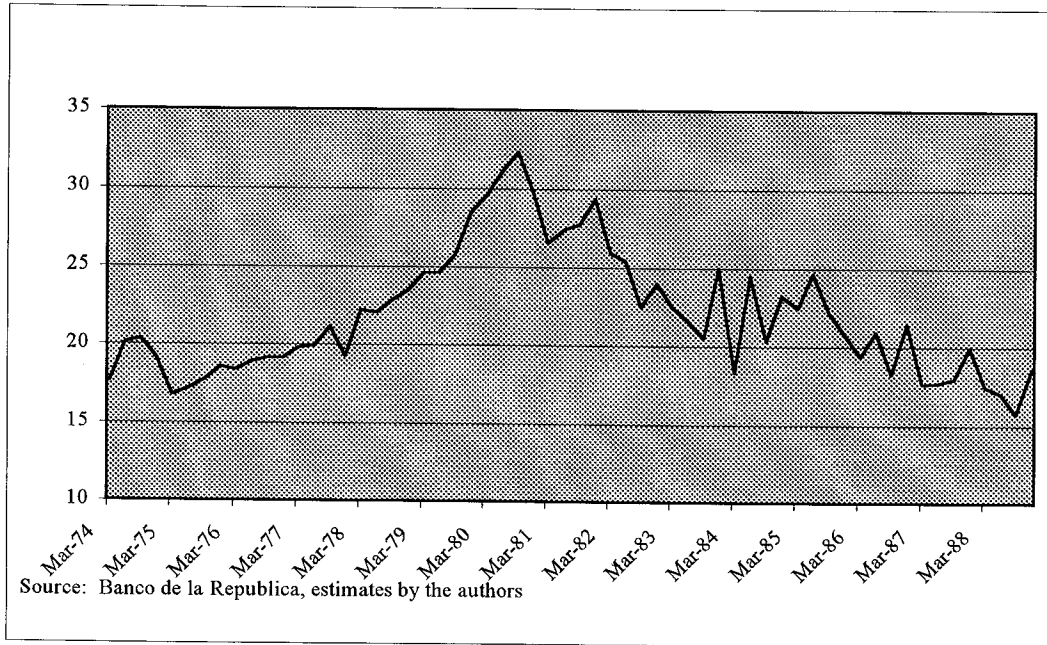
Figure 2b: The Intermediation Spread 1991-1996

Source: Colombian Bankers' Association, estimates by the authors
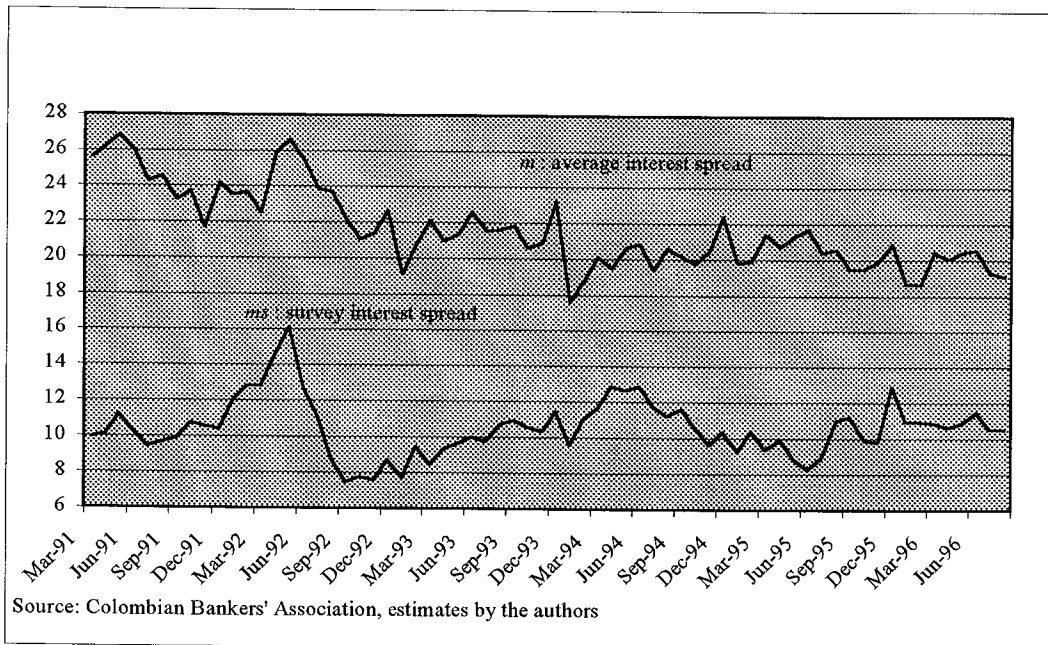
Figure 3. Total Banking System - Intermediation Spreads and Interest Rates

