Macroeconomic Determinants of Banking spread in Brazil: An Empirical Evaluation

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Abstract: This paper analyses the determinants of banking spread in Brazil, seeking particularly to focus on the macroeconomic determinants of spread in recent times. It uses a VAR model to identify the macroeconomic variables that may directly or indirectly have been influencing spread in Brazil over the period 1994-2005. It presents evidence that interest rate levels and, to a lesser degree, the inflation rate are the main macroeconomic determinants of high banking spread in Brazil.

Key Words: Banking spread; VAR models; Brazilian banking sector.

Resumo: Este artigo analisa os determinantes do spread bancário no Brasil, buscando em particular examinar os determinantes macroeconômicos do spread no período recente. Para tanto, utiliza um modelo VAR para identificar as variáveis macroeconômicas que podem direta ou indiretamente ter influenciado o spread no Brasil em 1994/2005. Ele apresenta evidências de que o nível da taxa de juros e, em menor grau, a taxa de inflação, são os principais determinantes macroeconômicos no Brasil.

Palavras-chave: spread bancário; modelo VAR; setor bancário brasileiro.

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1. Introduction

A number of international studies have highlighted the importance of macroeconomic factors – including rate of inflation, interest rates and interest rate volatility, GDP growth rate, capacity utilization etc. – in determining banking spread. Considering the macroeconomic instability that has characterized the Brazilian economy – expressed for example in the stop-go movement of the economy and the extremely high short-term interest rates – it is to be expected that such factors would be significant in explaining spread in Brazil. This issue has gained in importance as, despite a decline in interest rates since mid-1999, banking spread in Brazil continues extremely high in international terms, and in recent years has stood at around 40%. One of the main factors preventing credit growth in Brazil is the extremely high interest rates levied on loans in Brazil, which explains at least partly the high profitability of the major retail banks. Meanwhile, the low level of credit in Brazil is one of the factors that have contributed to below-potential economic growth.

In this connection, Afanasieff *et al* (2002), using the Ho & Saunders (1981) two-step approach to investigate whether macro- and micro-economic factors are relevant to explaining spread behaviour in Brazil, conclude that the results suggest that the factors most relevant to explaining such behaviour are macroeconomic variables, such as the basic interest rate and output growth. That result is no surprise, however, considering that other international studies offer evidence that uncertainty in banks' economic environment is one important cause of banking spreads.

This paper intends to explore in depth the discussion of what determines banking spread in Brazil, seeking particularly to analyse the macroeconomic determinants of spread in recent times. The paper is structured into 6 sections plus this introduction. Section 2 offers a review of the literature on the determinants of spread, while Section 3 briefly evaluates some case studies. Section 4 sets out an analysis of the evolution and determinants of banking spread in Brazil. Section 5 contains an analysis based on vector autoregression (VAR) designed to identify the macroeconomic variables that may have been influencing banking spread in Brazil directly or indirectly in the period 1994-2005. Finally, Section 6 summarises the paper's main conclusions.

2. Determinants of banking spread: a review of the conventional literature

The conventional theoretical literature on the determinants of banking spread[1] has developed around two major approaches. The first ("monopoly models") grew out of a seminal study by Klein (1971) and considers the bank as a *firm* whose main activity is to produce deposit and loan services intermediated by the use of bank service production technology, represented by a cost function

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[1] Banking spread can be defined overall as the difference between what the bank charges loan takers and the return it grants to depositors, and can be measured in two ways – which we will call "ex-ante spread" and "ex-post spread". Ex-ante spread (sometimes known as "bank interest spread") is measured by reference to banks' prefixing decisions on rates paid on deposits and rates charged on loans, made prior to performing any financial intermediation activity, and is normally calculated as the difference between the interest rates on the bank's loans and deposits, drawn from information on bank operations generally collected and published by central banks. Ex-post spread (also known as "net interest margin") is a measurement of the net yield of bank financial intermediation, according to the revenues actually generated by credit operations and the actual cost of deposit taking, normally calculated from accounting data made available by the bank itself.

of the *C(D,L)* type[2]. As a rule, the banking firm's activity is pursued in a market environment characterised by the presence of monopolistic or imperfect competition in both the credit and deposit markets. This means that the bank has the monopolistic power to set interest rates in at least one of the markets where it operates, normally the credit market, thus behaving as a price setter. This monopoly power is considered to explain the scale of bank operations and the related asset and liability structures, given that, by its decisions, an individual bank can affect the rate of return on liability components and on bank asset components. On this approach, therefore, banking spread reflects fundamentally the bank's "degree of monopoly", i.e. its ability to charge a higher price than the marginal cost of producing the services it offers.

In such a context, let r be the prevailing interest rate on the inter-bank market; r_l the interest rate charged on loans made by the bank; r_d the interest rate paid by deposits with the bank; α the compulsory reserves as a proportion of the bank's deposits; ε_L the interest elasticity of loan demand; ε_D the interest elasticity of deposit supply; C'_L the marginal cost of loan services; and C'_D the marginal cost of deposit services. Then, supposing that the bank is risk neutral[3] and that its behaviour is directed to maximising profits, it can be shown that the optimal interest margin on loans and deposits is given by[4]:

$$\frac{1}{\varepsilon_L^*} = \frac{r_L^* - (r + C'_L)}{r_L^*} \qquad (1)$$

$$\frac{1}{\varepsilon_D^*} = \frac{r(1-\alpha) - C'_D - r_D^*}{r_D^*} \qquad (2)$$

The equations (1) and (2) state that the banking firm, operating in monopoly competition conditions, sets the prices of its loan and deposit services in such a way that the Lerner indices[5] are equal to the inverse of the interest elasticity of the loan demand and deposit supply functions. Thus, the less sensitive the loan demand and deposit supply functions are to interest rate variations, the greater will be the bank's margin in both loan and deposit-taking operations and, thus, the greater the banking spread.

