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The Determinants of Bank Interest Spread in Brazil*

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Abstract

The behavior of bank interest spreads in Brazil reveal two stylized facts. First, a remarkable fall in the average rates since early 1999. Second, a strong and persistent dispersion of rates across banks. Such stylized facts suggest that both the time series and the cross section dimensions are important elements to understand the trend of the bank interest spread in the country.

This paper makes use of panel data techniques to uncover the main determinants of the bank interest spreads in Brazil. A question that the paper aims to address is whether macro or microeconomic factors are the most relevant ones affecting the behavior of such rates. A two-step approach due to Ho and Saunders (1981) is employed to measure the relative relevance of the micro and the macro elements.

The roles played by the inflation rate, risk premium, economic activity, required reserves (all macroeconomic factors) and CAMEL-type indicators (microeconomic factors) are highlighted. The results suggest that macroeconomic variables are the most relevant factors to explain the behavior of bank interest spread in Brazil.

Keywords: Bank Spread, Interest Rates, Brazilian Banks.
JEL Classification: G21, E43, E44.

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1. Introduction

Bank interest rates have been the focus of recent (October 1999) policy attention by the Brazilian Central Bank. In a highly publicised report[1], this institution showed a great concern for the high levels of the bank loan interest rates observed in the country. This report concluded that high default levels as well as high operating costs are amongst the main culprits for the high bank interest margin seen in the country.

The economic and policy relevance of such topic is beyond any questioning. However, the Central Bank report lacks a more formal approach to support their main conclusions. The decomposition of the bank interest margin among different factors is based on accounting identities and on a restricted sample of banks rather than on a bank profit maximization model.

The purpose of this paper is to provide an econometric account of the main determinants of the bank interest margin in Brazil. The study makes use of the two-step regression approach advanced by Ho and Saunders (1981) to uncover the influence of bank characteristic variables as well as macroeconomic influences as the main explanatory factors of the bank spread in the country.

The paper is structured as follows: after this Introduction, section 2 reviews the relevant literature. Section 3 overviews the recent behavior of bank interest rates in Brazil. Section 4 describes the methodology to be applied in the paper. Section 5 introduces the empirical model to be estimated. Section 6 deals with the sample and data issues. Section 7 presents the main results. Section 8 summarizes the main findings and concludes the paper.

2. Literature Review

In a comprehensive study, Demirgüç-Kunt and Huizinga (1999) investigate the determinants of bank interest margins using bank-level data for 80 countries in the years 1988-1995. The set of regressors include several variables accounting for bank characteristics, macroeconomic conditions, explicit and implicit bank taxation, deposit insurance regulation, overall financial

[1] See Banco Central do Brasil (1999) and the 2000 and 2001 follow-ups.

structure, and underlying legal and institutional indicators. The variables accounting for bank characteristics and macroeconomic factors are of special interest since they are close to the ones included in the regression estimated in our paper.

Demirgüç-Kunt and Huizinga report that the bank interest margin is positively influenced by the ratio of equity to lagged total assets, by the ratio of loans to total assets, by a foreign ownership dummy, by bank size as measured by total bank assets, by the ratio of overhead costs to total assets, by inflation rate, and by the short-term market interest rate in real terms. The ratio of non-interest earning assets to total assets, on the other hand, is negatively related to the bank interest margin. All the mentioned variables are statistically significant. Output growth, by contrast, does not seem to have any impact on bank spread.

Another branch of the literature is concerned with the adjustments of bank interest rates to the market interest rate[2]. These studies show that, in the long run, one cannot reject the hypothesis that bank interest rates follow the market interest rate in a one-to-one basis, i.e. that there is full adjustment to changes in the market interest rate. In the short-run, though, the departures of bank interest rates from the market interest rate are relevant and there is some evidence that adjustments towards the long run equilibrium are asymmetric, i.e. the adjustment varies according to whether one observes positive or negative unbalances.

There is some evidence of price rigidity in local deposit markets with decreases in deposit interest rates being more likely than increases in these rates in the face of changes in the market interest rate [Hannan and Berger (1991)]. One reason for such behavior is market concentration: banks in concentrated markets were found to exacerbate the asymmetric adjustments [Neumark and Sharpe (1992)].

The same sluggishness has been observed for the loan interest rate. Cottarelli and Kourelis (1994) apply a two-step approach to investigate the reasons for the stickiness of bank lending rates for a sample of countries. In the first step, the impact multipliers of changes in the market interest rate are calculated for each country in the sample. In the second step, such impact multipliers are regressed against a large set of explanatory variables controlling for cross-country differences in the competition within the banking system, in the extent of

[2] See, among others, Hannan and Berger (1991), Neumark and Sharpe (1992), Cottarelli and Kourelis (1994), Cottarelli *et al*. (1995), Scholnick (1996), and Heffernan (1997).

money market development and openness of the economy, in the banking system ownership, and in the degree of development of the financial system. Of interest are the results that the impact multiplier is higher for countries where inflation is higher and where public banks do not dominate the banking systems.

Angbazo (1997) studies the determinants of bank net interest margins for a sample of US banks using annual data for 1989-1993. The empirical model for the net interest margin is postulated to be a function of the following variables: default risk, interest rate risk, an interaction between default and interest risk, liquidity risk, leverage, implicit interest payments, opportunity cost of non-interest bearing reserves, management efficiency, and a dummy for states with branch restrictions. The results for the pooled sample suggest that the proxies for default risk (ratio of net loan charge-offs to total loans), the opportunity cost of non-interest bearing reserves, leverage (ratio of core capital to total assets), and management efficiency (ratio of earning assets to total assets) are all statistically significant and positively related to bank interest margins. The ratio of liquid assets to total liabilities, a proxy for low liquidity risk, is inversely related to the bank interest margin. The other variables were not significant in statistical terms.

Some recent contributions have made use of more structural models based on profit maximization assumptions for banks operating in imperfect markets to develop empirical equations to understand the behavior of bank interest rates. Recent contributions include Barajas *et al*. (1999) for Colombia, Catão (1998) for Argentina, and Randall (1998) for the Eastern Caribbean region.

Barajas *et al*. (1999) document significant effects of financial liberalization on bank interest spreads for the Colombian case. Although the overall spread has not reduced with the financial liberalization measures undertook in the early 1990s, the relevance of the different factors behind bank spreads were affected by such measures.

