ISSN 1518-3548

BANCO CENTRAL DO BRASIL

Working Paper Series 235

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March, 2011

ISSN 1518-3548
CGC 00.038.166/0001-05

Working Paper Series	Brasília	n. 235	Mar.	2011	p. 1-48

Working Paper Series

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Revisiting Bank Pricing Policies in Brazil: evidence from loan and deposit markets[1]

Leonardo S. Alencar[2]

Abstract

This paper addresses the determinants of interest rates in the Brazilian banking market. The results suggest that banks fully adjust their loan interest rates to a change in the monetary policy rate, but we also observe a rigid short-term response for some loan product categories. The study confirms that pricing policies can vary substantially depending on the market. For example, microeconomic factors did not seem to be a major determinant of retail loan rates, but they were found to be important determinants of corporate loan or time deposit rates. As two additional results, market concentration was found to have a robust significant positive effect on loan rates and interest spreads, as well as the international risk perception of Brazil, as proxied by the EMBI Brazil.

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

[1] The author would like to thank Sérgio Mikio Koyama, Wagner Piazza Gaglianone, Tito Cordella and Tony Takeda for comments and suggestions.
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1 Introduction

This paper examines the micro and macroeconomic determinants of bank interest rates in Brazil. The relevance of this issue stems from the fact there can be real effects on consumption and investment when bank prices are modified, even when there are no changes in the volume of credit. Besides this, knowing the behavior of bank interest rates is relevant to the conduct of monetary policy. As Brazil has the largest banking system in Latin America, and the credit market has been by far the most important source of financing to individuals and firms[3], identifying the factors driving these interest rates is an important exercise.

The paper focuses on the three most important banking market segments – corporate and retail loans and funding – using bank level data. Since there are differences in the evolution of corporate and retail loan interest rates (see Figure 1), a better knowledge of these differences is relevant for policy purposes.

In this study, we analyze the interest rate channel of monetary policy transmission for five loan products. Following much of the research in the literature on the pass-through from policy rates to bank interest rates, we test the so-called completeness hypothesis, i.e., the one-for-one effect of the policy rate on bank rates.

Measurement of the pass-through is important to assess the efficiency of monetary policy. But the scope of this paper is wider, and here we also investigate bank-specific factors that drive the heterogeneity in bank pricing policies. To do this, we focus on two particular pricing measures: the interest spread and a consolidated measure of interest rate per bank. In particular, we consider the effects on deposit and loan interest rates of control variables such as bank liquidity, as we expect that it acts as a buffer against market fluctuations, or bank capitalization, since financial institutions have to keep regulatory capital against risk-weighted assets, implying that their capital adequacy influences their lending. The analysis also controls for bank efficiency, size, inflation, economic activity, non-performing loans, international risk perception of

[3] As an example, from 2002 to 2010, the funding issues in the capital market were equivalent to only about 4% of the total new credit transactions.

Brazil and the volatility of monetary policy. By considering all these controls, this paper adds to the existing literature using Brazilian data.

Another important determinant of bank pricing behavior is the degree of concentration in the financial system. Berger (1995) states that a bank with a large market share may be able to set interest rates oligopolistically. Here we assume that the degree of market concentration is a proxy for market power, and our results show a positive effect of market concentration on the bank spread and loan interest rates, corroborating the relative market power hypothesis presented by Berger. This result is new for the Brazilian case.

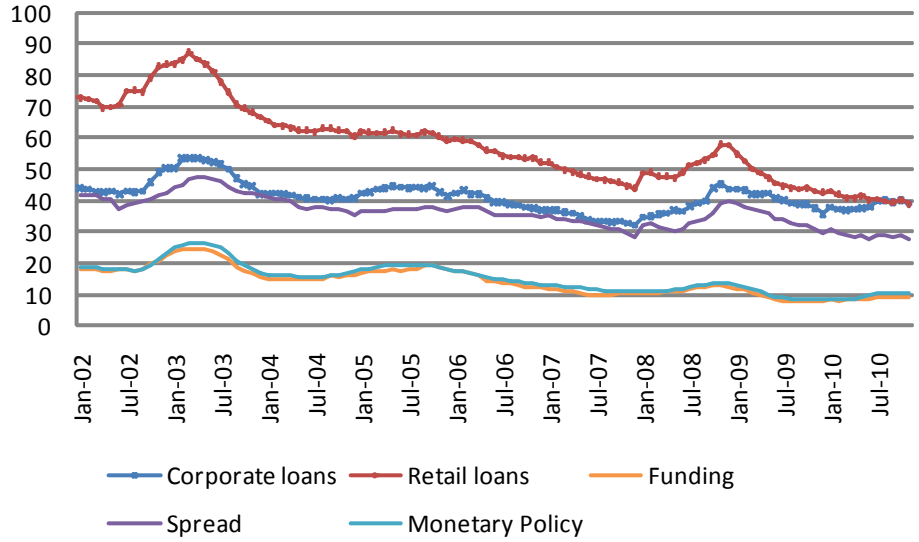
Following this introduction, Section 2 presents some facts regarding the evolution of interest rates in Brazil. Section 3 briefly reviews the literature on the determinants of bank interest rates. Section 4 presents the data and Section 5 discusses the estimated model and results. Section 6 concludes the text.

2 Some aspects concerning bank interest rates in Brazil

Before presenting the determinants of bank interest rates, it is important to describe its evolution and some institutional characteristics that may influence bank pricing policies in Brazil. Over the past decade, following a reduction in the monetary policy rate, there has been a fall in the average bank rates as well as in interest spreads, as can be seen in Figure 1.

During this period, many factors contributed to the reduction of bank interest rates, such as the decrease in the inflation rate, which diminished from 12.5% in 2002 to 5.9% in 2010. Besides, as presented by Banco Central do Brasil (2010), new borrowers with low risk profile joined the credit market, increasing the loan portfolio of banks without a significant change in the average indebtedness per customer; i.e., banks' loan book expanded without compromising borrowers' payment capacity. The presence of these new customers also reduced the share of high valued loans, decreasing credit risk concentration of the overall portfolio.

Figure 1 - Interest rates



Note: The figure plots the evolution of pre-fixed rates of credit operations with nonearmarked funds and time deposits, and the monetary policy interest rate. All of them are in annual terms, % p.a., with the exception of the average spread, which is in percentage points.

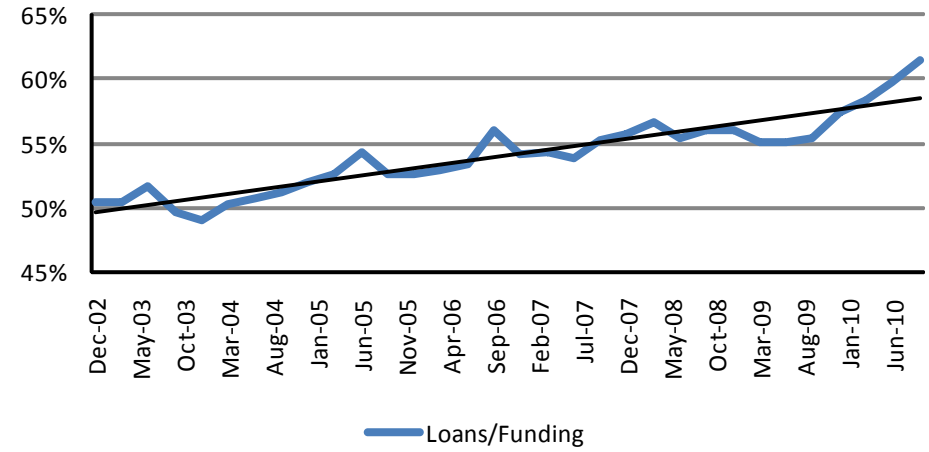
Moreover, the Central Bank implemented a new credit information system (called SCR), decreasing information asymmetries regarding borrowers, and new credit types were created, such as payroll-backed loans[4], which reduced the risk profile of banks' credit portfolio, as they have lower delinquency rates, decreasing institutions' losses. All these factors, accompanied by some others, helped to reduce bank interest rates as well as spreads.