If the market structure is of the oligopolistic type in both loan granting and deposit taking, then the optimal interest margin on loans and deposits is given by:

$$\frac{s}{\varepsilon_L^*} = \frac{r_L^* - (r + C'_L)}{r_L^*} \qquad (3)$$

$$\frac{s}{\varepsilon_D^*} = \frac{r(1-\alpha) - C'_D - r_D^*}{r_D^*} \qquad (4)$$

Where: s is the market-share of the n[th] bank.

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[2] Where D is the volume of deposits "produced" by the bank and L is the volume of loans. The traditional assumption is made that the marginal cost of loans and deposits is positive and increasing, that is $\frac{\partial C}{\partial D} > 0; \frac{\partial C}{\partial L} > 0; \frac{\partial^2 C}{\partial D^2} > 0; \frac{\partial^2 C}{\partial L^2} > 0$ (Freixas & Rochet, 1997).

[3] This means that bank is concerned only with the expected value of its profits, and gives no importance to dispersion of profits around an expected value. In that case, the bank's aim will be to maximise expected profit, rather than maximising the expected utility of profit.

[4] See Freixas & Rochet (1997, Ch 3).

[5] The Lerner index, defined as the difference between the price and the marginal cost, divided by the price, measures the capacity to set prices above the marginal costs, being an inverse function of the elasticity of demand and of a number of banks. The values of the index range from 0 (perfect competition) to 1 (monopoly).

From equations (3) and (4) it can be shown that the bank's interest margins on loan operations and deposit taking is a growing function of its market share. Therefore, any reduction in the number of banking firms – resulting, for instance from bank mergers and buyouts – will increase bank concentration and thus interest margins. One of this model's results is thus that banking spread is a growing function of the degree of overall bank sector concentration.

The second approach grew out of a seminal study by Ho & Saunders (1981)[6], and conceives the bank not as a firm, but simply as an intermediary between the final loan taker (firms) and the final lender (households). However, this intermediation activity is subject to two types of uncertainty. Firstly, there is uncertainty due to lack of synchronisation between deposits and loans. This lack of synchronisation entails an interest rate risk for the bank. In order to understand why, let us imagine that the bank encounters unexpectedly high loan demand, exceeding the volume of deposits and its free reserves. In this case, it will be forced to finance the surplus credit demand on the inter-bank market, thus incurring a refinancing risk in the event the interest rate rises (cf. Maudos & Guevara, 2003, p. 4). On the other hand, if the bank encounters unexpectedly high deposit supply, exceeding the volume of loans granted by the bank in the same period, it will then have to apply those surplus funds on the inter-bank market. In that way, the bank will be incurring a reinvestment risk in the event the interest rate falls (*Ibid*, p. 4).

Secondly, the intermediation activity exposes the bank to uncertainty regarding the rate of return on loans. That uncertainty results from the fact that a part of its loans will not be recovered because of non-payment, voluntary or otherwise, by loan takers. The percentage of non-performing loans, however, is not a variable known ex-ante by the bank, which can only estimate a likelihood of default.

One feature the Klein and Ho & Saunders approaches have in common is the assumption that banks have market power, i.e. both approaches assume that banks are free to set the interest rates charged on credit operations and paid on deposits. Unlike the Klein approach, however, Ho & Saunders assume that the bank is a risk-averse agent. In other words, the bank's goal is not to maximise expected profit, but rather to maximise the expected utility of profit. In that context, they show that optimum spread (s^*) is given by (Maudos & Guevara, 2003, p. 6):

$$s^* = \frac{1}{2}\left(\frac{\alpha_D}{\beta_D} + \frac{\alpha_L}{\beta_L}\right) + \frac{1}{2}\left(\frac{C(L)}{L} + \frac{C(D)}{D}\right) - \frac{1}{4}\frac{U''(\overline{W})}{U'(\overline{W})}\left[(L+2L_0)\sigma_L^2 + (L+D)\sigma_M^2 + 2(M_0 - L)\sigma_{LM}\right] \quad (5)$$

- where α_D is the linear intercept of the probability function of a deposit being made at the bank, β_D is the sensitivity of the probability of a deposit being made at the bank to variations in the deposit interest rate, α_L is the linear intercept of the probability function of a loan application to the bank, β_L is loan application sensitivity to variations in the credit operation interest rate; *C(L)/L* is the average cost of credit operations; *C(D)/D* is the mean cost of deposit-taking operations; $\overline{W}$ is the bank's final stock of wealth; $-\left[\frac{U''(\overline{W})}{U'(\overline{W})}\right]$ is the bank's absolute degree of risk aversion[7]; σ^2_L is the standard deviation of the yield on loans (a measure of the bank's credit risk); σ^2_M is the standard deviation of the yield on applications/loans on the inter-bank market (a measure of the bank's interest rate risk); σ_{LM} is the co-variance between credit risk and interest rate risk; L_0 é is the bank's starting stock of loans; and M_0 is the bank's initial net position on the inter-bank market.