In a single equation specification, the bank lending rate is regressed against the ratio of the deposit rate to (one minus) the reserve ratio, a scale variable represented by the volume of total loans, wages, and a measure of loan quality given by the percentage of nonperforming loans. A test for market power is performed with the results showing that the banking sector in Colombia was imperfect before the liberalization but that a competitive industry describes the data well in the post-liberalization period. Another change linked with the liberalization

process was an increase in the coefficient of loan quality after the liberalization. The authors notice that “this change could signal a heightened awareness on the part of bank managers regarding credit risk, and/or it could reflect an improved reporting of nonperforming loans” (p. 212). A negative sign found for the scale variable indicates that economies of scale are prevalent for both periods.

The regression results are then used to decompose the bank intermediation spread into four factors: financial taxation (reserve requirements and forced investments), operating costs, market power, and loan quality. For the pre-liberalization period, operating costs made up about 38% of bank spread while market power, financial taxation and loan quality accounted for 36%, 22% and 4% of the spread, respectively. For the post-liberalization period, the impact of market power is set equal to zero to be consistent with the regression results. Loan quality now accounts for 29% of the spread while operating costs and financial taxation were responsible for, respectively, 45% and 26% of the spread.

Unlike other Latin American countries, Argentina used to operate a currency board arrangement with the widespread use of foreign currency (US dollar) alongside the domestic one. Domestic banks are allowed to intermediate freely in domestic as well as in foreign currency.

Using monthly data for Argentinean banks for the June 1993 to July 1997 period, Catão (1998) studies the determinants of the intermediation spread for loan and deposits denominated both in domestic as well as in foreign currencies. Both intermediation margins are related to the average tax ratio, to the cost of reserve requirements, to operating costs, to problem loans, to the exchange rate risk, and to the market structure as measured by the Herfindahl index.

The only marked difference between the domestic and foreign currency markets is a positive and significant impact of the market structure on spread for the former markets and a non-significant impact for the latter. Catão observes that such difference reflects “the fact that most peso borrowers cannot arbitrage between domestic and foreign sources of funds, thus becoming subject to the monopoly power of local banks” (p. 21). By contrast, “interbank competition for the typical US dollar borrower is bound to be considerably fiercer and the scope for banks to exert monopoly power over the client is therefore much reduced” (p. 21).

For both markets, the intermediation spreads are mostly affected by operating costs and problem loans. The quantitative effects of both factors are nearly the same for the domestic currency market while operating costs seem to be more important than problem loans in the US dollar market. The impact of reserve requirements on spread is economically small "reflecting the fact that banks' reserves at the Central Bank are remunerated at interest rates close to that of time deposits" (p. 21).

Randall (1998) documents that for the Eastern Caribbean countries[3], unlike the evidence gathered above, the impact of loan loss provisioning has been to reduce bank interest margin rather than to increase it once the tendency of banks to under provision in the case of government loans is accounted for. Like in other countries, operating expenses seem to have a large impact on bank spreads in the Eastern Caribbean region. Over the sample period, the ratio of operating expenses to total asset explains 23% of the estimated spread.

Ho and Saunders (1981) advocate a two-step procedure to explain the determinants of bank interest spreads in panel data samples.[4] In the first-step, a regression for the bank interest margin is run against a set of bank-specific variables such as non-performing loans, operating costs, the capital asset ratio, etc. plus time dummies. The time dummy coefficients of such regressions are interpreted as being a measure of the "pure" component of a country's bank spread. In the second-step, the constant terms are regressed against variables reflecting macroeconomic factors. For this second step, the inclusion of a constant term aims at capturing the influence of factors such as market structure or risk-aversion coefficient, which reflect neither bank-specific observed characteristics or macroeconomic elements.

Brock and Rojas-Suarez (2000) apply the two-step procedure for a sample of five Latin American countries during the mid 1990's (Argentina, Bolivia, Colombia, Chile, and Peru)[5]. For each country, the first-stage regressions for the bank interest spread include variables controlling for non-performing loans, capital ratio, operating costs, a measure of liquidity (the

[3] The Eastern Caribbean region is comprised by the following countries, in alphabetical order: Anguilla, Antigua and Barbuda, Dominica, Grenada, Montserrat, St. Kitts and Nevis, St. Lucia, St. Vincent and the Grenadines. These countries share a common currency and a common central bank.

[4] Section 4 discusses this approach in more detail.

[5] The period of analysis varies for each country: January 1995 to April 1996 for Argentina, February 1992 to April 1996 for Bolivia, February 1991 to March 1996 for Colombia, April 1991 to April 1995 for Chile, and March 1993 to April 1996 for Peru.

ratio of short term assets to total deposits) and time dummies. The coefficients on the time dummies are estimates of the "pure" spread.

Their results show positive coefficients for capital ratio (statistically significant for Bolivia and Colombia), cost ratio (statistically significant for Argentina and Bolivia), and the liquidity ratio (statistically significant for Bolivia, Colombia, and Peru). As for the effects of non-performing loans, the evidence is mixed. Apart from Colombia, where the coefficient for non-performing loans is positive and statistically significant, for the other countries the coefficient is negative (statistically significant for Argentina and Peru). The authors explain these findings as "a result of inadequate provisioning for loan losses: higher non-performing loans would reduce banks' income, thereby lowering the spread in the absence of adequate loan loss reserves" (p. 130). The result for Argentina is striking given the opposite findings reported by Catão (1998).

In the second stage, Brock and Rojas-Suarez (2000) run a regression for the measure of "pure" bank spreads on macroeconomic variables reflecting interest rate volatility, inflation rate and GDP growth rate. Their results show that interest rate volatility increases bank spread in Bolivia and Chile; the same happens with inflation in Colombia, Chile and Peru. For the other cases, the coefficients are not statistically significant.

On balance, bank spreads in Bolivia are explained by micro variables, while bank spreads in Chile and Colombia are accounted for by both macro and micro factors. As for Argentina and Peru, there is still a large fraction of the spread that cannot be explained by any of the above factors.

In addition to the studies concerning Latin American countries, Saunders and Schumacher (2000) apply Ho and Saunders two-step method to a sample of banks of seven OECD countries (namely Germany, Spain, France, Great Britain, Italy, United States and Switzerland). The purpose of the authors is to decompose the determinants of bank net interest margins into regulatory, market structure and risk premium components.