A. Average spread: m

Falls by 5.8

observed — trend

B. Survey spread: ms

Remains constant

observed — trend

C. Average lending rate: il

Increases by 0.4

observed — trend

D. Survey lending rate: ils

Falls by 1.9

observed — trend

E. Average deposit rate: id

Increases by 6.2

observed — trend

F. Survey deposit rate: ids

Falls by 1.9

observed — trend
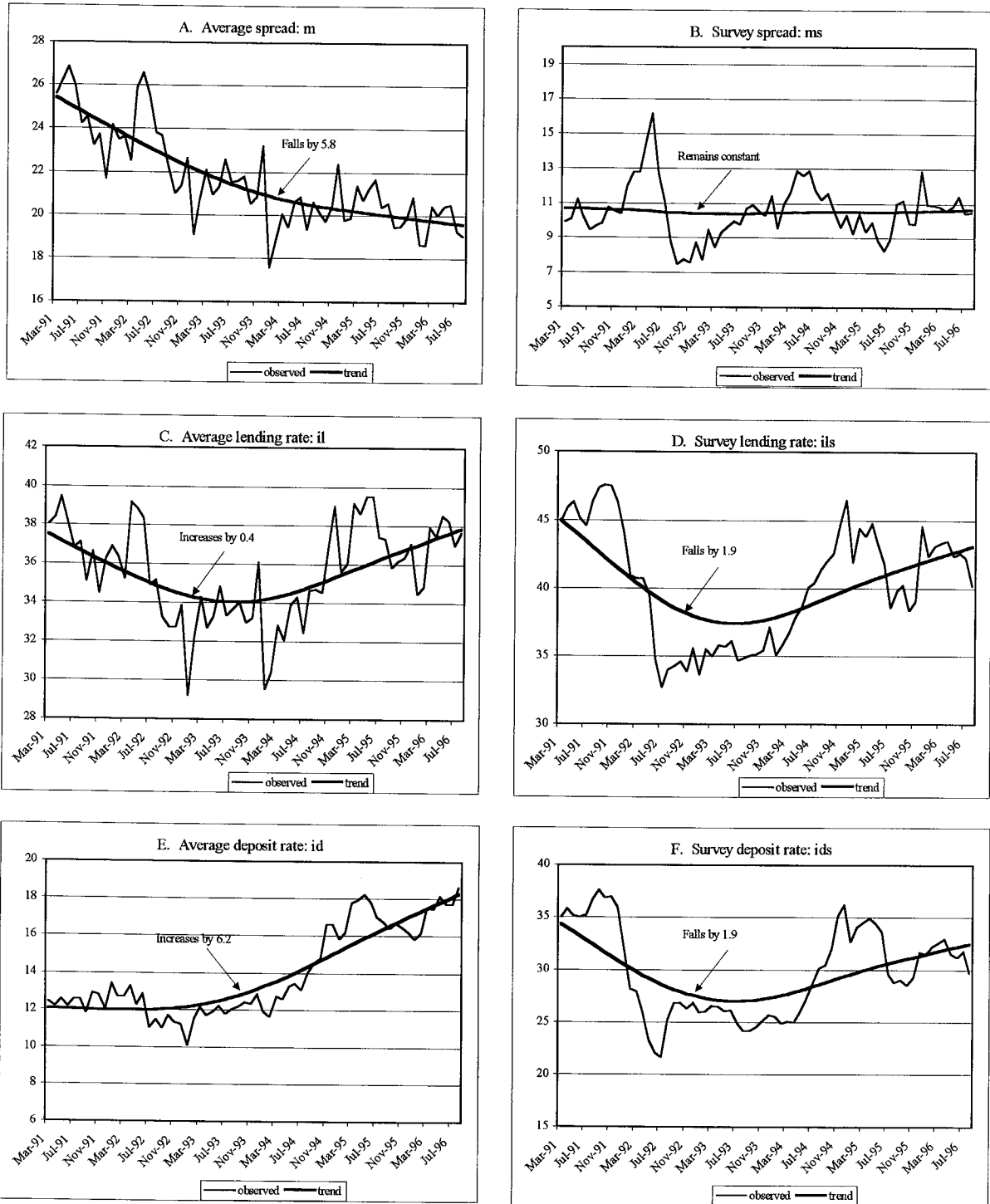
Figure 4. Total Banking System Indicators