As regards to credit volume, the reduction in the base rate produced a decrease in the return of many liquid assets. As a consequence, financial institutions gradually transferred their investments from these assets to credit operations so as to maintain their profitability. This transfer strongly expanded the volume of credit in the financial system. From 2001 to 2009, its value increased from 26.8% to 45% of the gross domestic product (GDP). In the same period, credit operations with nonearmarked funds rose from 15.5% to 30.4% of GDP. Along this process, the credit portfolio of banks grew at higher rates than the funding expansion, but not sufficiently to put a pressure, due to limited funding, on loan and funding rates, as can be seen in Figure 2. In

[4] Payroll-backed loans are personal loans with principal and interests payments automatically deducted from the borrowers' payroll check. The borrowers can be salaried workers or retirees and, in practice, the automatic deduction turns future income into collateral. In January 2004, payroll-backed loans represented 34.3% of personal loans with pre-fixed interest rates. In December 2010, its proportion increased to 68.8%.

addition, the use of foreign funding or securitization is still low in Brazil. In June 2010, only 6.1% of the financial system's liabilities had a foreign counterparty or were connected to currencies from other countries.

Figure 2 - Credit growth sustainability



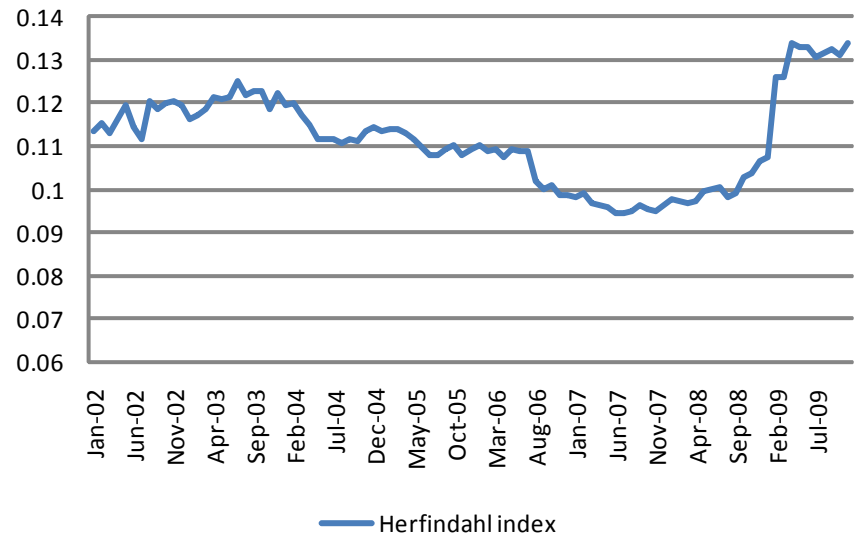
The high liquidity of Brazilian banks and their good capitalization are two other factors that have allowed the expansion of the credit portfolio without pressuring interest rates. In December 2009, the ratio of liquid assets to total assets was 50%, compared to 30% in countries such as France, Sweden and Belgium, or to ratios lower than 15% in countries such as Portugal and United States. Besides this, unlike other countries, the securities portfolio of Brazilian banks consists mainly of public bonds, which are accepted by the Brazilian Central Bank in its interbank market operations and have an organized and liquid secondary market.

The good capitalization of the financial system is due to an expansion in the capital basis that occurred in the last decade, through the issue of new capital and profit retention. As a consequence, the capital ratios of Brazilian banks have been kept at comfortable levels, exceeding standard requirements. In December 2009, the Basel ratio for the banking system was 18.6%, well above the 11% level required by Brazilian regulations.

To conclude this section, the evolution of bank concentration is presented in Figure 3. It can be seen that between 2002 and 2003 there was an increase in concentration. This period was characterized by some acquisitions and reduction in the

number of institutions, in which banks sought new sources of revenue and demanded scale, to face the prospect of reduced earnings resulting from the downward trend in interest rates. After that, despite several acquisitions and financial system consolidation, changes in the dispersion of market shares in the financial system and the entry of new competitors decreased the market concentration. More recently, following the financial crises of 2008, there were some important bank acquisitions. Nevertheless, the characteristics of the recent deals seem to have mitigated possible anticompetitive effects (Banco Central do Brasil, 2010).

Figure 3 - Evolution of bank concentration in Brazil



3 A brief review of the literature

Few studies have examined the interest rate pass-through in Brazil. The first of them is that by Alencar (2003), who found that the monetary policy rate changes lead to a less than one-for-one change of corporate loan rates in the short run, and to a complete pass-through to funding and retail loan rates. Besides this, he found differences in the pass-through across different bank lending rates. More recently, Castro and De Mello (2010) studied the asymmetry of the response of retail lending rates to monetary policy shocks and found evidence for asymmetric adjustment.

On the other hand, the international literature on the subject is extensive and many different approaches have been applied. Among the earlier papers, Hannan and

Berger (1991) studied the case of deposit interest rates and Kourelis and Cottarelli (1994) examined loan interest rates in an international context. Following these preliminary articles, to mention some papers, Sander and Kleimeier (2002) and De Bondt (2002) analyzed the asymmetric adjustment of retail bank interest rates to monetary impulses, using European data; Kleimeier and Sander (2006) investigated the pass-through by differentiating between expected and unexpected monetary policy shocks; and De Graeve et al. (2007) and Gambacorta (2008) tested the existence of bank heterogeneity in the pass-through. The international literature usually finds that changes in bank interest rates are sluggish in the short run, but there is no consensus on a possible one-for-one pass-through in the long run. The papers that allow for asymmetric response on bank rates typically find evidence of asymmetries, while some papers find heterogeneity in the response of banks to monetary policy shocks. The literature usually compares bank rates with market rates of equal maturity to distinguish the pass-through of marginal costs from term structure effects of base rates, but there are some studies that compare bank rates with the monetary policy rate, such as the one by Kleimeier and Sander (2006).

In addition to studies about the pass-through, in the last decade there has also been an effort to understand the determinants of interest rate spreads in Brazil. Among these studies, we can cite Afanasieff et al. (2002), Bignotto and Rodrigues (2006) and Oureiro et al. (2006), all of whom found that macroeconomic variables such as the inflation rate, risk premium and economic activity are relevant factors to explain the behavior of interest spreads. Moreover, microeconomic factors such as the default risk, interest-rate risk, administrative costs, liquidity level and banking service revenues have also been found to produce significant impacts on the spread. More recently, the Brazilian Central Bank developed an accounting decomposition of interest spreads (Koyama et al., 2008), which decomposes the banking spread among operational costs, loan default costs, reserve requirements, taxes, cross subsidies in credit lines and the cost of deposit insurance.