Among the three control variables used in the first step, the one with the major impact is the implicit interest rate, a fee proxy. That is, for almost all countries, banks have to increase margins to finance implicit interest payments. Besides that, the coefficients for the

opportunity cost of reserves were positive and significant in most countries and years. At last, bank capital ratios were also in general significant and positive.

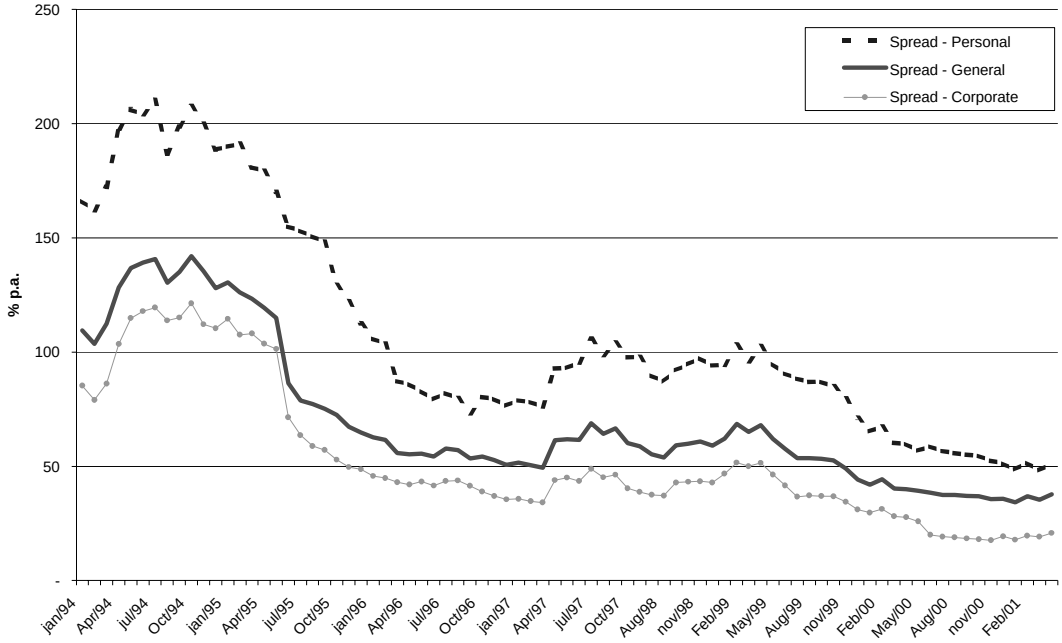
The intercepts of these first step regressions can be understood as the common pure spread across all banks in a single country at the same time. The authors then ran a cross-country second step regression, in which the dependent variable was the estimated pure spreads from the first step. This second stage is supposed to measure the sensitivity of the margins with respect to market structure and interest rate volatility. The results showed that, first, the more segmented and restricted the system is, the higher the spreads are, probably due to the monopoly power, and, second, that the volatility of interest rate has also a significant impact on the margins. These findings suggest that the pure spreads are sensitive to both, market structure and volatility effects, and also that the effects are quite heterogeneous across countries.

3. Recent Evolution of Bank Interest Rates in Brazil

The Brazilian banking system has traditionally been characterized by high lending rates and low levels of credit as a proportion of GDP. Recently, with inflation under control and a stable macroeconomic environment there has been a notable trend towards a more balanced credit market, with a vigorous fall in bank interest margins and an increase in credit.

Figure 1 illustrates the behavior of the bank interest spread in Brazil for both the corporate and the personal sectors. Since 1995, interest spreads in Brazil have been in a downward trend. The overall interest spread has fallen from a rate of 135% p.a. at the beginning of 1995 to 35% p.a. in early 2001.

Figure 1: Bank Interest Spread in Brazil



The stabilization plan (Plano Real) launched in July 1994 succeeded in controlling inflation rates and creating a more stable macroeconomic environment. As a result, the basic interest rate reduced (excepting the immediate post-Real period, when the government introduced very restrictive temporary policies to control credit expansion[6], and periods of external shocks) and output growth resumed.

In 1999, the Brazilian government adopted some measures with the declared purpose of curbing banks' spread, namely a gradual reduction of reserve requirements – from 75% to 45% for demand deposits and from 20% to zero for time deposits – and cuts in financial market taxation for household loans – from 6% to 1.5%, same level of corporate loans.[7]

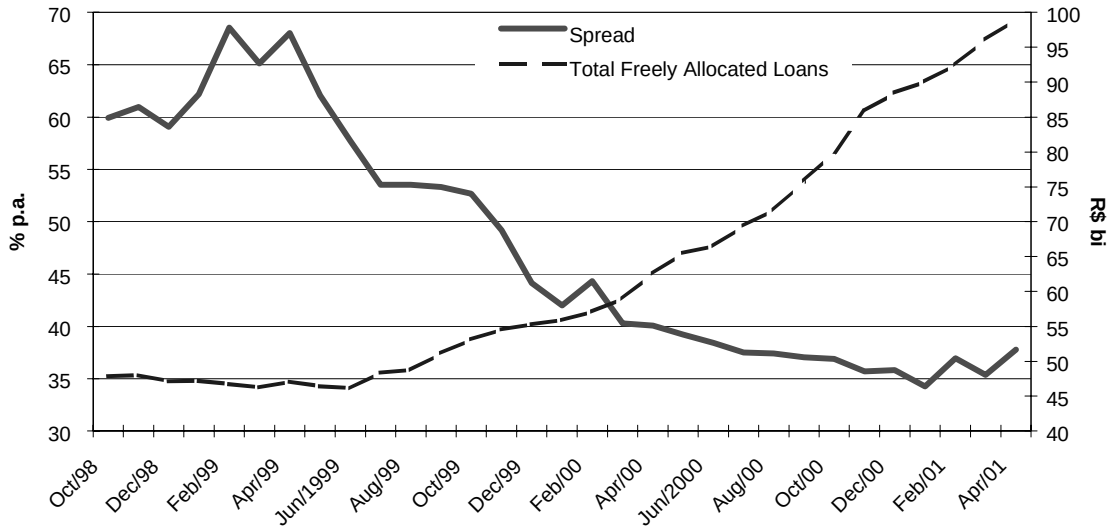
Figure 2 illustrates that the drop in the spread rates since mid-1999 was simultaneous to an expansion of freely allocated credit in the economy. Total freely allocated loans in the banking system increased 127% in the two-year period from April 1999 to April 2001, rising from R$ 44 billion to R$ 100 billion. It is important to emphasize though that overall credit in

[6] Those measures included a marginal 100% reserve requirement on time deposits and a 15% reserve requirement on loans, causing a sharp increase in bank interest spreads at the end of 1994/beginning of 1995.