[6] In what follows, we will work with the most recent extension of the Ho & Saunders approach developed by Maudos & Guevara (2003). See, also, Allen (1988), McChane & Sharpe (1985),and Angbazo (1997)

[7] Note that, as a result of the risk aversion hypothesis, U´(.) > 0 and U´´(.) < 0.

From equation (5), it can be concluded that the determinants of banking spread are:

- *The competitive market structure*: the greater the interest elasticity of loan demand and deposit supply (i.e. the lower the values of β_L e β_D), the smaller will be the optimum spread.
- *The bank's average operating cost*: $\left[\frac{C(L)}{L}+\frac{C(D)}{D}\right]$
- *The bank's degree of risk aversion*: $-\left[\frac{U''(\overline{W})}{U'(\overline{W})}\right]$
- *The volatility of market loan interest rates:* σ^2_M
- *The credit risk:* σ^2_L
- *The co-variance between loan risk and interest rate risk:* σ_{LM}
- *The average size of the credit and deposit operations undertaken by the bank: (L+D).*

One important aspect of the Ho & Saunders approach is that it leaves room for the influence of macroeconomic variables in determining banking spread (cf. Saunders & Schumacher, 2000, p. 815). The volatility of interest rates levied on loans on the inter-bank market is a direct reflection of the country's macroeconomic stability. The less stable a country's economy – e.g. the greater the variation in the inflation rate and exchange rate – the greater will be the resulting volatility of the basic interest rate[8] and, consequently, the greater the banking spread. In such a context, spread can be reduced by macroeconomic policies to reduce interest rate volatility.

Macroeconomic instability can affect banking spread through two other channels. The first is the degree of risk aversion. Banks' risk aversion must to some extent reflect the instability of the market environment where they operate. The less stable the environment, the greater banks' aversion to risk must be. Thus, a country with a history of major macroeconomic instability (high inflation, for instance) will have banks with a high degree of risk aversion. The second channel is the covariance between interest rate risk and credit risk. A highly volatile basic interest rate will be expressed to some extent in a highly variable level of real output. In such a context, firms' profits will also be highly variable, increasing the likelihood of default at times when profits fall below expected values. Thus, macroeconomic instability is reflected not just in a highly volatile interest rate, but also in high credit risk, i.e. such instability generates high co-variance between yield on loans and yield on inter-bank market applications. From (5), it can be seen that the greater such co-variance, the greater will be banking spread.

One final remark on equation (5): the spread given by this expression should be understood as "pure" banking spread (cf. Maudos & Guevara, 2003, p. 7). In practice there are other variables that explain banks' net interest margin, but which are difficult, if not impossible, to incorporate into the theoretical model. These variables reflect institutional and regulatory aspects of banking activities. As a result, actual net interest margin comprises two elements: "pure" banking spread (s^*) and the "impure" net interest margin (*f*) explained by institutional and regulatory factors.

3. Some International Case Studies

A vast empirical literature on the determinants of banking spread has developed in recent years. One major component of the literature has been concerned with testing empirically the theoretical model of banking spread developed by Ho & Saunders (1981). Among the most important

[8] Mainly in the case where monetary policy is conducted on the basis of the system of inflation targeting.

studies taking this approach are Saunders & Shumacher (2000) and Maudos & Guevara (2003), and some of these studies will be described below.

Most of this work uses the "pure spread" estimation methodology pioneered by Ho & Saunders. The methodology assumes that actual spread comprises "pure" spread adjusted upwards or downwards by implicit interest expense (exemption from bank charges for certain classes of customer), by the opportunity cost of holding reserves and by capital requirements resulting from regulatory standards and bank supervision. Given that context, "pure" spread is estimated in a two-step process. The first step involves running a cross-section regression for each bank's net interest margin in the chosen country in a given year (cf. Saunders & Shumacher, 2000, p.819). That equation is given by:

$$NIM_{ic} = \gamma_c + \sum_i \delta_j X_{jic} + u_i \quad (6)$$

- where: NIM_{ic} is the bank's net interest margin *i* in country *c* in the period *t*; X_{jic} is a vector of control variables (implicit interest expense, opportunity cost of required reserves and capital requirements for credit risk exposure) for each bank *i* in country *c* in some period *t;* γ_c is the regression constant, which is an estimate of "pure spread" for all *i* banks in country *c* at any time *t*, and u_i is the residual.

In this first step, equation (6) is processed for each country in the sample over the study period. The "pure spread" estimates obtained in the first step vary over time and among countries.[9] Accordingly, in the second step, a regression is run with panel data from the "pure" spread estimates obtained in the first step against a series of variables that reflect the market structure and intermediation risks. The equation to be estimated is given by:

$$\gamma_{tc} = \theta_0 + \sum_{c-1} \eta_c + \theta_1 \sigma_c \quad (7)$$

- where: γ_{tc} is the "pure spread" time series (t=1,...,8) for 7 countries (c=1,...,7); η_c is a set of dummy variables that reflect the average effects across seven countries of market structure on spread; θ_1 is the sensitivity of the "pure" spread to intermediation risk, and σ_c is the prevailing interest rate volatility on the inter-bank market. This methodology has the advantage of separating the influence of macroeconomic variables (such as interest rate volatility) from the influence of microeconomic variables (e.g. banking sector market structure) on "pure" spread.