One of the major contributions of the present paper is to find robust results concerning the impact of market concentration on bank loan interest rates. Some studies have attempted to examine the degree of competition in the Brazilian financial system and its influence on interest rates. Belaisch (2003), for example, concluded that the

Brazilian banking sector neither behaves as a cartel nor as perfectly competitive. On the other hand, Nakane et al. (2006) found that even the Bertrand competition overestimated the observed degree of market power for both loans and time deposits in Brazil. Our results add some evidence corroborating the market power hypothesis. Since more on the international literature will be presented while discussing the results, we now describe the data.

4 Data

The scope of this paper is the Brazilian banking sector. The data comprises monthly interest rates from 63 banks during the period from January 2002 to November 2009. These financial institutions account for more than 80% of the total assets of the Brazilian banking market. The interest rates apply to new operations, and interest rates on loans are pre-fixed rates of operations with nonearmarked funds. The panel of banks is a balanced panel[5]. Interest rates on time deposits, total corporate loans, total retail loans and interest spreads[6] are analyzed, and also of the following five loan products: vendor, working capital, personal loans, purchase of vehicles and purchase of other goods. A brief description of the last five loan categories can be found in the Appendix.

The control variables are divided into macroeconomic, market structure and bank-related variables (microeconomic characteristics). There are five macroeconomic variables: the monetary policy rate and its volatility, the inflation rate, real income and a control for international shocks. As a proxy for real income, we use the real average income of employed people (registered on the books as opposed to workers in the informal economy), which is measured by the Brazilian Institute of Geography and Statistics (IBGE). In addition, to check the robustness of some results, we use the Index of Economic Activity of the Central Bank of Brazil (IBC-Br) as another proxy for real income. The inflation rate is the Broad National Consumer Price Index (IPCA), which is the price index related to inflation targeting in the country, and we use the JP Morgan Emerging Markets Bond Index for Brazil (EMBI Brazil) to control for the international risk perception of the country, which can affect debt and funding instruments. The

[5] The choice of a balanced panel can generate a selection bias in the estimates, but has the advantage of presenting the behavior of banks that have had at least one retail or corporate business line throughout the whole period of the study.
[6] Interest spread is equal to the difference between the interest rates of total loans and time deposits.

monetary policy rate is the rate of the Special System of Clearance and Custody (Selic). A description of the calculation of its volatility can be found in the Appendix. We did not seasonally adjust the data.

Regarding the bank-related controls, they consist of balance sheet data. The size indicator is the logarithm of total assets of each bank, liquidity is measured by cash deposits and securities over total assets, and the capitalization index is the excess capital over total assets, that is, the amount of capital that banks hold in excess of the minimum required to deal with prudential regulation standards. The advantage of this last measure is that it takes into account the risk of the bank's portfolio (Gambacorta and Mistrulli, 2004). There are also two measures of inefficiency. The first one is the ratio of the total cost that the bank incurs to collect deposits over the total volume of these deposits (funding efficiency), which is used in the loan regressions. The second is employed in the time-deposit and interest spread regressions and is represented by the ratio of total loans and deposits to the number of branches (management efficiency). Besides these, we also use as a control the aggregate loan default rate (the percentage of the credit portfolio in arrears by more than 15 days), and we control for the proportion of payroll-backed loans in retail loans, which may influence overall retail rates.

The market structure is controlled by the Herfindahl index, bank concentration in relation to assets, and we use as a robustness check the ratio between the assets of the three largest banks divided by the total assets in our banking sample. These are popular measures of concentration in the banking literature (Alegria and Schaeck, 2008).

Recent studies on the determination of interest rates have usually been based on a specification of error correction, or variants of this technique (e.g., Kleimeier and Sander, 2006; De Graeve et al., 2007; Gambacorta, 2008). In this work we follow another approach, since unit root tests for the different variables examined suggest that the variables are stationary, except for the management inefficiency variable. These tests are presented in Table 1, which also shows some descriptive statistics of the variables used in the econometric estimations.

Table 1 - Summary statistics and unit root tests

	Observations	Mean	Std. dev.	Minimum	Maximum	ADF
Bank related variables						
Interest rates:						
Spread	4,292	43.869	30.388	1.778	843.956	271.892***
Total corporate loans	4,750	43.921	21.439	11.133	857.500	229.237***
Total retail loans	4,845	90.642	66.532	12.451	546.454	179.308***
Time deposits	4,294	15.924	4.422	6.047	39.980	120.378*
Vendor	1,238	28.843	11.511	10.498	87.208	252.805***
Working capital	2,690	37.559	11.722	6.200	109.330	1,148.040***
Personal loans	2,820	68.827	58.403	16.666	403.286	1,165.920***
Purchase of vehicles	1,517	41.178	15.459	12.370	119.630	498.232***
Purchase of other goods	1,563	53.907	31.334	6.462	186.121	473.219***
Capitalization	5,985	17.155	61.017	-6.060	1,248.480	287.722***
Funding inefficiency	5,985	0.052	0.054	0.0001	1.328	577.517***
Management inefficiency	5,985	771.406	1,709.630	1.943	22,704.453	85.637
Size	5,985	9.246	0.923	7.217	11.702	151.301*
Liquidity	5,926	0.335	0.605	0.0001	25.552	221.508***
Payroll loans portfolio growth rate	70	0.015	0.014	-0.030	0.050	-6.315***
Aggegate default rate	95	8.418	0.746	6.910	9.970	-2.992**
Aggregate corporate loan default rate	95	4.184	0.773	2.850	6.280	-3.929***
Aggregate retail loan default rate	95	14.116	0.929	11.830	15.890	-3.889***
Macroeconomic variables						
Monetary policy interest rate	95	16.017	4.420	8.650	26.320	-4.943***
Inflation rate	95	6.762	6.217	-2.491	42.908	-4.164***
Income growth rate	95	107.900	367.833	-98.423	2189.087	-4.532***
Economic activity growth rate	82	29.340	123.619	-53.271	627.423	-4.792***
Monetary policy rate volatility	95	0.006	0.007	0.000	0.032	-4.685***
Embi Brazil growth rate	95	-0.652	13.529	-18.044	69.911	-6.480***
Market structure						
Herfindahl index	95	0.141	0.010	0.124	0.161	-5.256***
3-bank concentration ratio	95	0.573	0.040	0.514	0.639	-4.557**

Note: The panel unit root test applied here is the one proposed by Maddala e Wu (1999); the standard Augmented Dickey-Fuller (ADF) test is used for aggregate variables, except for the market structure variables that used the one proposed by Banerjee et al. (1992), which tests the unit-root/no-break null against the stationarity/mean-shift alternative. *, **, *** indicate significance at the 10, 5 and 1% levels, respectively.

5 Results

A change in the monetary policy rate is related to changes in bank rates because an increase in the base rate is followed by a reduction in funds available for lending, raising bank rates through the known interest rate channel. Having this in mind, the

starting point of our analysis is the estimation of the pass-through interest rate of five loan products. To achieve this objective, we estimate regressions of the following form:

$$i_{k,t} = \mu_k + \sum_j \alpha_j i_{k,t-j} + \sum_l \beta_l i_{t-l}^M + \Gamma \Phi_t + \varepsilon_{k,t} \qquad (1)$$

where k = 1 …, N (k = banks) and t = 1,…, T (t = periods). $i_{k,t}$ is the bank interest rate, i_t^M is the monetary policy rate, Φ_t is a vector that includes seasonal dummies and a dummy that captures the effect of the crisis of September 2008[7], and $\varepsilon_{k,t}$ is the random error. Eleven lags of each variable were included in the unrestricted model, and non-significant terms were then excluded. The model allows for fixed effects across banks, as indicated by the intercept μ_k [8]. The long-term pass-through is calculated by:

$$\Pi = \frac{\sum \beta_l}{1 - \sum \alpha_j} \qquad (2)$$

where β_0 represents the immediate pass-through.