A. Percentage of nonperforming loans

B. Average reserve ratio

C. Administrative Costs/Total Assets

D. Demand deposits/ total deposits and other liabilities
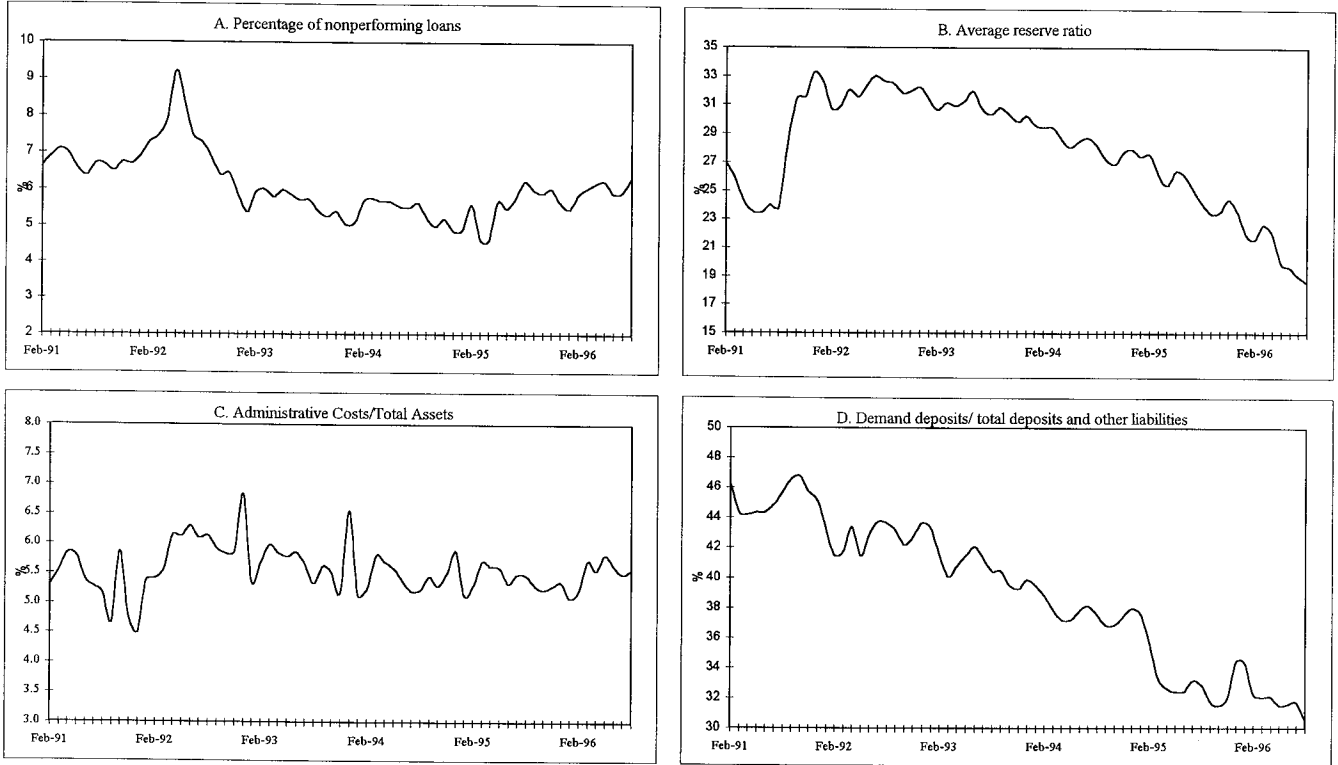
Source: Estimates by the authors based on Colombian Bankers' Association data.