Saunders & Schumacher (2000) obtained the following results: (i) the microeconomic variable with greatest impact on banking spread is implicit interest payment – i.e. where banks offset revenue lost as a result of charge exemptions by a higher interest margin; opportunity cost of reserves and bank capital assets ratio also had a positive and statistically significant influence on "pure" spread[10]; (ii) banking sector market structure had little influence on spreads – in fact, on average, only 0.2% of net interest margins could be explained by banks' market power; and (iii) interest rate volatility had a positive and statistically significant impact on banking spread – indeed, on average a 1% increase in the volatility of interest rates increases bank margins by about 0.2%. This means that the more volatile the basic interest rate, the greater the average spread charged by banks.

Maudos & Guevara (2004) examine determinants of banking spread, measured by net interest margin, from data for 1,826 banks in five European countries (Germany, France, United Kingdom, Italy and Spain) from 1993 to 2000. They propose an extension of the theoretical model of

[9] Saunders & Schumacher (2000), for example, use a sample of 746 banks in seven countries (United States, Germany, France, United Kingdom, Italy, Spain and Switzerland) in the period 1988-1995. Repeating these cross-section regressions for years 1-8 of the period under study yields eight estimates of "pure" spread for each country. In this way, an eight-period series is obtained for "pure" spread.

[10] That is to say, high regulatory and/or endogenously determined capital ratios – as protections against risks – tend to erode bank profitability.

determinants of spread developed by Ho & Saunders (1981), to include operating costs and a direct measure of the degree of competition (Lerner index) as explanatory variables.

Maudos & Guevara used a one-stage panel data regression in order to estimate the theoretical model they developed of the determinants of spread, measured by net interest margin, and considering as explanatory variables a number of bank and country characteristics for each period. The explanatory variables of the theoretical model, all expected to relate positively with spread are: competitive structure (measured by the Lerner index), operating costs (in relation to total assets), degree of risk aversion (ratio of net worth to total assets), interest risk, credit risk, interaction between credit risk and interest risk (measured by multiplying the two variables) and average size of operations (log of the volume of loans).

In addition to the variables of the theoretical model, they also consider, as explanatory variables, implicit interest payments (measured by net operating expenditure of non-interest revenues as a percentage of total assets), the opportunity cost of bank reserves (ratio of liquid reserves to total assets) – both expected to relate positively to spread – and quality of management – expected to relate negatively to interest margin. However, as a proxy for quality of management, they use the ratio operating costs/revenues, an increase in which lowers quality of management, resulting in a smaller interest margin; thence the negative sign between the ratio and net interest margin is to be expected. The results of that study show that most of the variables posited by the theoretical model are statistically significant and have the expected sign, i.e. interest margin relates positively with the Lerner index, operating costs, bank risk aversion, credit risk and interest risk. Significant, positive coefficients were also yielded by implicit interest payments and opportunity cost of bank reserves, and significant, negative coefficients by the operating costs/revenues ratio, as expected by the authors.

Brock & Rojas-Suárez (2000) conducted an empirical analysis using panel data on determinants of banking spread in Latin American countries. Using a sample of banks in six Latin American countries (Argentina, Bolivia, Colombia, Chile, Mexico and Peru) over the period 1991 to 1996, they investigated why banking spread had not diminished in these countries in a period of financial liberalisation resulting from reforms to the banking sector, marked particularly by reductions in reserve requirements and in direct restrictions on credit and interest rates. For that purpose, they analysed the evolution of six measures of ex-post spread (net interest margin), finding significant differences among these measurements in all the countries. In addition, they use the model of Ho & Saunders (1981) with a two-step panel regression using bank-specific variables, in order to estimate the determinants of spread for each of the countries individually, except Mexico. In the first step, which derived "pure spread", Brock & Rojas-Suárez controlled the microeconomic factors[11] and, in the second step, they ran a regression of the "pure spread" for each country explained by the following variables: interest rate volatility, inflation rate and GDP growth rate.

The first step results indicate that some of the variables relate positively and significantly in some of the countries: capital-asset ratio (Bolivia and Colombia), cost ratio (Argentina and Bolivia) and liquidity ratio (Bolivia, Colombia and Peru). On the other hand, contrary to expectations, non-performing loans ratio did not relate positively with banking spread in any of the countries, while in two countries (Argentina and Peru) the correlation was negative and significant. The authors suggest that this result may be associated with inadequate loan loss provisioning: higher non-performing loans would reduce banks' income. In the second stage regression, using macroeconomic variables, the best results were given by interest rate volatility, inflation rate and GDP growth rate. Thus macroeconomic uncertainty, represented by interest rate volatility (Bolivia and Chile) and inflation (Bolivia, Colombia, Chile and Peru), related positively with spread, corroborating the results from developed countries.

[11] The variables considered are non-performing loan ratio (non-performing loans/total assets), capital ratio (equity/total assets), cost ratio (overhead and other operating costs/performing loans) and liquidity ratio (short-term assets/total deposits).

Finally, economic growth rate yielded non-significant coefficients (of varying sign) in all the countries. The authors conclude, overall, that spread in Bolivia is explained by microeconomic factors; in Chile and Colombia, by both macro and microeconomics factors; while spreads in Argentina and Peru are not really explained by either macro or micro variables.