The model was estimated using the difference GMM estimator suggested by Arellano and Bond (1991). In the choice of lags, we kept those that were significant to at least 10%, and the seasonal dummies were retained even if not significant up to this value. In the choice of the instruments, the dummies and the variables lagged two or more periods were treated as exogenous. The second lag of the remaining variables was used to instrument these remaining regressors. In the estimations, we found no evidence of serial correlation, and the Hansen test did not reject the validity of the instruments.

Table 2 presents the main results by loan product. The complete estimation can be found in Table A1 of the Appendix.[9] Our estimates for the short- and long-term pass-through are positive and significant at the usual levels. The hypothesis of the long-run

[7] This crisis variable is a step dummy that takes the unit value from September 2008 on, and zero in previous periods.
[8] We chose to use a model with fixed rather than random effects because that is the usual treatment in the literature (e.g., see De Graeve et al., 2007 and Gambacorta, 2008).
[9] To save space, the coefficients on seasonal dummies are not reported in the estimations presented in the Appendix.

coefficient being equal to one cannot be rejected. Therefore, banks fully adjust the interest rate to a change in the monetary policy rate. On the other hand, we observed a rigid short-term response for the loan categories of working capital, personal loans and purchase of goods other than vehicles. Having this in mind, a possible explanation for a higher immediate pass-through in the vendor category can be found in the average maturity of these loans. Within our sample period, the average maturity of the vendor category is 72 days, while for the other examined loan products it is over 175 days. Since the monetary policy rate (Selic) is rather short-term, it should have a greater effect on credit lines with shorter average maturity. In the international literature on estimations by loan categories, De Graeve et al. (2007) found values for the immediate pass-through between 0.194 and 0.982 for Belgium, and Kleimeier and Sander (2006) found between -0.15 and 0.82 for several European countries.

Table 2 - Interest rate transmission by loan product categories

Dependent variable: Loan interest rate	Corporate loans			Retail loans	
	Vendor	Working Capital	Personal loans	Purchase of vehicles	Purchase of other goods
Immediate pass-through	1.110***	0.683***	0.385***	0.689***	0.549***
	(0.217)	(0.108)	(0.093)	(0.190)	(0.135)
Long run pass-through	1.202***	1.029***	2.484**	1.441***	1.424**
	(0.180)	(0.104)	(1.201)	(0.217)	(0.550)
Tests					
Wald test for unitary immediate pass-through	0.26	8.52***	42.88***	2.66	11.09***
	[0.619]	[0.006]	[0.000]	[0.115]	[0.003]
Wald test for unitary long run pass-through	1.26	0.08	1.53	4.12*	0.59
	[0.278]	[0.778]	[0.224]	[0.053]	[0.450]
Serial correlation problems in the errors	No	No	No	No	No
Hansen test	2.79	21.85	20.82	4.76	0.57
No. of banks / observations	15 / 1,121	32 / 2,504	35 / 2,673	24 / 1,307	20 / 1,408

Note: The complete estimation results are presented in the Appendix. Heteroskedasticity-robust standard errors are in parentheses, and the brackets contain p-values. ***, **, * indicate significance at the 1, 5 and 10% levels, respectively.

A second set of results is summarized in Tables 3 and 4, and the complete estimation can be found in the Appendix (Tables A2 and A3, respectively). Now we examine the effects of different explanatory variables on bank interest rates. As there

are large differences in the evolution of corporate and retail rates, it seems important to identify the contributory factors to this phenomenon. Therefore, the regressions that follow consider as the dependent variable interest rates of total corporate and retail loans, and also of time deposits, and the interest spread. Here we modify Model (1) slightly to:

$$i_{k,t} = \mu_k + \sum_j \alpha_j i_{k,t-j} + \sum_n \sum_l \kappa_{n,l} Y_{n,t-l} + \Gamma \Phi_t + \varepsilon_{k,t} \qquad (3)$$

where *Y* is a vector of control variables, including the monetary policy rate, and now Φ_t includes only seasonal dummies[10]. Now six lags of the explanatory variable are included in the unrestricted model, and non-significant terms are excluded. The long-run, or total, effect of the explanatory variables on the different bank interest rates is given by:

$$\Pi_n = \frac{\sum_l \kappa_{n,l}}{1 - \sum_j \alpha_j} \qquad (4)$$

which is presented in Tables 3 and 4. The first part of each of these tables presents the effects of macroeconomic variables; the second part shows the influence of bank-related variables; the third part exhibits the effects of the market structure; the fourth part presents the immediate monetary policy effect on bank interest rates; and the last part presents Wald tests for unitary pass-through and two specification tests. Besides these, our benchmark equation uses the Herfindhal index, the real average income of employed people (from IBGE) and monthly data from January 2002 to November 2009. On the other hand, our robustness checks use as an alternative market concentration the three-bank concentration index, as an alternative income proxy the Index of Economic Activity of the Central Bank of Brazil (IBC-Br), and as an alternative sample period data from January 2003 to November 2009. Table 3 also presents an estimation

[10] The dummy for the September 2008 crises is not included because *Y* contains an index that takes into account international shocks (EMBI Brazil).

including the proportion of payroll-backed loans in retail loans, as a control variable[11], to assess its importance to explain the behavior of retail interest rates.

None of the estimations presented show any sign of miss-specification. As expected, monetary policy interest rate influences loan and time deposits rates significantly, both in the long and short term (the immediate pass-through). The Wald tests show that we cannot reject that banks fully adjust the short-term lending rate to a change in the base rate, but this hypothesis is rejected for time deposits. The pass-through is complete in the long run for corporate loans (the null hypothesis of a unitary coefficient is not rejected), and the robustness results do not allow us to conclude if it is greater than or equal to one in the case of retail loans (a similar result for Canada was found by Moazzami, 1999). On the other hand, there is some evidence in favor of time deposit interest rate stickiness, even in the long run. This stickiness may be related to a lack of competition in the bank funding market. As regards the interest spread, we found evidence that the monetary policy rate has an immediate impact on it, but it seems that this effect vanishes in the long run. To contrast our results with some international evidence, we can mention Berstein and Fuentes (2004), who found pass-through values between 0.70 and 0.88 for the Chilean loan market, and Gambacorta (2008), who obtained a short-term value around 0.45, both for loan and time deposits, in Italy. Like our results, Gambacorta detected that the long-run effect of changes in the policy rate was less than one for time deposits, but complete for loans.

Regarding the volatility of monetary policy, our results show that it is positively (negatively) correlated with the loan (time deposit) rate. This can be explained by a context where banks, in order to maximize their expected utility (wealth), are risk averse to fluctuations in interest rates. Since most of the credit (from nonearmarked funds) from banks is contracted at a pre-fixed rate in Brazil, this risk may be relevant, as shown by our results. In such a case, the models of Ho and Saunders (1981) and

[11] This variable is equal to the proportion of payroll backed loans in retail loans from February 2004 on, and zero in previous periods due to data availability constraints. This constraint does not seem to be relevant, because the volume of payroll loans was low before January 2004, when a change in the law (Law 10.820/03, December 2003) allowed such loans to be made to salaried workers in the private sector and retirees instead of just government personnel.