[7] In addition to these measures, some other changes were also implemented, including the following: new credit risk rating system and provisioning rules; broadening of the coverage of loan transactions reported to the Central Bank risk bureau (*central de risco*); public availability of interest rates charged on overdraft accounts by each bank; creation of certificates of bank credit (*cédulas de crédito bancário*), a new bond supposed to be easier to recover when defaulted.

the economy has increased in a more moderate term. Directed credit in the economy (including housing and rural credit) has even declined, allowing overall credit to stay stable at 29 percent of GDP, notwithstanding the strong growth in free credit observed in Figure 2.

Figure 2: Bank Interest Spread and Total Freely Allocated Loans



Despite the entire recent downward trend observed for the bank spread in Brazil, such rates are still very high by international standards. Table 1 compares the observed spread interest rates for Brazil and other selected countries. The difference in the bank spread observed in Brazil and those observed for the developed countries is of one order of magnitude, i.e. ten times or larger. Even when Latin America is taken as the benchmark, Brazil tops the list in spite of the drastic drop observed in 2000.[8]

[8] The purpose of the table is just to illustrate the orders of magnitude of the bank interest rates found in different countries. We recognize that financial systems across the world are very heterogeneous and therefore cross-country comparisons should be viewed with caution.

Table 1: Spread Rates for Selected Developed and Latin American Countries – % p.a.

	Spread Rates (lending - deposit rates)						Inflation
	1995	**1996**	**1997**	**1998**	**1999**	**2000**	**2000**
Developed Countries							
USA	2.91	2.88	2.82	2.88	2.66	2.77	3.4
Canada	1.50	1.73	1.37	1.57	1.53	1.57	2.7
Australia	3.79	4.14	4.19	3.37	-	4.66	4.5
Japan	2.50	2.36	2.15	2.05	2.04	2.00	-0.6
UK	2.58	2.91	2.95	2.73	-	-	2.9
Euro Area	-	4.80	4.18	3.53	3.20	3.15	2.3
Latin America							
Argentina	5.95	3.15	2.27	3.08	2.99	2.75	-0.9
Bolivia	32.15	36.81	35.32	26.59	23.11	23.62	4.6
BRAZIL *	130.45	67.79	54.62	60.71	57.50	38.72	7.0
BRAZIL **	-	-	53.84	58.36	54.42	38.57	7.0
Chile	4.43	3.91	3.65	5.26	4.07	5.64	3.8
Colombia	10.38	10.84	10.09	9.66	9.08	14.21	9.5
Mexico	20.47	12.19	9.89	14.95	16.26	11.96	9.5
Peru	11.46	11.17	14.95	15.69	14.52	14.62	3.8
Uruguay	60.86	63.39	51.94	42.84	39.03	36.94	4.8
Venezuela	15.02	11.83	8.99	11.51	10.85	8.90	16.2

Source: Brazil*: our calculation

Brazil** and Other Countries: IMF, *International Financial Statistics*, lines 601 and 60p

The last column of Table 1 shows that the difference in the interest spreads cannot be explained on the basis of inflation differentials among the countries. Inflation in Brazil was lower than inflation in Colombia, Mexico, and Venezuela.

Table 2 compares the simple correlation coefficients of the bank spread with the loan and deposit rates for Brazil, Argentina, Chile and Mexico. Different from other Latin American countries, the variation of the interest spread in Brazil is strongly correlated with both the loan and deposit rates. For the other Latin American countries, the loan rates impact more significantly the spread, probably due to the fact that the deposit interest rate in these countries are set in accordance to the behavior of international interest rates.

Table 2: Correlation of Spread with Loan and Deposit Rates for Selected Latin American Countries (1991/96)

Country	Loan Rate	Deposit Rate
Brazil (1994-2000)	0.97	0.87
Argentina	0.89	0.05
Chile	0.75	0.22
Mexico	0.42	-0.33

Source: Brazil – our calculation

Other Countries – Brock and Rojas-Suarez (2000)

In addition to the high-observed temporal variation of the bank interest rates in Brazil it is also worth highlighting the important cross-sectional dispersion of such rates. Table 3 computes the coefficients of variation for the loan, deposit and spread rates both over time and across banks for all the banks in the country.[9]

Table 3: Coefficients of Variation for the Loan, Deposit and Spread Rates

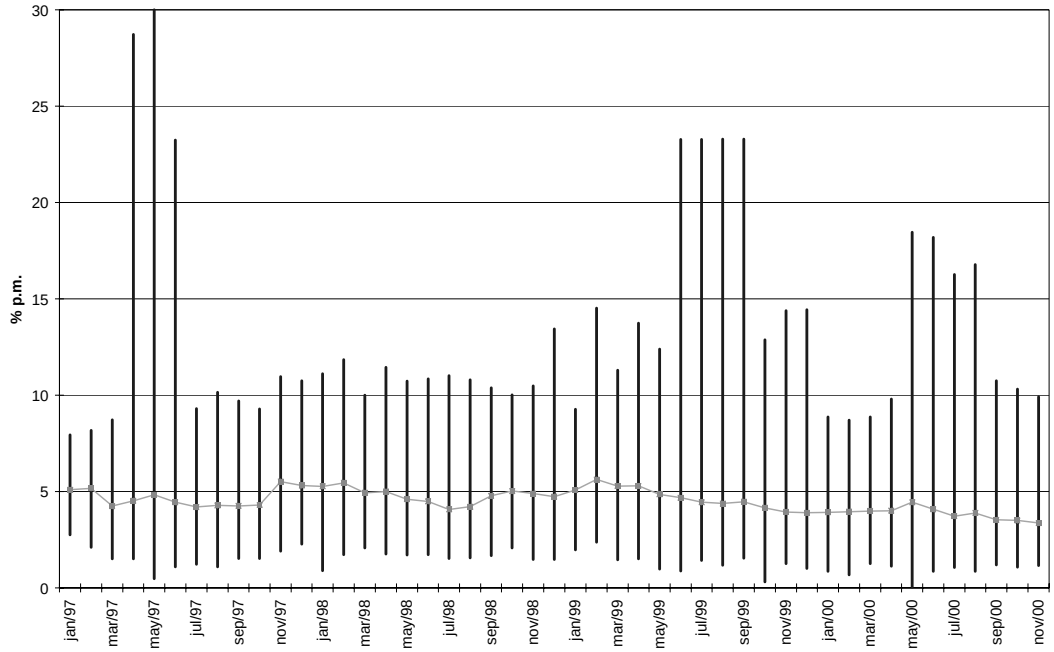
	Loan Rate		Deposit Rate		Spread	
	Over Time	Across Banks	Over Time	Across Banks	Over Time	Across Banks
1997	0.0931	0.4436	0.2634	0.5413	0.0491	0.5435
1998	0.0771	0.4038	0.1839	0.4877	0.0607	0.5221
1999	0.1451	0.4222	0.3467	0.5679	0.0843	0.5459
2000	0.0820	0.5402	0.0524	0.6758	0.1363	0.5479
1997-2000	0.1701	0.4656	0.3111	0.5266	0.1427	0.4870