One recent study (Gelos, 2006) analyses the evolution of ex-ante spread and ex-post spread in Latin America and the determinants of ex-post spread in emerging countries, considering bank-specific data in the period 1999 to 2002 for 85 developing countries, among them 14 Latin American countries. From the descriptive evidence, Gelos observes that in the Latin American countries the credit/GDP ratio is low, while ex-ante and ex-post spread levels are high by international standards. In his econometric estimations, the explanatory variables he uses for interest margin are bank-level characteristics (measured by bank size, bank equity, overheads costs and a dummy for foreign ownership), several country-level characteristics (competition, reserve requirements, deposit rates, indirect taxes, legal protection and availability of information about potential borrowers) and macroeconomic characteristics (GDP growth, inflation, volatility of inflation and country risk ratings).

Gelos (2006) estimates "cross-country" regressions for 2002 and the results suggest that, of the bank-level characteristics, only bank size and overhead costs are significant (and relate positively). Of the country-level and macroeconomic features, deposit rate and reserve requirements are associated positively with banking spread, while GDP growth displays a significant negative correlation, a result associated with banks' exercising their market power. However, concentration does not correlate significantly with spread, which the author associates with the significant relationship between concentration and overhead costs. He also estimates panel regressions with data for 1999 and 2002, confirming the relationships of the significant variables in the previous regression, although reserve requirements showed reduced significance because the related data do not vary over time. The estimation also confirms the significance of the positive coefficients for legal structure and taxes and the negative coefficient for foreign ownership. In conclusion, Gelos suggests that in Latin American countries, interest rates are higher, banks less efficient, and reserve requirements greater than in other emerging countries, and that these factors have significant impact on spread.

4. Overview of banking spread in Brazil

4.1. Evolution of spread in recent times

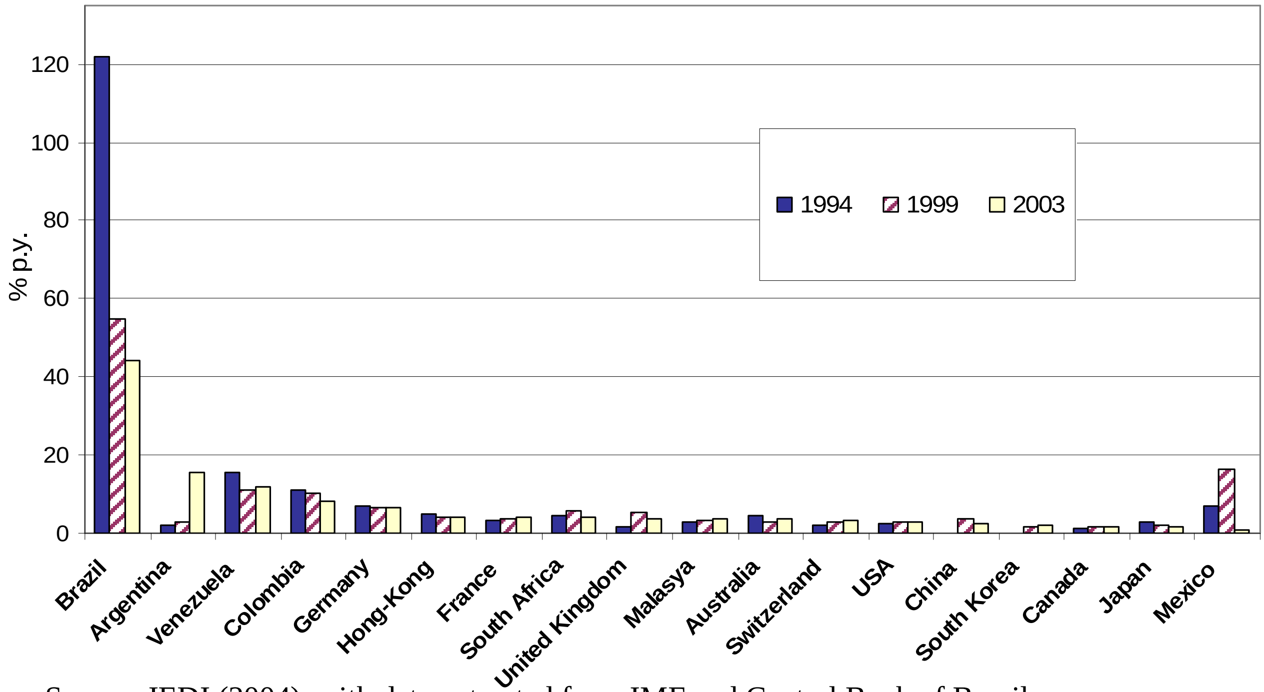
Loan interest rates charged in Brazil figure among the highest in the world, according to IMF figures. Figure 1 shows that, in 1994, the average spread for both corporate and the personal sectors was around 120% in the Brazilian banking system: approximately eight times higher than the second-highest rate charged in any country in the sample. The early years, when the Real Plan was being introduced, are now past, but the spread charged by financial institutions in Brazil continues high – around 55% in 1999 – although the gap in relation to other Latin American countries has narrowed. In 2003, average spread in Brazil was 44%, approximately three times the rate charged in other Latin American countries and ten times higher than in East Asian countries.