Maudos and Guevara (2004) indicate there is a positive correlation between interest rate volatility and the spread.[12]

In principle, as stated by Gambacorta (2008), better economic conditions increase the expected net value of investment projects, increasing the demand for loans and also bank demand for funds. From this perspective, the interest rates on loans and time deposits would depend positively on the level of economic activity.[13] On the other hand, an increase in national income boosts the funding sources of banks, diminishing deposit interest rates and so loan rates. Which of these effects will prevail depends on production opportunities, individual preferences, etc. Our results found robust evidence that income growth is associated with higher loan rates and spreads in Brazil, but they are inconclusive regarding funding rates. As expected, since we are working with nominal interest rates, the effect of inflation is positive and significant for both interest rates. The interest spread is also positively influenced by inflation. With respect to the international risk perception, which can affect debt and funding instruments (EMBI Brazil), Tables 3 and 4 present significant and robust results that a higher risk perception is associated with higher interest rates and spreads.

Kashyap and Stein (2000) and Kishan and Opiela (2000) found evidence that small banks with low liquidity and low capitalization charge higher rates for loans and are more vulnerable to monetary shocks. This is because, given that the market considers them more risky, they pay a higher premium on their funding and consequently tend to have higher interest rates. By being more susceptible to asymmetric information regarding the value of their assets, these banks are less able to protect their credit relationships in the case of monetary shocks. Additionally, banks must maintain a certain level of capital in terms of their risk assets, implying that their ability to expand their lending depends on their capitalization.

[12] Curiously, even though the individual results on loan and time deposit rates strongly indicate such effect, the interest spread result is not robust. One possible explanation is that the loan and time deposit rates are calculated from the granting of new credit and funding operations, while the interest spread, following the Brazilian Central Bank's standards, is measured using loan rates on the total volume of credit, having greater inertia, as can be seen in the estimations in the Appendix. As a consequence, it tends to be less sensitive to changes in the explanatory variables.

[13] Besides this, Melitz and Pardue (1973) presented a theoretical argument to the effect that increases in income are associated with higher loan rates.

Table 4 shows that better capitalized banks have both lower interest spreads and time deposit rates. On the other hand, there is no evidence in Table 3 that capitalization influences bank pricing policies on the loan side. Liquid banks have lower interest rates on corporate loans, and there is some evidence that they also present lower spreads. This last result is interesting because since reserve requirements are high in Brazil in comparison to other countries, if a change in these requirements affects liquidity (see Gray, 2011), it will also affect corporate rates and the spread. An additional result presented in Table 3 is that smaller banks also are shown to have lower interest rates on corporate credit.

Another determinant of banks' behavior in setting interest rates is the degree of competition in the credit market. This may be a relevant factor in the Brazilian case, since Chang et al. (2008) presented evidence that around 10% of banks in the Brazilian financial system made nearly all the bank loans. Nonetheless, Berger and Hannan (1989) discerned two possible impacts of banking concentration on bank pricing. On the one hand, a more concentrated banking sector tends to operate in an oligopolistic manner, charging higher interest rates. On the other, the higher concentration may be related to the fact that the most efficient banks have increased their market share, leading to lower loan rates. Our findings indicate that market concentration has a significant and robust positive effect on loan rates and interest spreads. This result corroborates the market power hypothesis of Berger (1995), by which banks with large market share are associated with higher loan rates and interest spreads.

The degree of banks' operational inefficiency and the default rate of their credit portfolio represent a cost to the bank, so it is also expected that these variables influence banks' pricing decisions. In our estimations, more efficient banks have lower corporate loan rates and higher time deposit rates. In addition, higher delinquency ratios are associated with higher loan rates and interest spreads.

Table 3 - The determinants of bank loan interest rates (long run coefficients)

Dependent variable: Bank interest rate	Corporate loans			Retail loans			
	Benchmark model	Alternative concentration index	Alternative income proxy, concentration index and sample period	Benchmark model	Benchmark model, including payroll-backed loan variable	Alternative concentration index	Alternative income proxy, concentration index and sample period
(1) Macroeconomic variables							
Monetary policy rate	0.803***	0.798***	0.846***	1.928***	1.704***	1.900***	0.995*
	(0.183)	(0.164)	(0.168)	(0.426)	(0.457)	(0.388)	(0.593)
Interest rate volatility	126.707***	135.110***	174.208***	179.044***	162.061***	249.151***	88.683
	(31.457)	(27.877)	(54.763)	(48.114)	(43.237)	(64.473)	(64.798)
Inflation	0.263***	0.297***	0.565***	0.342**	0.292**	0.432***	1.639**
	(0.066)	(0.069)	(0.175)	(0.159)	(0.137)	(0.153)	(0.786)
Income growth	0.001***	0.001***	0.004**	0.006***	0.005***	0.005***	0.051***
	(0.0004)	(0.0004)	(0.001)	(0.001)	(0.001)	(0.001)	(0.012)
EMBI Brazil growth rate	0.111***	0.117***	0.124***	0.236***	0.194***	0.172**	0.117***
	(0.029)	(0.028)	(0.041)	(0.079)	(0.068)	(0.066)	(0.038)
(2) Bank related variables							
Default rate	2.805***	3.419***	3.016***	8.212***	5.475***	9.931***	13.548***
	(0.899)	(1.066)	(1.250)	(2.724)	(1.910)	(2.985)	(4.065)
Size	9.493*	10.089*	17.620**	-2.223	-4.604	-2.152	5.524
	(4.823)	(5.766)	(7.758)	(19.024)	(19.138)	(19.257)	(21.855)
Liquidity	-1.727*	-2.086**	-2.407**	0.533	0.401	0.275	-3.809*
	(0.920)	(0.953)	(0.993)	(0.947)	(0.898)	(1.003)	(2.192)
Funding inefficiency	16.829**	20.107**	17.516*	6.548	4.492	11.871	39.790
	(7.141)	(7.915)	(9.938)	(12.318)	(11.477)	(13.536)	(24.766)
Capitalization	-0.003	-0.005	-0.003	-0.172	-0.176	-0.171	-0.177
	(0.003)	(0.004)	(0.004)	(0.126)	(0.126)	(0.124)	(0.136)
Payroll-backed loan portfolio growth rate					-147.965***		
					(71.533)		
(3) Market structure							
Market concentration	147.862**	40.078***	59.824***	501.878***	611.222***	97.247**	128.716**
	(62.148)	(11.773)	(15.635)	(188.799)	(187.092)	(42.490)	(49.496)

Table 3 - *(continued)*

Dependent variable: Bank interest rate	Corporate loans			Retail loans			
	Benchmark model	Alternative concentration index	Alternative income proxy, concentration index and sample period	Benchmark model	Benchmark model, including payroll-backed loan variable	Alternative concentration index	Alternative income proxy, concentration index and sample period
(4) *Immediate* monetary policy rate coefficient	0.949***	0.942***	1.014***	1.159***	1.037***	1.121***	0.609*
	(0.259)	(0.234)	(0.234)	(0.246)	(0.268)	(0.250)	(0.365)
(5) Tests							
Wald test for unitary immediate pass-through	0.04	0.06	0.00	0.42	0.02	0.23	1.14
	[0.845]	[0.808]	[0.951]	[0.521]	[0.888]	[0.631]	[0.290]
Wald test for unitary long run pass-through	1.14	1.50	0.83	4.74**	2.38	5.39**	0.00
	[0.291]	[0.226]	[0.366]	[0.034]	[0.129]	[0.024]	[0.994]
Hansen test	32.13	32.39	40.28	34.98	36.01	34.50	36.93
Serial correlation problems in the errors	No	No	No	No	No	No	No
No. of banks / observations	50 / 4,662	50 / 4,662	50 / 3,769	51 / 4,758	51 / 4,758	51 / 4,758	52 / 3,847