The results of Table 3 show that the cross-section dispersion of the interest rates is even more pronounced than the temporal variation. Such across banks dispersion is observed for all the three bank rates. Table 3 also shows that the cross-section dispersion of interest rates has not significantly changed over the years.

[9] The coefficient of variation is the ratio of the standard-error to the mean of the corresponding series. The column "Over Time" shows the coefficients of variation when the individual observations that make the series up are the average rates (for all the banks) for each month. In contrast, the column "Across Banks" shows the coefficients of variation when the observations that make the series up are the average rates (for every month) for each bank.

The same evidence can be gathered by the observation of Figure 3. This figure shows, for each month, the minimum and maximum lending rates observed in the market for the universe of banks in the country. One can see that the dispersion is not only quite significant but also very persistent over time.[10]

Figure 3: Mean, Maximum and Minimum Loan Rate



The temporal variation of the interest spreads observed in Brazil, the still high levels of such rates, the dispersion of rates charged across banks, and the persistence of such dispersion justify our use of panel data techniques to analyze the behavior of the interest margins in the country. Specifically, our aim is to decompose the main determinants of the interest spread into microeconomic (inefficiencies or lack of competition of the sector, for example) and macroeconomic (volatility of the basic interest rate, inflation and economic growth) variables.

4. Methodology

The methodology to be applied to the data borrows from the two-step approach advanced by Ho and Saunders (1981). Their applied methodology is based on an adaptation of a model of bid-ask prices of security dealers [see, e.g. Ho and Stoll (1980)] to the determination of the bank interest margin.

[10] The isolated peaks observed in Figure 3 reflect marginal operations performed by very small banks. Part of the dispersion may be due to market segmentation strategies pursued by different banks.

The representative bank is modeled as a risk-averse agent that acts as a dealer in a market for the immediate provision of deposits and loans. It holds illiquid assets and it therefore runs the risk of an unbalanced portfolio with either excessive demand for loans or insufficient supply of deposits. The bank sets both the deposit and the loan rates with the aim of maximizing a mean-variance objective function in end-of-period wealth.

Depositors and borrowers are supposed to arrive randomly according to Poisson processes. Ho and Saunders assume linear symmetric specifications for the Poisson arrival rates of loans and deposits:

$$\lambda_L = \alpha - \beta b, \qquad \lambda_D = \alpha + \beta a \tag{1}$$

where *a* and *b* are the fees charged on deposits and loans.

The equilibrium bank interest margin has then the following simple specification:

$$s = a + b = \frac{\alpha}{\beta} + \frac{1}{2} R \sigma_I^2 Q \tag{2}$$

The bank interest spread is thus the sum of two terms. The first term (α/β) is a measure of the "risk neutral spread" in the sense that it is the bank spread that would be chosen by a risk neutral bank. The risk neutral spread is the ratio of the intercept (α) to the slope (β) of the symmetric deposit and loan arrival probability functions. Ho and Saunders interpret this first term as a measure of market power, since if a bank faces relatively inelastic demand and supply functions in the two markets, it exercises market power by charging a greater spread.

The second term is a measure of risk premium and it reflects the composition of three elements, namely the coefficient of absolute risk aversion (*R*), the variance of the interest rate on net credit inventories (σ_I^2), and the size of the deposit/loan transaction (*Q*).

The basic model was extended by, among others, Allen (1988), McShane and Sharpe (1985), and Angbazo (1997) to consider more than one type of loans, other sources of interest rate uncertainty, and asymmetric arrival probability functions.

Ho and Saunders develop a two-step methodology to empirically evaluate the main determinants of the bank interest spread. The first step makes use of a panel of banks to relate the bank-level interest spread to a vector of bank observable characteristics plus a set of time dummies. The time dummy coefficients are interpreted as a measure of the pure bank spread.

The time dummy coefficients are then used as the dependent variable in the second step regression. The set of regressors in the second step includes a measure of interest rate volatility plus other macroeconomic variables.

This two-step approach has been applied to bank data by Ho and Saunders (1981) and Angbazo (1997) for US banks, by McShane and Sharpe (1985) for Australian banks, by Brock and Rojas-Suarez (2000) for Latin American banks (Argentina, Bolivia, Chile, Colombia, Mexico, Peru, and Uruguay), and by Saunders and Schumacher (2000) for a bank sample for US and six European countries (Germany, Spain, France, Great Britain, Italy, and Switzerland).

5. Empirical Model

The empirical model to be estimated in this paper makes use of a panel data set for Brazilian banks to implement the two-step approach described in the previous section. The following equation is used for the first step:

$$s_{it} = \delta + \boldsymbol{D}\gamma + \boldsymbol{X}_{it}\beta + \varepsilon_{it} \qquad (3)$$

where s_{it} is the interest spread for bank *i* in period *t* (*i* = 1, ..., *N*; *t* = 1, ..., *T*) measured as the difference between the loan and the deposit rates, $\boldsymbol{D}$ is a set of *T* time dummy variables taking the value one for period *t*, $\boldsymbol{X}_{it}$ is a vector of bank characteristics, ε_{it} is the statistical disturbance, and δ, γ, and β are parameters to be estimated.

The vector of bank characteristics includes the following variables: a) number of bank branches; b) the ratio of non-interest bearing deposits to total operational assets; c) the ratio of interest-bearing funds to total earning assets; d) operating costs; e) bank liquidity; f) the ratio of service revenues to total operational revenues; g) the bank net worth; and h) bank leverage. Details on the calculation of each variable are given in section 6.