A second important observation on the behaviour of banking spread in Brazil[12] is that it has tended clearly downward since 2000. As can be seen in Figure 2 below, average spread charged by Brazilian banks reached a maximum of 150% p.a. early in 1995, in response to the strongly contractionary monetary policy measures implemented by the Central Bank in the period immediately

[12] In talking about banking spreads in Brazil, we are using the same definition as the Central Bank, according to which "banking spread is defined as the difference between lending and deposit rates for CDBs [certificates of bank deposit]. The average CDB rate for the set of financial institutions was calculated from the average of the individual rates weighted by each institution's net deposits" (Banco Central do Brasil, 2002, p. 50).

following introduction of the Real Plan[13]. It then declined significantly in the course of 1996 as restrictive monetary measures were relaxed and agents became less wary of the risk of contagion by the Mexican crisis, until reaching a plateau of approximately 40% at the start of 2000. Spread has continued at those – still extremely high – levels ever since.

Figure 1. Bank spread in Brasil and other countries



Source: IEDI (2004), with data extracted from IMF and Central Bank of Brazil.

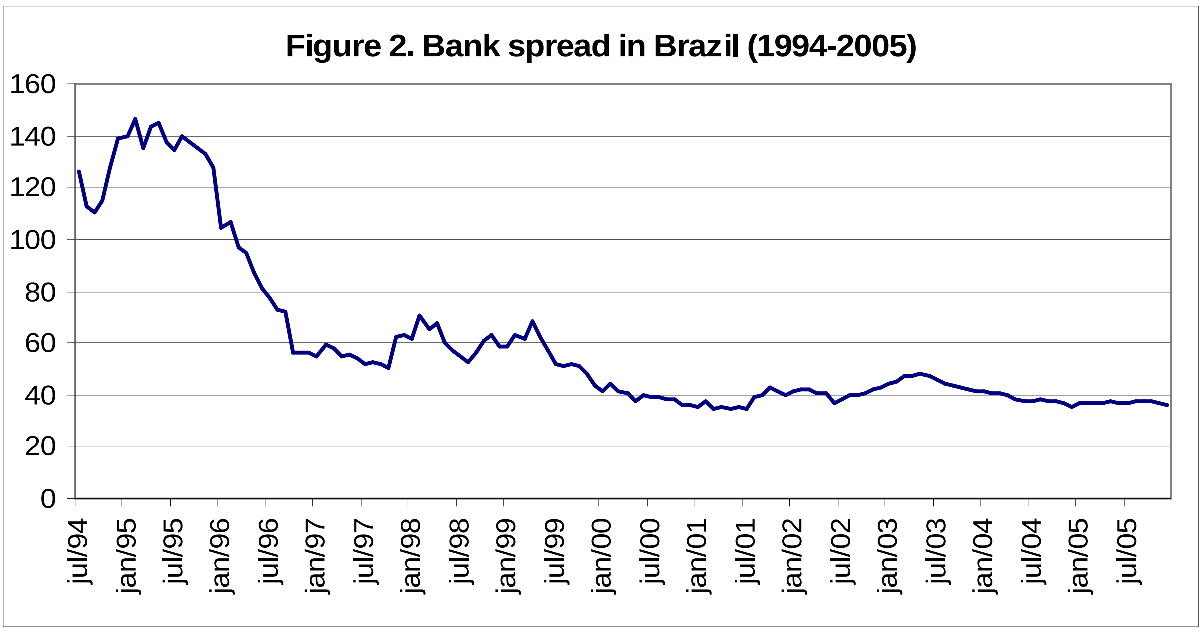


Figure 2. Bank spread in Brazil (1994-2005)

Source: Central Bank of Brazil. Note: Average banking spread related to operations with preset interest rate.

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[13] In addition to the policy of positive real interest rates, these measures initially included a compulsory reserve of 100% on sight deposits and, from December 1994 onwards, 30% on time deposits and 15% on any credit operation.

One hypothesis to explain why spreads are so high in Brazil might be banks' market power, evidence of which is the increasing concentration of banking in recent times. Indeed, some recent studies of the Brazilian banking sector – e.g., Belaisch (2003) – show that the market structure prevailing in this sector is essentially non-competitive. In that context, with few incentives to increase their operating efficiency, banks operate with high spreads, either as a way of generating revenue sufficient to cover their high costs or as a result of their ability to price their services at levels substantially above the marginal cost of producing bank services.

One factor supporting the hypothesis that the problem of spread in Brazil results from banks' market power is the recent tendency for bank concentration to increase. In the period 1988-2003, the 15 largest banks' market share in banking system total assets increased from around 29% in June 1988 to approximately 47% in January 2003 (cf. Central Bank of Brazil data). If the hypothesis of banks' market power is correct, then the concentration indices should also have an impact on loan rates charged by banks, resulting in high rates of return on assets. Indeed, the evidence may suggest that this is the case in the retail private banking sector at least, considering that mean profitability of Brazil's 3 largest private banks – Bradesco, Itaú and Unibanco – was 17.3% in the period 1994-2001, far higher than the average of 11.8% of 3 major non-financial Brazilian firms – Petrobrás, Votorantim and CVRD (Málaga *et al*, 2003, p. 12).

The Brazilian literature on determinants of banking spread has not been conclusive on the subject. The studies conducted present evidence that, although the market structure of the Brazilian banking sector is imperfect, it does not have the characteristics of a cartel. In fact, a review by Nakane (2003) of the empirical literature on the Brazilian case points to the following conclusions: (i) measured by the Herfindahl index, concentration in the Brazilian banking sector is not high compared with indices for other countries; (ii) the market concentration indices have no statistically significant impact on interest rates charged by the banks; and (iii) the market structure of the banking sector does not correspond to either of the extreme market structures (perfect competition and cartel) and can therefore be characterized as an imperfect structure.