Note: This table shows the long-run, or total, effect of the explanatory variables on bank interest rates (Eq. (4)), which was estimated based on Eq. (3) . The complete estimation results are presented in the Appendix. The benchmark results use the Herfindhal index, the real average income of employed people and monthly data from January 2002 to November 2009. The alternative market concentration index is the three-bank concentration, the alternative income proxy is the Index of Economic Activity of the Central Bank of Brazil (IBC-Br), and the alternative sample period ranges from January 2003 to November 2009. Heteroskedasticity-robust standard errors are in parentheses, and the brackets contain the p-values. ***, **, * indicate significance at the 1,5 and 10% levels, respectively.

Table 4 - The determinants of bank funding interest rates and interest spread (long run coefficients)

Dependent variable: Bank interest rate	Time Deposits			Interest spread		
	Benchmark model	Alternative concentration index	Alternative income proxy, concentration index and sample	Benchmark model	Alternative concentration index	Alternative income proxy, concentration index and sample period
(1) Macroeconomic variables						
Monetary policy rate	0.950***	0.954***	0.991***	0.242	0.291	0.520***
	(0.014)	(0.012)	(0.009)	(0.202)	(0.185)	(0.145)
Interest rate volatility	-4.848**	-6.421***	-9.373***	31.347	43.189	130.824**
	(2.066)	(1.919)	(2.487)	(47.041)	(49.340)	(56.553)
Inflation	0.036***	0.033***	0.016***	0.763***	0.808***	0.721**
	(0.006)	(0.006)	(0.003)	(0.269)	(0.274)	(0.285)
Income growth	-0.0001	-0.00009	0.001***	0.005***	0.005***	0.049***
	(0.00006)	(0.00006)	(0.0005)	(0.001)	(0.001)	(0.016)
EMBI Brazil growth rate	0.008***	0.008***	-0.001	0.206***	0.210***	0.191***
	(0.001)	(0.001)	(0.0008)	(0.046)	(0.046)	(0.056)
(2) Bank related variables						
Loans default rate				1.638***	2.509***	3.537***
				(0.583)	(0.715)	(0.864)
Size	0.183	0.265	1.154***	-6.014	-4.993	4.008
	(0.314)	(0.301)	(0.381)	(5.982)	(6.005)	(7.190)
Liquidity	-0.080	-0.073	0.030	-27.045*	-27.633*	-26.499
	(0.087)	(0.088)	(0.065)	(14.170)	(13.922)	(16.695)
Management inefficiency	-0.0002**	-0.0002***	-0.0001**	0.001	0.001	0.001
	(0.00008)	(0.00008)	(0.00009)	(0.001)	(0.001)	(0.002)
Capitalization	-0.002***	-0.002***	-0.002***	-0.026**	-0.027**	-0.026**
	(0.0004)	(0.0004)	(0.0002)	(0.011)	(0.011)	(0.011)
(3) Market structure						
Market concentration	-8.683*	-1.802	-0.527	284.161***	74.733***	101.131***
	(4.500)	(1.238)	(0.974)	(95.891)	(27.738)	(29.792)

Table 4 - *(continued)*

Dependent variable: Bank interest rate	Time Deposits			Interest spread		
	Benchmark model	Alternative concentration index	Alternative income proxy, concentration index and sample	Benchmark model	Alternative concentration index	Alternative income proxy, concentration index and sample period
(4) *Immediate* monetary policy rate coefficient	0.808***	0.814***	0.903***	0.571*	0.705**	0.164***
	(0.033)	(0.032)	(0.040)	(0.305)	(0.311)	(0.051)
(5) Tests						
Wald test for unitary immediate pass-through	31.80***	31.62***	5.64**			
	[0.000]	[0.000]	[0.021]			
Wald test for unitary long run pass-through	12.35***	12.85***	0.920			
	[0.001]	[0.001]	[0.342]			
Hansen test	24.08	21.69	30.29	33.04	30.01	30.76
Serial correlation problems in the errors	No	No	No	No	No	No
No. of banks / observations	47 / 4,158	47 / 4,158	47 / 3,396	47 / 4,204	47 / 4,204	47 / 3,442

Note: See Table 3 note.

As shown in Figure 1, the decline of retail loan rates in Brazil has been much more pronounced than observed in the corporate segment. Some of the possible explanations for this behavior can be the increase in the proportion of payroll-backed loans in retail loans, and the greater effect of the monetary policy rate on retail rates, as can be seen in the point estimates of Table 3. Additionally, our results show that corporate rates are much more sensitive to bank related variables than retail rates. One possible explanation is that since in corporate banking there are more alternative credit providers and entry barriers on lending are lower, there is greater competition in corporate business lines (World Bank, 2007). So competition may be driving the importance of bank related variables as determinants of corporate rates. But this is a conjecture.

6 Concluding remarks

Knowing the behavior of bank interest rates is relevant to conducting monetary policy and also to designing public policies. With this in mind, this article sought to examine how banks set their interest rates. In the estimations presented, we found a complete transmission of the monetary policy rate to loan rates in the long term, demonstrating the effectiveness of this policy. On the other hand, in the estimations for time deposit and short-run loan rates, the results indicated some degree of rigidity, especially for loan products with higher average maturity.

Among the many results, we found a significant and robust impact of international risk perception, as proxied by the EMBI Brazil, on interest rates and spreads. Market concentration was also found to have a significant and robust positive effect on loan rates and interest spreads. This last result corroborates the market power hypothesis of Berger (1995), according to which banks with large market share charge higher loan rates and interest spreads.

This study also confirmed the importance of examining different markets in the Brazilian banking sector, since pricing policies can vary substantially depending on the market. One key finding of the paper is that corporate business rates seem to be more sensitive to bank related variables, such as liquidity and efficiency, than retail rates.

Also, the increasing importance of payroll-backed loans seems to be influencing the behavior of the overall retail loan rate.

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Appendix

A.1 Description of some variables

Working capital is a line of credit with a maturity greater than thirty days, intended to finance the operational activities of enterprises. It requires collateral.

Vendor is a line of credit that allows a company to receive cash immediately and sell to customers on time payments.

Purchase of vehicles covers purchase of cars, trucks and motorcycles by individuals.

Purchase of other goods is a line of credit for the purchase of goods other than vehicles, and requires collateral, usually the good itself.

Personal loan is a line of credit to individuals in which the credit is not tied to the purchase of a specific good or service.

The **volatility of interest rates** was estimated from daily data. It was calculated as follows:

$$\alpha_k = ln(i_{dt} / i_{d-1t})$$

$$\mu_t = \sum_{k=1}^{n} \frac{\alpha_k}{n}$$

where "i_d" represents the base rate on day *d* of period *t*, "i_{d-1}" is the same rate on day *d*-1, and *n* is the number of observations. The volatility of the monetary policy rate in period *t* was calculated as:

$$Monetary\ policy\ rate\ volatility_{\ t} = \sqrt{\sum_{k=1}^{n} \frac{(\alpha_k - \mu_t)^2}{n}}$$

A.2 Estimations

Further information from Tables 2, 3 and 4 of the text is presented here in Tables A1, A2 and A3.