Figure 5. Private and State-Owned Banks
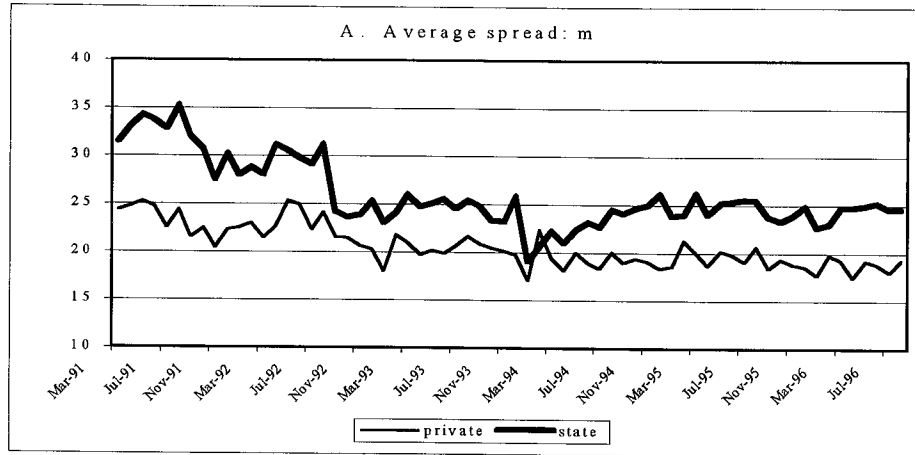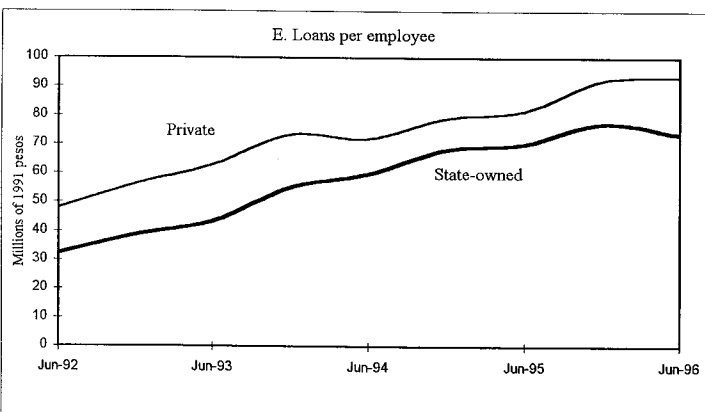Intermediation Spreads and Interest Rates