4.2. Empirical studies of banking spread in Brazil

One of the pioneering studies of determinants of banking spread in Brazil is Aronovich (1994). Using a two-stage, least-square regression, this study examined the effects of inflation and level of activity on spread in Brazil's economy from the first quarter 1986 to the fourth quarter 1992, a period when Brazil was experiencing high rates of inflation. The theoretical model developed by Aronovich admits that banks follow a rule of loan pricing guided by cost structure, regardless of whether the sector is oligopolistic or not. His results indicate that inflation tends to widen the gap between loan and deposit rates, i.e. spread. He suggests that this phenomenon is caused by the possibility of a re-allocation among the components of the bank assets, or even incorporating into mark-up the risk premium involved in credit. In that regard, inflation has a negative effect on level of activity by inducing an increase in bank loan rates. On the other hand, the statistical tests suggest that an increase in productive capacity utilization would reduce spread, thus pointing to a pro-cyclic effect.

Another study by Afanasieff *et al* (2002) identified two stylized facts about spread behaviour after the Real Plan: (a) a marked fall in interest rates after 1995[14]; and (b) persistently high dispersion among bank loan rates. These facts provided the rationale for applying the methodology first

[14] A more stable international environment, a fall in the overnight rate and measures adopted by the Central Bank of Brazil all contributed to a reduction in spreads (Paula & Alves Jr. 2003, p. 358). The Central Bank measures included particularly a reduction in compulsory reserve requirements, from 75% to 45% on sight deposits and from 20% to 0% on time deposits, new rules for loan-loss provisioning, reduction in the financial operations (IOF) tax rate from 6% to 1.5% and development of a credit risk centre.

used to determine banking spreads by Ho & Saunders (1981). The first step involved panel data for 142 commercial banks between February 1997 and November 2000, so as to reflect how spread was influenced by individual (bank-level) microeconomic variables[15], i.e., those relating to bank-specific characteristics. From that panel, it was possible to obtain an estimate of "pure" spread (see Sections 2 and 3 of this paper). The second step involved a structural model to estimate the long-term influence of macroeconomic variables – market interest rates, a measure of risk premium (C-bond spread over a US Treasury bond of equivalent maturity), inflation rate, output growth rate, compulsory reserves on sight deposits, and financial tax rates – on the "pure" spread calculated previously.

The results of the first-step regressions show the following variables to be statistically significant: non-interest-bearing deposits to total assets, operating costs, service revenue to total operating revenues – all of which have a positive effect on banking spread –, as well as a dummy for foreign banks, whose negative sign indicates that such banks charge smaller average spreads. The coefficients estimated in the second step were significant, suggesting that macroeconomic aspects are prominent as major determinants of spreads in Brazil. The results of the regression suggest that spread tends to grow with rises in basic interest rate, risk premium, output growth and taxes. Contrary to expectations, the rate of inflation affects spread negatively, possibly because inflation may be capturing the effect of banks' appropriation of *seigniorage* on spread.

Another important study of determinants of banking spread in Brazil was conducted by the Central Bank of Brazil in connection with the project "*Juros e spread bancário*" (Interest rates and banking spread)[16]. Published in the form of annual reports starting in 1999, this study offers an accounting breakdown of spread[17], in addition to other econometric studies of the determinants of spread in Brazil. Banking spread in Brazil is broken down on the basis of the margins charged by a sample of banks – a sample extended from 2004 onwards, to take in a larger universe (commercial banks and multi-banks, including state-owned ones) encompassing all the banks operating in Brazil for which information (on their fixed-rate, freely-allocated credit operations only) is available at each base date. The following components are considered: (a) a residual corresponding, by and large, to bank net margin; (b) tax wedge, including direct and indirect taxes; (c) *Fundo Garantidor de Crédito* (FGC, credit guarantee fund); (d) overhead; and (e) default (provision expenses for non-performing loans).

Figure 3 shows how each of these components participate in banking spread in Brazil, from 2000 to 2003, now using the methodology revised in 2004[18]. From the accounting decomposition of