The measure of the pure bank spread is the estimate of $(\delta + \gamma_t)$, where γ_t is the t^{th} element in the γ vector. Let ps_t denote the estimate of the pure spread. In the second-step of the procedure, the following equation is estimated:

$$ps_t = \phi + \boldsymbol{Z_t}\boldsymbol{\lambda} + u_t \tag{4}$$

where $\boldsymbol{Z_t}$ is a vector of macroeconomic variables, u_t is the statistical disturbance, and ϕ and $\boldsymbol{\lambda}$ are parameters to be estimated.

The vector of macroeconomic variables contains the market interest rate, a proxy for risk premium, the inflation rate, the output growth rate, the required reserve ratio on demand deposits, and a financial taxation rate.

6. Sample and Data

Monthly data for all the commercial banks operating in Brazil during the period from February 1997 to November 2000 is used in the study. Bank observations that were missing, misreported or that constituted clear outliers were excluded from the sample. Banks with less than twelve months of observations were also excluded from the sample. The final sample is an unbalanced panel data with 142 commercial banks. The total number of observations is 5,578. The average number of observations per period is 121.3.

The deposit interest rate is the rate paid on 30-day certificates of deposits. The loan interest rate is the average rate charged on fixed-rate free-allocated operations. In other terms, both floating-rate operations as well as credit directly channeled through legal requirements (mainly credit to the housing and rural sectors) are excluded from the computation of the loan rate.

Both interest rates are posted rates. By contrast, most of the literature makes use of reported interest income and interest expenses when computing bank interest margins. The advantage of our measure is that the posted rates are more likely to be influenced and to respond to changes in the economic environment than interest income and expense. One possible drawback of posted rates is that they can be far from the effective rates paid to depositors and charged from borrowers due to the exclusion of factors such as payment of fees, commissions,

idle resource requirements, etc. in their calculation. Moreover, being an ex ante measure, posted rates do not account for loan losses of any nature.

Balance sheet and income statement data come from *COSIF*, a monthly report that all financial institutions in Brazil are required to submit to the Central Bank.

The bank characteristic variables included in the first-step regression aim at controlling for different individual factors that are due to affect the bank interest spread. The main factors considered in the paper include the bank size, its operational policies, and its exposure to risks of different kinds. Our proxies for these factors include the number of bank branches, the ratio of non-interest bearing deposits to total operational assets, the ratio of interest-bearing funds to total earning assets, operating costs, bank liquidity, the ratio of service revenues to total operational revenues, bank net worth, the leverage ratio, and a dummy variable for foreign-controlled banks.

The number of bank branches (*b*) is our measure of bank size. The expected sign for this variable is not clear *a priori*. On one side, bigger banks can have more market power, which is conducive to higher interest spreads. On the other hand, economies of scale can lead bigger banks to operate with lower average costs, which work to reduce bank spreads. Another possibility is that, due to market segmentation, some small and specialized banks can operate in niche markets charging low lending rates.

Non-interest bearing deposits are mainly demand deposits. Banks are forbidden by law to pay any interest on demand deposits. Total operational assets are total bank assets minus fixed assets. The ratio of non-interest bearing deposits to total operational assets (*nibd*) measures the channeling of non-interest-bearing resources to fund bank activities on the asset side. Non-interest bearing deposits are less costly than interest-bearing resources. Thus, one can expect that banks with higher values for *nibd* are associated with lower values for the interest spread. However, one can also argue that this variable is actually capturing the effect of the opportunity cost of non-interest bearing reserves, in which case one would expect a positive sign for it in the interest spread equation.[11]

[11] Courakis (1984) shows that, when banks operate in imperfect markets, it is possible that an increase in the reserve requirement ratio can lead to lower interest spread.

Moreover, although non-interest bearing deposits may imply less interest costs for the bank, it is not clear that banks that rely heavily on non-interest bearing deposits have overall lower costs. Due to the distortions created by a long period of high inflation, many Brazilian banks developed a large and costly branch network with the aim of attracting non-interest bearing deposits subject to inflationary corrosion.

It is therefore unclear what the expected sign for *nibd* should be.

Interest-bearing funds include interest-bearing deposits (mainly passbook savings and time deposits) plus purchased funds. Total earning assets are defined as total operational assets less the sum of foreign-denominated resources, demand deposits, and public sector resources.

The ratio of interest-bearing funds to earning assets (*ibf*) tries to capture the importance of costly resources to fund the bank asset activities. The expected sign for this variable is not *a priori* certain due to the same reasons given for the *nibd* variable.

Operating cost (*opc*) is the ratio of administrative costs to total assets. Banks with higher operating costs are expected to have higher interest spreads.

Bank liquidity (*liquid*) is defined as the ratio of total operational assets to total bank liabilities. This variable is expected to be negatively related to interest spread. An increase in liquidity reduces the bank liquidity risk, which reduces the interest spread due to a lower liquidity premium charged on loans.

Service revenues include mainly revenues from fee collection. Operational revenues include service plus interest revenues. The ratio of service revenues to operational revenues (*servr*) proxies for the importance of bank's off-balance sheet activities. Angbazo (1997) argues that off-balance sheet activities have two opposing effects on banks. On one hand, off-balance sheet activities "should increase profitability since they permit banks to expand in investments that would be passed up if restricted to equity- or deposit-financing" (p. 76). But, on the other hand, since these activities are subject to lower capital requirements, there is a moral hazard effect that may lead banks to "increase off-balance sheet activities in a manner that increases asset risk and enhances the subsidy value of deposit insurance if the premium does not reflect the marginal risk associated with new investment opportunities" (p. 76).

The bank net worth (*netw*) is a summary measure of its earnings performance. The effect of the net worth on interest spread is expected to be negative. Large net worth provides a cushion for banks to better face different risks involved in its activities, which reduces the interest spread.

The leverage ratio (*lever)* is defined as the ratio of total liabilities plus net worth to bank net worth. An increase in the leverage ratio is interpreted as an increase in the bank solvency risk, which is conducive to higher interest spread.

A dummy variable for foreign-controlled banks (*forgn*) was also included in the regression.

In the second-step regression, the estimate of the pure spread is related to a set of macroeconomic variables, which include the market interest rate, a risk premium measure, inflation rate, output growth, the required reserves on demand deposits, and financial taxation.