A. Average spread: m

B. Average lending rate: il
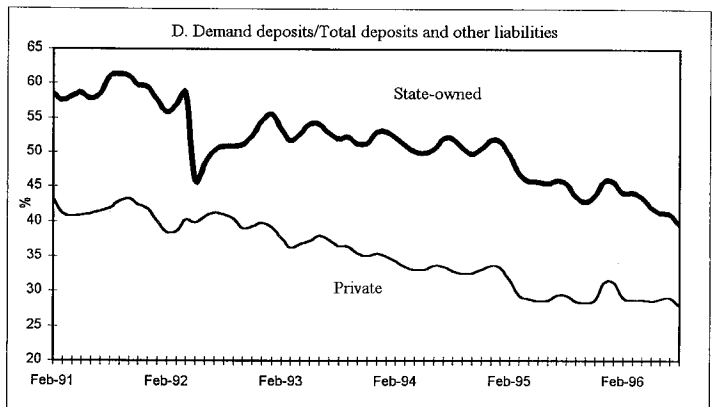

C. Average deposit rate: id
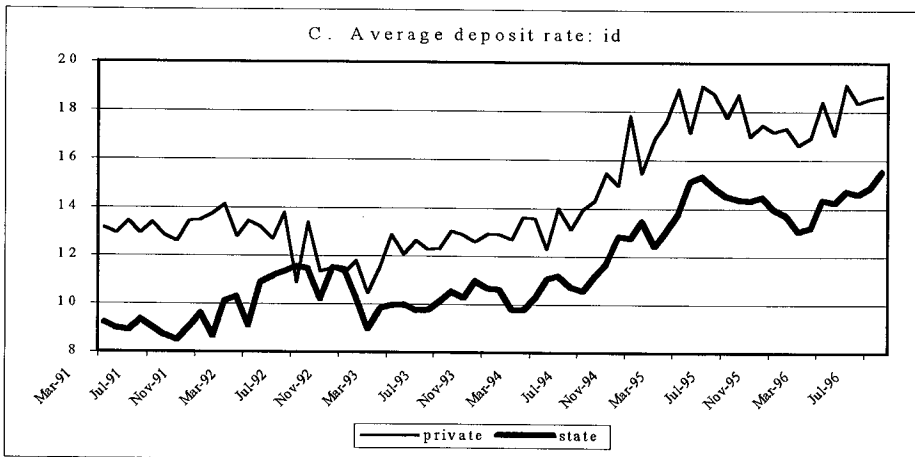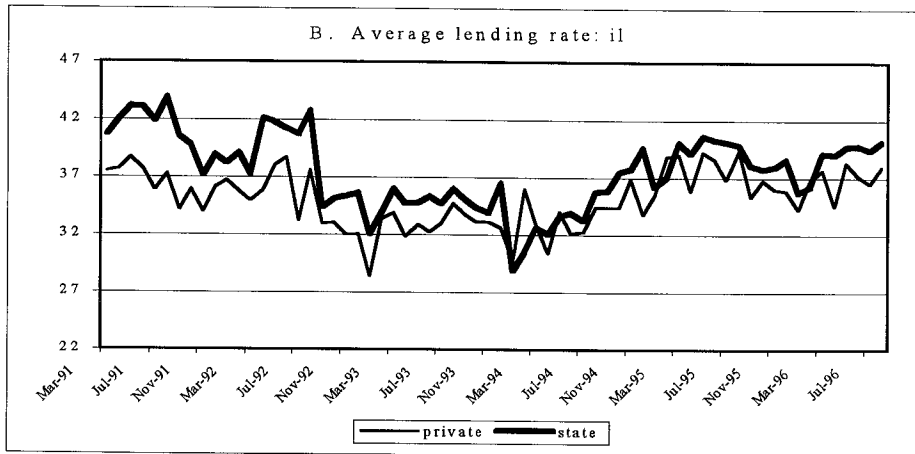
Figure 6. Private and State-owned banks - Indicators