Table A1 - Interest rate transmission estimations by loan product category

	Corporate loans		Retail loans		
	Vendor	Working Capital	Personal loans	Purchase of vehicles	Purchase of other goods
Lending rate (t-1)	0.227*	0.266***	0.693***	0.690***	0.753***
	(0.112)	(0.049)	(0.124)	(0.118)	(0.045)
Lending rate (t-2)		0.144**	0.176**		-0.100**
		(0.053)	(0.086)		(0.041)
Lending rate (t-3)				0.116**	
				(0.046)	
Lending rate (t-4)			-0.081**		
			(0.038)		
Lending rate (t-5)	-0.151***				
	(0.038)				
Lending rate (t-6)				-0.152***	0.081*
				(0.048)	(0.046)
Lending rate (t-7)		-0.075**	0.056*		
		(0.037)	(0.030)		
Lending rate (t-10)					-0.034**
					(0.016)
Lending rate (t-11)					-0.090***
					(0.020)
Monetary policy rate (t)	1.110***	0.683***	0.385***	0.689***	0.549***
	(0.217)	(0.108)	(0.093)	(0.190)	(0.135)
Monetary policy rate (t-4)				-1.433***	
				(0.280)	
Monetary policy rate (t-5)				1.243***	
				(0.252)	
Monetary policy rate (t-7)					-1.218***
					(0.290)
Monetary policy rate (t-8)					1.225***
					(0.380)
September 2008 effect (t)	4.074***	3.423***	0.053	0.455	0.552
	(1.081)	(1.023)	(0.556)	(0.780)	(1.576)
Hansen test	2.79	21.85	20.82	4.76	0.57
Arellano-Bond test for autocorrelation:					
AR(2)	[0.404]	[0.540]	[0.698]	[0.635]	[0.864]
AR(3)	[0.820]	[0.921]	[0.641]	[0.998]	[0.198]
AR(4)	[0.958]	[0.397]	[0.208]	[0.817]	[0.678]
AR(5)	[0.694]	[0.357]	[0.772]	[0.748]	[0.621]
AR(6)	[0.173]	[0.877]	[0.263]	[0.684]	[0.580]
AR(7)		[0.475]	[0.204]	[0.554]	[0.838]
AR(8)		[0.849]	[0.728]		[0.435]
AR(9)					[0.397]
AR(10)					[0.496]
AR(11)					[0.496]
AR(12)					[0.143]
No. of banks / observations	15 / 1,121	32 / 2,504	35 / 2,673	24 / 1,307	20 / 1,408

Note: The models have been estimated using the GMM estimator suggested by Arellano and Bond (1991). Heteroskedasticity-robust standard errors are in parentheses, and the brackets contain the p-values. ***, **, * indicate significance at the 1,5 and 10% levels, respectively. To save space, the coefficients on seasonal dummies were not reported.

Table A2 - Estimation results of the determinants of bank loan interest rates

Dependent variable: Bank interest rate	Corporate loans			Retail loans			
	Benchmark model	Alternative concentration index	Alternative income proxy, concentration index and sample period	Benchmark model	Benchmark model, including payroll-backed loan variable	Alternative concentration index	Alternative income proxy, concentration index and sample period
Macroeconomic variables							
Monetary policy rate (t)	0.949***	0.942***	1.014***	1.159***	1.037***	1.121***	0.609*
	(0.259)	(0.234)	(0.234)	(0.246)	(0.268)	(0.250)	(0.365)
Interest rate volatility (t)	149.583***	159.569***	208.839***				
	(43.448)	(38.873)	(73.460)				
Interest rate volatility (t-3)				107.662***	98.666***	146.963***	
				(34.801)	(32.369)	(54.486)	
Interest rate volatility (t-4)							54.286
							(44.783)
Inflation (t)				0.206**	0.177**	0.255***	0.074
				(0.093)	(0.082)	(0.092)	(0.157)
Inflation (t-1)							0.213*
							(0.112)
Inflation (t-2)	0.159**	0.169***	0.299***				0.324***
	(0.063)	(0.060)	(0.089)				(0.105)
Inflation (t-4)	0.151**	0.182***	0.378**				0.390***
	(0.066)	(0.066)	(0.166)				(0.142)
Income growth (t-1)							
Income growth (t-2)	0.001**	0.002***		0.004***	0.003***	0.003***	
	(0.0006)	(0.001)		(0.001)	(0.0006)	(0.001)	
Economic Activity Growth (t-1)							0.019***
							(0.005)
Economic Activity Growth (t-4)			0.005**				0.011***
			(0.002)				(0.003)
EMBI Brazil growth rate (t)				0.049**	0.027*	0.047**	
				(0.020)	(0.014)	(0.019)	
EMBI Brazil growth rate (t-1)	0.063***	0.063***	0.065***	0.042*	0.045*		
	(0.019)	(0.019)	(0.022)	(0.023)	(0.023)		
EMBI Brazil growth rate (t-2)	0.068***	0.075***	0.084**				
	(0.022)	(0.021)	(0.034)				
EMBI Brazil growth rate (t-3)				0.050***	0.045***	0.054***	0.072***
				(0.016)	(0.015)	(0.016)	(0.024)

Table A2 - ***(continued)***

Dependent variable: Bank interest rate	Corporate loans			Retail loans			
	Benchmark model	Alternative concentration index	Alternative income proxy, concentration index and sample period	Benchmark model	Benchmark model, including payroll-backed loan variable	Alternative concentration index	Alternative income proxy, concentration index and sample period
Bank related variables							
Lending rate (t-1)	-0.180***	-0.181***	-0.198***	0.398***	0.391***	0.410***	0.387***
	(0.065)	(0.067)	(0.057)	(0.114)	(0.112)	(0.109)	(0.130)
Corporate loans default rate (t)	3.311***	4.038***	3.616**				
	(1.004)	(1.127)	(1.381)				
Retail loans default rate (t-3)				4.938**	3.333**	5.858**	8.293**
				(2.042)	(1.531)	(2.339)	(3.595)
Size (t)	11.207*	11.915*	21.123**	-1.336	-2.803	-1.269	3.381
	(5.954)	(7.221)	(10.062)	(11.330)	(11.430)	(11.257)	(13.752)
Liquidity (t)				0.320	0.244	0.162	-2.332*
				(0.562)	(0.541)	(0.588)	(1.298)
Liquidity (t-4)	-2.039*	-2.464**	-2.886**				
	(1.101)	(1.142)	(1.257)				
Funding inefficiency (t)	19.867**	23.748**	20.999*	3.937	2.734	7.002	24.357
	(9.041)	(9.972)	(12.475)	(7.731)	(7.225)	(8.470)	(16.117)
Capitalization (t)	-0.004	-0.006	-0.004	-0.103	-0.107	-0.101	-0.108
	(0.004)	(0.005)	(0.004)	(0.077)	(0.078)	(0.074)	(0.085)
Payroll-backed loan portfolio growth rate (t)					-90.084**		
					(43.817)		
Market structure							
Herfindhal index (t)	174.557**			301.788*	372.125**		
	(66.293)			(155.643)	(163.110)		
3-bank concentration (t)		47.333***	71.717***			57.361*	78.793*
		(14.514)	(20.778)			(29.917)	(42.600)
Tests							
Long run monetary policy rate coefficient	0.803***	0.798***	0.846***	1.928***	1.704***	1.900***	0.995*
	(0.183)	(0.164)	(0.168)	(0.426)	(0.457)	(0.388)	(0.593)
Wald test for unitary long run pass-through	1.14	1.50	0.83	4.74**	2.38	5.39**	0.00
	[0.291]	[0.226]	[0.366]	[0.034]	[0.129]	[0.024]	[0.994]
Wald test for unitary immediate pass-through	0.04	0.06	0.00	0.42	0.02	0.23	1.14
	[0.845]	[0.808]	[0.951]	[0.521]	[0.888]	[0.631]	[0.290]
Hansen test	32.13	32.39	40.28	34.98	36.01	34.50	36.93
Arellano-Bond test for autocorrelation							
AR(2)	[0.198]	[0.192]	[0.217]	[0.950]	[0.946]	[0.973]	[0.485]
No. of banks / observations	50 / 4,662	50 / 4,662	50 / 3,769	51 / 4,758	51 / 4,758	51 / 4,758	52 / 3,847