The market interest rate is the overnight *Selic* rate. The proxy for risk premium is the C-bond spread over a US Treasury bond of equivalent maturity. The inflation rate is measured as the monthly rate of change of the general price index (IGP-DI) as calculated by Fundação Getúlio Vargas.[12] Output growth is measured by the first difference of the logarithm of the seasonally adjusted industrial production series as calculated by IBGE. Financial taxation is the burden of indirect taxes on a typical loan operation funded with 30-day certificates of deposits.[13]

One expects that the bank interest spread increases when the basic interest rate (*irate*) or the proxy for risk premium (*ivol*) increase. The same is expected to happen when inflation rate (*infl*), or the required reserves on demand deposits (*rres*), or financial taxation (*tax*) increase. As for the effect of output growth (*ygr*) on interest spread, it can be either positive or negative. On one hand, higher output growth signals a greater demand for bank loans, leading banks to charge more on their loans. On the other hand, to the extent that economic growth is indicative of increased competition and macroeconomic stability, one can expect that lower spread is associated with stronger growth.

[12] The measure of inflation used in this study is not the same as the one targeted by the Central Bank as part of the inflation targeting monetary regime. The last one is a consumer price index, IPCA calculated by Fundação IBGE. We chose a broader price index due to the fact that the focus of this paper is overall bank loans, both to households as well as to companies.

7. Results

The first-step equation was estimated by means of a within-group estimator where the observations for each bank constitute a group. This estimation procedure amounts to estimate equation (3) by ordinary least squares with the inclusion of time dummy variables for each month in the sample. Dynamic adjustments of the bank spread to changes in the regressors are allowed through the inclusion of lagged terms in the equation. Six lags of each variable were included in the unrestricted model. Non-significant terms are then excluded. The statistic of the Wald test on the validity of the imposed restrictions is equal to 39.65 for a Chi-squared (30) distribution [*p-value* equal to 0.112]. Equation (5) reports the implied long-run results of the first-step regression:[14]

$$\hat{s}_{it} = \underset{(11.4)}{3.068} + \underset{(0.25)}{0.015}\ln b_{it} + \underset{(4.13)}{0.053}\,nibd_{it} - \underset{(1.44)}{3.12\times10^{-3}}\,ibf_{it} + \underset{(2.17)}{0.039}\,opc_{it} + \underset{(1.54)}{3.47\times10^{-4}}\,liquid_{it} + \underset{(2.36)}{0.032}\,servr_{it} + \underset{(1.42)}{7.93\times10^{-4}}\,lever_{it} - \underset{(2.81)}{0.778}\,forgn_{it} + D_t\hat{\gamma} \quad (5)$$

$$R^2 = 18.19\% \qquad \hat{\sigma} = 1.817 \qquad \text{Joint Significance}: \chi^2(27) = 333.9$$
$$\text{Time Dummies Significance } \chi^2(39) = 280.1$$

The results of the first-step regressions suggest that large banks charge higher interest spreads but the coefficient is not precisely estimated though.

The ratio of non-interest bearing deposits to total operational assets (*nibd*) affects positively the interest spread. One reason for this positive link is related to the fact that the opportunity cost of non-interest bearing reserves increases when *nibd* is high, leading banks to charge higher spreads.

The same reason can explain why the ratio of interest-bearing funds to earning assets (*ibf*) is negative in equation (5).

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[13] The taxes considered in the analysis are the IOF (Tax on Financial Operations), PIS-COFINS (Taxes on Gross Revenues), and CPMF (Tax on Debit Transactions).

As expected, operating costs (*opc*) act to increase the bank interest margin. The expected negative sign for liquidity (*liquid*), however, is not confirmed.

The ratio of service revenues to operational revenues (*servr*) is found to have a positive impact on the interest spread. To the extent that this variable proxies for the relevance of off balance sheet activities, our results may be capturing some moral hazard behavior due to the regulatory treatment of such activities leading to higher asset risk and, as a result, to higher bank spread as well.

The variable bank net worth (*netw*) is completely eliminated in the specification search.

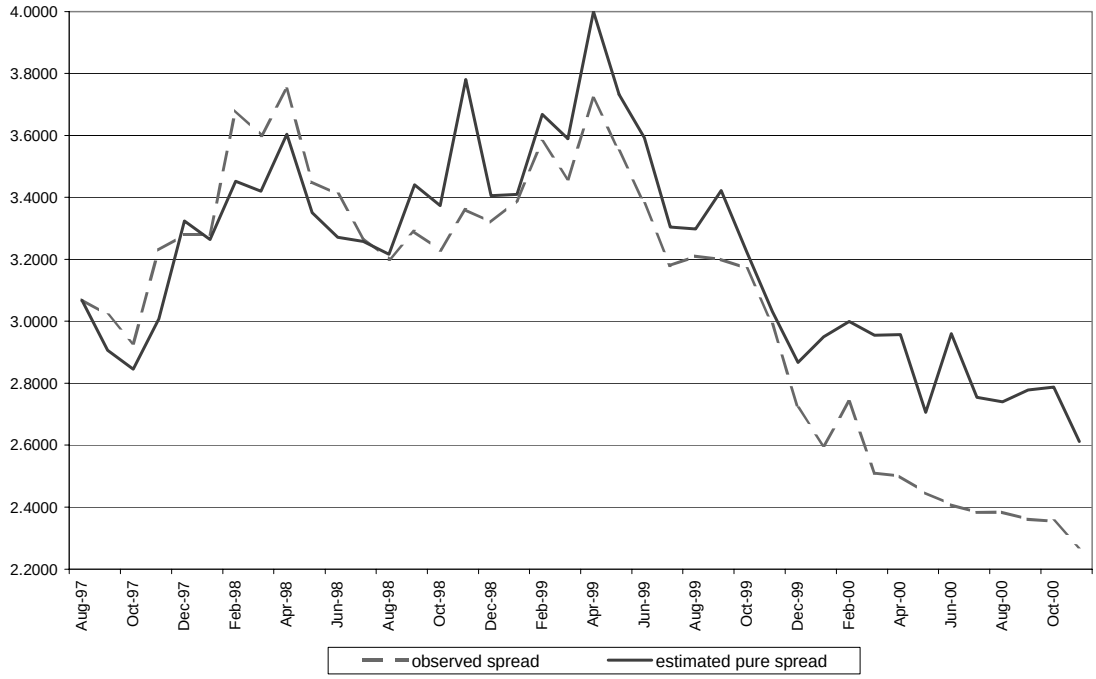
An increase in bank leverage (*lever*) is associated with higher interest margins due, probably, to higher solvency risk. The estimated coefficient for this variable is not statistically significant though.