A. Percentage of nonperforming loans

B. Average reserve ratio

C. Administrative costs/total assets

D. Demand deposits/Total deposits and other liabilities
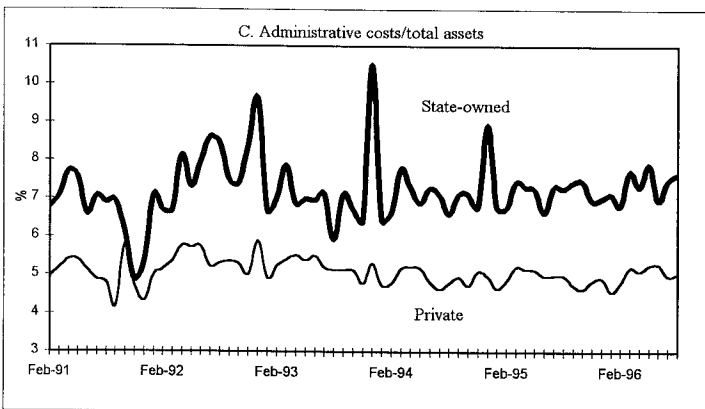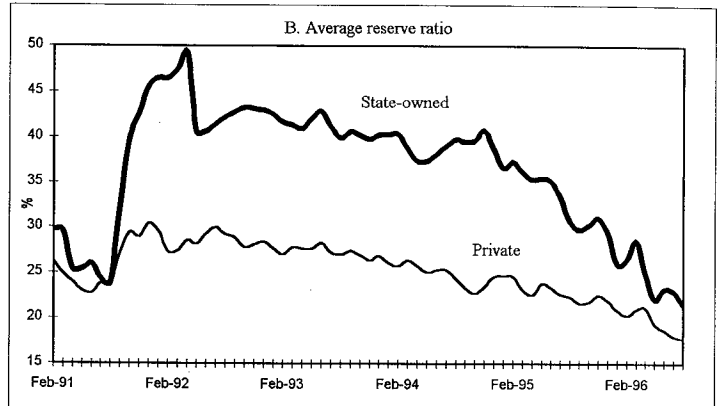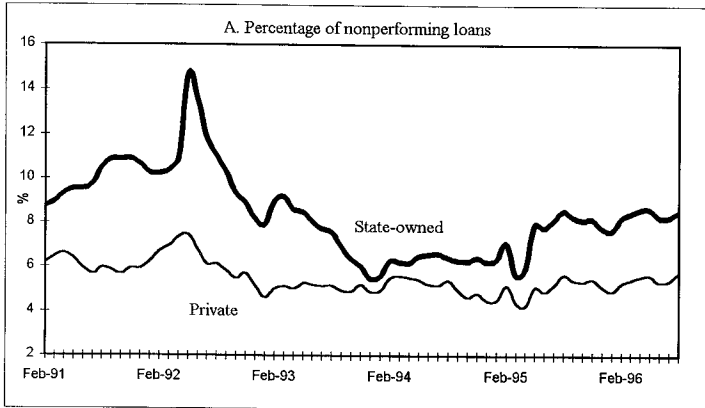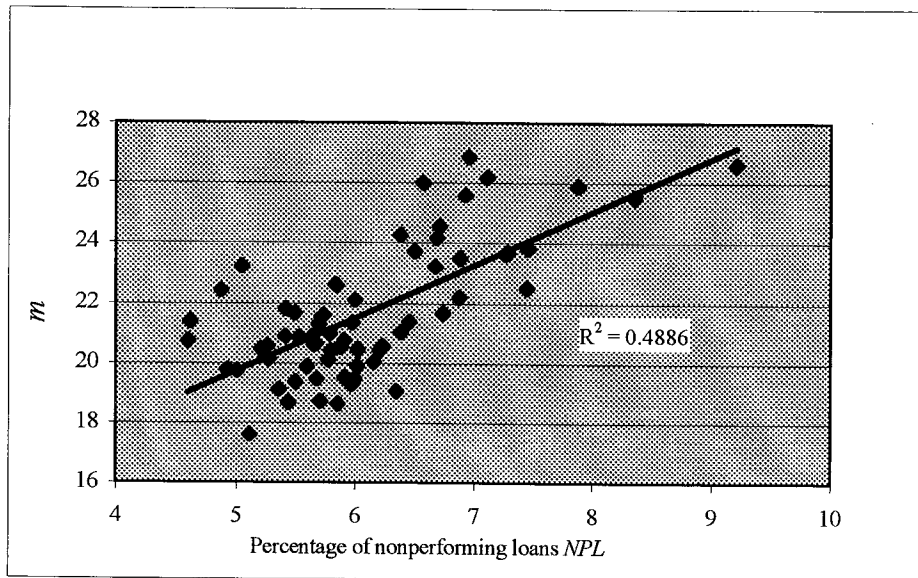