Note: The benchmark results use the Herfindhal index, the real average income of employed people, and monthly data from January 2002 to November 2009. The alternative market concentration index is the three-bank concentration, the alternative income proxy is the Index of Economic Activity of the Central Bank of Brazil (IBC-Br), and the alternative sample period ranges from January 2003 to November 2009. The models are estimated using the GMM estimator suggested by Arellano and Bond (1991). Heteroskedasticity-robust standard errors are in parentheses, and the brackets contain the p-values. ***, **, * indicate significance at the 1,5 and 10% levels, respectively. To save space, the coefficients on seasonal dummies were not reported.

Table A3 - Estimation results of the determinants of bank funding interest rates and interest spread

Dependent variable: Bank interest rate	Time Deposits			Interest spread		
	Benchmark model	Alternative concentration index	Alternative income proxy, concentration index and sample period	Benchmark model	Alternative concentration index	Alternative income proxy, concentration index and sample period
Macroeconomic variables						
Monetary policy rate (t)	0.808***	0.814***	0.903***	0.571*	0.705**	0.164***
	(0.033)	(0.032)	(0.040)	(0.305)	(0.311)	(0.051)
Monetary policy rate (t-1)				-1.837***	-2.005***	
				(0.558)	(0.559)	
Monetary policy rate (t-2)				1.345***	1.395***	
				(0.356)	(0.349)	
Interest rate volatility (t)				10.269	13.978	41.271**
				(15.649)	(16.217)	(18.169)
Interest rate volatility (t-1)	-4.123**	-5.483***	-8.546***			
	(1.748)	(1.592)	(2.064)			
Inflation (t)	0.016***	0.015***		0.052*	0.063**	0.087**
	(0.003)	(0.003)		(0.028)	(0.028)	(0.039)
Inflation (t-1)	0.014**	0.012**	0.015***			
	(0.005)	(0.005)	(0.003)			
Inflation (t-2)				0.130***	0.131***	0.140***
				(0.033)	(0.032)	(0.050)
Inflation (t-4)				0.067**	0.067**	
				(0.031)	(0.031)	
Income growth (t-1)						
Income growth (t-2)	-0.00008	-0.00008		0.001***	0.001***	
	(0.00005)	(0.00005)		(0.0002)	(0.0002)	
Economic Activity Growth (t)						0.005*
						(0.003)
Economic Activity Growth (t-1)			-0.0002**			0.003*
			(0.0001)			(0.002)
Economic Activity Growth (t-3)			0.001***			
			(0.0003)			
Economic Activity Growth (t-4)			0.0008***			0.005***
			(0.0002)			(0.001)
EMBI Brazil growth rate (t)	0.002***	0.002***		0.031***	0.030***	0.035***
	(0.0007)	(0.0006)		(0.007)	(0.007)	(0.009)
EMBI Brazil growth rate (t-1)	0.002***	0.002***	-0.001	0.035***	0.037***	0.025**
	(0.0007)	(0.0007)	(0.0008)	(0.007)	(0.007)	(0.009)
EMBI Brazil growth rate (t-2)						
EMBI Brazil growth rate (t-3)	0.002***	0.002***				
	(0.0006)	(0.0006)				

Table A3 - *(continued)*

Dependent variable: Bank interest rate	Time Deposits			Interest spread		
	Benchmark model	Alternative concentration index	Alternative income proxy, concentration index and sample period	Benchmark model	Alternative concentration index	Alternative income proxy, concentration index and sample period
Bank related variables						
Bank interest rate (t-1)	0.149***	0.146***	0.088**	0.590***	0.594***	0.623***
	(0.026)	(0.026)	(0.036)	(0.082)	(0.081)	(0.100)
Bank interest rate (t-2)				0.194***	0.196***	0.185***
				(0.052)	(0.053)	(0.064)
Bank interest rate (t-4)				-0.113***	-0.114***	-0.124***
				(0.033)	(0.033)	(0.040)
Loans default rate (t)				0.536**	0.812***	1.116***
				(0.221)	(0.267)	(0.262)
Size (t)	0.155	0.226	1.053***	-1.970	-1.616	1.264
	(0.268)	(0.258)	(0.335)	(1.898)	(1.902)	(2.330)
Liquidity (t)	-0.068	-0.062	0.027			
	(0.074)	(0.074)	(0.059)			
Liquidity (t-1)				-8.859*	-8.943*	-8.359
				(4.708)	(4.624)	(5.453)
Management inefficiency (t)	-0.0001**	-0.0001***	-0.0001**	0.0004	0.0005	0.0005
	(0.00007)	(0.00007)	(0.00008)	(0.0005)	(0.0005)	(0.0006)
Capitalization (t)	-0.0009***	-0.0009***	-0.0008***	-0.008**	-0.008**	-0.008**
	(0.0002)	(0.0002)	(0.0002)	(0.003)	(0.003)	(0.003)
Capitalization (t-3)	-0.0009***	-0.0009***	-0.001***			
	(0.0001)	(0.0001)	(0.0001)			
Market structure						
Herfindhal index (t-3)	-7.385**			93.088***		
	(3.705)			(33.129)		
3-bank concentration (t)		-1.539	-0.481		24.187**	31.904***
		(1.029)	(0.880)		(9.160)	(9.553)
Tests						
Long run monetary policy rate coefficient	0.950***	0.954***	0.991***	0.242	0.291	0.520***
	(0.014)	(0.012)	(0.009)	(0.202)	(0.185)	(0.145)
Wald test for unitary long run pass-through	12.35***	12.85***	0.920			
	[0.001]	[0.001]	[0.342]			
Wald test for unitary immediate pass-through	31.80***	31.62***	5.64**			
	[0.000]	[0.000]	[0.021]			
Hansen test	24.08	21.69	30.29	33.04	30.01	30.76
Arellano-Bond test for autocorrelation						
AR(2)	[0.370]	[0.350]	[0.170]	[0.980]	[0.988]	[0.701]
AR(3)				[0.458]	[0.446]	[0.853]
AR(4)				[0.140]	[0.139]	[0.335]
AR(5)				[0.310]	[0.298]	[0.278]
No. of banks / observations	47 / 4,158	47 / 4,158	47 / 3,396	47 / 4,204	47 / 4,204	47 / 3,442

Note: See Table A2 note.

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