The dummy variable for foreign-controlled banks (*frgn*) is negative indicating that these banks charge lower interest spreads on average.

The estimated values for the constant term plus the coefficients on the time dummy variables are our measure of the bank pure spread. Figure 4 contrasts the estimate for the pure spread with the average bank spread. The average bank spread is calculated for the whole banking system rather than for the banks present in our sample.

[14] The long run shows the sum of the coefficients of each variable at its significant lags. In order to spare space, the coefficients on the time dummy variables are not reported. The estimated standard deviations for each coefficient are based on the robust Huber-White sandwich estimators. The t-values are reported in parentheses.

Figure 4: Bank Interest Spread and Pure Spread



Both series track each other fairly closely up to October 1999. In the first part of the sample the actual bank spread was larger than the estimated pure spread whereas the opposite seems to be true towards the end of the period.

These results suggest that microeconomic factors (in the form of individual differences amongst banks) do not seem to be a major determinant of interest spreads in Brazil.[15] The lack of influence of microeconomic factors on the interest spread is even more pronounced after October 1999 when the Brazilian Central Bank launched a series of measures with the aim of reducing the interest spreads (see Section 3).

It remains to be presented the possible relevance of the macroeconomic factors as determinants of the interest margin in the country.

The second step regression makes use of a general to particular specification search. First, an unrestricted model is estimated. The unrestricted model is a distributed lag one with five lags

[15] Recall that the pure spread is what one would observe for the interest spread after accounting for the influence of the microeconomic factors. Thus, if such factors were relevant one would expect to find a large displacement between the pure and actual spreads.

of the explanatory variables included. Second, a reduction process is implemented through the elimination of the non-significant variables. The final model is the restricted version of the two-step equation. Third and last, the long-run implied equation is computed from the restricted model.

The long run solution associated to the estimated restricted equation is shown below:[16]

$$ps_t = \underset{(8.15)}{1.399} + \underset{(5.90)}{0.398}\,irate_t + \underset{(3.60)}{0.080}\,risk_t - \underset{(4.24)}{0.167}\,infl_t + \underset{(4.09)}{0.117}\,ygr_t + \underset{(0.67)}{0.335}\,rres_t + \underset{(2.06)}{0.665}\,tax_t \quad (6)$$

$$R^2 = 97.85\% \quad \hat{\sigma} = 0.0739 \quad F(19,16) = 38.39 \quad AR1-1F(1,15) = 0.342$$
$$ARCH1\,F(1,14) = 0.0003 \quad Normality\ \chi^2(2) = 3.478 \quad RESET\ F(1,15) = 0.632$$

The restricted equation shows no sign of mis-specification. Moreover, the imposed restrictions are not rejected by the data. The Wald statistic on the restriction is equal to 0.503, with a *F(11,5)* distribution [*p-value* is equal to 0.8411].

The results suggest that the pure spread increases with rises in either the basic interest rate or in the risk premium, as expected. Increases in the required reserves are also accompanied by surges in the interest spread, although the coefficient is not statistically significant. The impacts of the output growth and of the financial taxation are also to increase the bank spread.

Contrary to expectations, however, inflation rate affects negatively the pure spread. One possible explanation for this finding is that inflation may be capturing the effect of bank seigniorage collection on interest spreads. Commercial banks collect segniorage (or an inflation tax) on non-interest bearing demand deposits. According to Cardoso (2002), when seigniorage revenue (or inflationary revenue) falls, commercial banks can pass this loss of revenue on to depositors who will receive lower interest rates on deposits and to borrowers who will face higher interest rate on loans. One would therefore observe higher interest spreads. Cardoso (2002) finds empirical support for this relation for the post-Real period in Brazil.

[16] The t-statistics are shown in parentheses. Some diagnostic tests are also reported: *AR*1 is a Wald test for the presence of serial auto-correlation of order one; *ARCH1* is a Wald test for the presence of ARCH residuals of order one; *Normality* is Jarque-Bera test for normal residuals; and *RESET* is Ramsey regression specification test for functional form mis-specification. See Doornik and Hendry (1996) for further details.

The high coefficient of determination of equation (6) suggests that macroeconomic factors are important determinants of the bank interest spread in Brazil.

The constant term in equation (6) shows what one would expect for the estimated spread once the macroeconomic factors have been accounted for. Ho and Saunders (1981) interpret this coefficient as measuring the impact of market power on the bank interest margin. The significance for this term suggests that other factors apart from those controlled for in the regressions may be relevant to explain the movements of the pure spread. Market power can be one of such factor although the results obtained by Nakane (2001), showing that the banking industry in Brazil is fairly competitive, do not support this conjecture. Regulatory restrictions in the form of compulsory credit at subsidized rates for rural and real estate loans are another contender.

8. Conclusions

Bank interest spread in Brazil has shown an impressive downward trend in the recent period. A stable macroeconomic environment as well as the official priority given to the reduction of the interest margins are the main factors behind this behavior.

Another important feature of bank interest spreads in Brazil is its high and persistent cross-sectional dispersion. These elements disclose a market where productive inefficiencies and regulatory burden allow that some banks keep operating even charging rates much higher than their rivals.

These stylized facts are consistent with the findings of our econometric results. Using a panel data of 142 Brazilian banks for the February 1997-November 2000 period, the two-step approach due to Ho and Saunders (1981) is implemented. The results show the relevance of the macroeconomic conditions over bank's observable characteristics as the main determinants of bank interest spreads in Brazil. However, some yet unidentified factors still account for a large portion of the spread behavior in the country.

Despite all the recent developments, bank interest margins in Brazil have remained stubbornly high by international standards. It is not clear if further reductions can still be expected from the development of the macroeconomic conditions. Given the nature of the cross-section dispersion of the interest spread, we foresee that the possible trend is now for such rates to be

more and more affected by changes in the microeconomic environment that shakes the industry structure and modifies the behavior of the different banks towards reducing slack and improving managerial practices.

As far as the Central Bank is concerned, we envision a world with the primacy of the prudential regulation and supervision tools over the traditional short-term monetary policy instruments as the most effective ways to ensure a convergence of the best-practices in the local banking industry towards the international benchmarks.

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