E. Loans per employee

F. Loans per branch
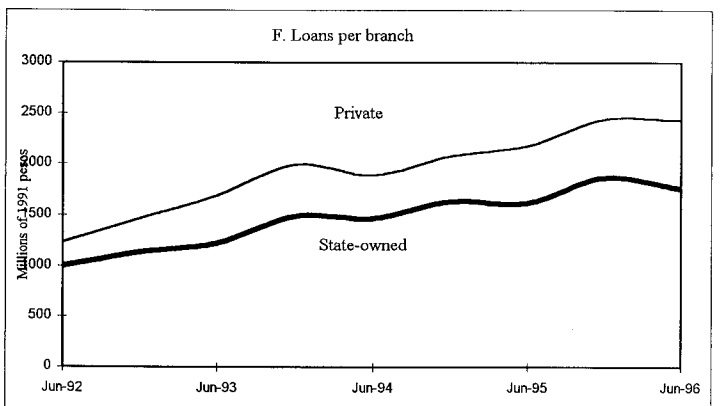
Figure 7. Loan Quality and the Intermediation Spread

REFERENCES

Acosta, C. and L.B. Villegas (1989). "Eficiencia y economías a escala en la banca", *Revista de la Superintendencia Bancaria*, vol. 1 (2).

Barajas, A. (1996). "Interest rates, market power, and financial taxation: an application to Colombian banks 1974-1988", mimeo, IMF, November.

Berger, A.N. and R. De Young (1997). "Problem Loans and Cost Efficiency in Commercial Banks", *Journal of Banking and Finance*, 21.

Bernal, O. and S. Herrera (1983). "Producción, Costos y Economías de Escala en el Sistema Bancario Colombiano", *Ensayos Sobre Política Económica* (3), Banco de la República.

Bresnahan, T. F. (1989). "Empirical Studies of Industries with Market Power," in R. Schmalensee, and R. D. Willig, eds., *Handbook of Industrial Organization* . New York: Elsevier Science Publisher B.V.

Caprio, G., and L. Summers (1993). "Finance and its Reform: Beyond Laissez-Faire," Policy Research Working Paper No. 1171. Washington: The World Bank.

Catao, Luis. (1998). "Intermediation Spreads in a Dual Currency Economy: Argentina in the 1990s". IMF Working Paper, forthcoming.

Claessens, S., Demirguic-Kunt, A., and H. Huizinga (1998). "How does Foreign Entry Affect the Domestic Banking Market?", mimeo, World Bank.

Clavijo, S. (1991). "El Márgen de la Intermediación Financiera en Colombia." *Banca y Finanzas* (Febrero): 45-51.

Clavijo, S. (1992). "Overcoming Financial Crisis During Transition from a Repressed to a Market-Based System: Colombia 1970-89," in A. Cohen & F.R. Gunther, eds., *The Colombian Economy: Issues of Trade and Development*. Boulder, Colorado: Westview Press.

Carvajal, A.M. and J.P. Zárate (1996). "Márgenes de Intermediación: Efectos de Regulación y Costos (una nota contable), mimeo, Banco de la República.

Enders (1995), *Applied Econometric Time Series*, Wiley Series in Probability and Mathematical Statistics, John Wiley and Sons Inc, 1995.

Ferrufino, A. (1991). "Reestimación y Ampliación de la Evidencia sobre las Economías de Escala en el Sistema Financiero Colombiano", *Ensayos Sobre Política Económica* (19), Banco de la República.

Fuentes, R. and M. Baasch. (1997). "Determinantes de los Spreads Bancarios: El Caso de Chile", Universidad de Chile, mimeo, Facultad de Ciencias Económicas y Administrativas, Departamento de Economía, marzo.

Gruben, W. C. and J. Koo. (1997). "Contestability and Capital Flows in Argentina's Banking System", mimeo, Federal Reserve Bank of Dallas.

Gruben, W. C. and R. P. McComb. (1996). "Privatization, Competition, and Supracompetition in the Mexican Commercial Banking System", mimeo, Federal Reserve Bank of Dallas.

Hannan, T. and J.N. Liang (1993). "Inferring Market Power from Time-Series Data: The Case of the Banking Firm", *International Journal of Industrial Organization* (11).

Hanson, J. A., and R. de Rezende Rocha. (1986). *High Interest Rates, Spreads, and the Costs of Intermediation: Two Studies* . Washington, D.C.: The World Bank.

Hellman, T., K. Murdock, and J.E. Stiglitz (1998). "Liberalization, Moral Hazard in Banking, Prudential Regulation: Are Capital Requirements Enough?," Research Paper No. 1466, Graduate School of Business, Stanford University.

Judge, G., W.E. Griffiths, C.E. Hill, H. Lutkepohl and T. Lee (1985). *The Theory and Practice of Econometrics* (2nd ed.). New York: John Wiley & Sons.

Lora, E. (1991). *Apertura y Modernización: las Reformas de los Noventa*, Fedesarrollo y Tercer Mundo Editores.

Montes, F. and A. Carrasquilla (1986). "Sensibilidad de la Tasa de Interés Activa de los Bancos a Cambios en los Parámetros de Política Económica", *Ensayos Sobre Política Económica* (10).

Morris, F., M. Dorfman, J. P. Ortiz, and M. C. Franco. (1990). *Latin America's Banking Systems in the 1980's: A Cross-Country Comparison* . Washington, D.C.: The World Bank.

Randall, R. (1998). "Interest Rate Spreads in the Eastern Caribbean", IMF Working Paper, WP/98/59, April.

Rojas-Suárez and S. Weisbrod (1996). "The Do's and Don'ts of Banking Crisis Management", in R. Hausmann & L. Rojas-Suárez, eds., *Banking Crises in Latin America*, Washington, DC: The Inter-American Development Bank.

Shaffer, S. (1993). "A Test of Competition in Canadian Banking". *Journal of Money, Credit, and Banking*, Vol. 25, No. 1.

Shaffer, S. (1989). "Competition in the U.S. Banking Industry". *Economics Letters* 29.

Spiller, P.T. and E. Favaro. (1984). "The Effects of Entry Regulation on Oligopolistic Interaction: the Uruguayan Banking Sector". *Rand Journal of Economics* 15 (Summer).

Steiner, R., Barajas, A., and N. Salazar. (1997). "El Márgen de Intermediación Bancaria en Colombia", *Coyuntura Económica*, December.

Suescún, R. (1987). "Nueva Evidencia sobre Economías de Escala en la Banca Colombiana", *Ensayos Sobre Política Económica* (12), Banco de la República.

Suescún, R. and M. Misas (1996). "Cambio tecnológico, ineficiencia de escala e ineficiencia X en la banca colombiana", Banco de la República, Serie Borradores Semanales de Economía, no. 59.

Suominen, M. (1994). "Measuring Competition in Banking: A Two-Product Model", *Scandinavian Journal of Economics*.

Yu, H. (1995). "The Determinants of Interest Rate Margins: Empirical Evidence on the Canadian Banking Industry", *The International Journal of Finance*, Vol.7, No.4.

INTERNATIONAL MONETARY FUND

Western Hemisphere Department

Interest Spreads in Banking: Costs, Financial Taxation, Market Power, and Loan Quality in the Colombian Case 1974–96

Prepared by Adolfo Barajas, Roberto Steiner, and Natalia Salazar[1]

Authorized for distribution by Leonardo Cardemil

IMF WORKING PAPER

INTERNATIONAL MONETARY FUND