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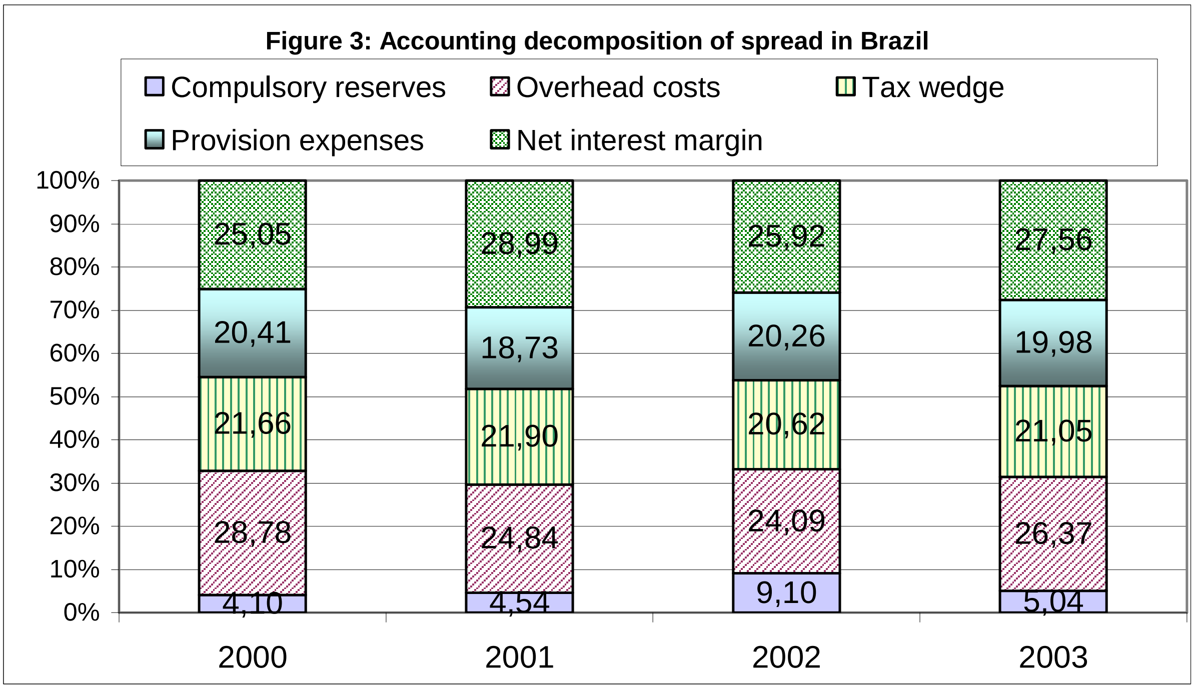
[15] The variables selected by Afanasieff *et al* (2002) were: (a) number of bank branches; (b) ratio of non-interest-bearing deposits to total operating assets; (c) ratio of interest-bearing assets to total assets; (d) operating costs; (e) bank liquidity; (f) ratio of service revenue to total operating revenues; (g) bank net worth; and (h) bank leverage.

[16] See, among others, Banco Central do Brasil (1999; 2002; 2004).

[17] The accounting decomposition of spread can be carried out by way of simple accounting definitions like those presented here (cf. Demirgüç-Kunt & Huizinga, 1999, p. 381). Bank net interest margin (NIM) is defined as the ratio of the book value of interest revenue to the value of the bank's assets. Let BTA be the before-tax profit, ATP the after-tax profit, TA the bank's total assets, and TX the amount of taxes paid by the bank. Then: $\frac{BTA}{TA} \equiv \frac{ATP}{TA} + \frac{TX}{TA}$. Let OV be the bank's overheads, LLP loan-loss provision and NII non-interest income. Profitability as a proportion of the bank's after-tax assets may be expressed as: $\frac{BTA}{TA} \equiv NIM + \frac{NII}{TA} - \frac{OV}{TA} - \frac{LLP}{TA}$. It follows from this that the bank's net interest margin (NIM) may be expressed as: $NIM = \frac{ATP}{TA} + \frac{TX}{TA} - \frac{NII}{TA} - \frac{OV}{TA} - \frac{LLP}{TA}$. Thus, the net interest margin can be calculated residually, given that the values of pre-tax profitability, taxes paid, non-interest income, overhead and loan-loss provision are all known as proportions of the bank's assets.

[18] In Figure 3 the "FGC Cost" is added to "Tax Wedge", as the values are smaller than 0.30%. The methodology revised in 2004 sets out a new manner of calculating overhead using Aumann-Shapley price calculation, rather than the revenue generation-based cost allocation approach used previously (See Banco Central do Brasil, 2004, Ch. III).

spread, the most important constituent factors are, respectively, net interest margin (a 2000-2003 average of 26.9%) and overhead (26.0%), followed by tax wedge (21.6%) and provision expenses (19.9%). Compulsory reserves, the least important item in the accounting decomposition, came to represent a relatively more significant effect in 2002 (9.1% of spread), as a result of the imposition of additional compulsory reserve requirements that year.



Source: Central Bank of Brazil

The accounting decomposition of spread assumes that the following structural equation is valid:

ln *spread*= β_0 Trend + β_1 ln *selic* + β_2 ln *adm* + β_3 ln *risk* + β_4 ln *imp* + β_5 ln *comp* (6)

where: β_{ii} (i= 0,..., 5) are the estimated parameters, Trend is a deterministic trend that controls other variables which may affect spread, but are not included in the equation above[19]. The regressors are *Selic*, which is the Central Bank of Brazil's basic interest rate[20]; *adm*, a measure of banks' overhead; *risk*, a proxy for credit risk, measured as C-Bond spread over a US Treasury bond of equivalent maturity; *imp,* indirect taxes; and *comp*, compulsory reserves as a percentage of banks' sight deposits.

Eight lags were used for all the estimation variables, including dummy variables for January 1996, November 1997 and December 1997, so as to generate normal residuals. The equation thus estimated by the Banco Central was:

ln spread= - 0,0003 trend + 0,503 *ln* Selic+ 1,554 *ln* adm + 0,219 *ln* risk + 0,723 *ln* imp *(7)*

From that equation it can be concluded, according to the methodology adopted by the Central Bank, the average spread among Brazilian banks depends positively on the basic interest rate, bank overhead, risk and taxes. As the variables were expressed as natural logarithms, it follows that the

[19] These include inflation rate, level of economic activity, structural changes in the banking industry resulting from interest rate policy, banks entering the market etc.

[20] Selic interest rate is the interest rate for overnight interbank loans, collateralised by those government bonds that are registered with and traded on the Selic. This is the interest rate equivalent to the *Federal Funds* rate in the United States.

coefficients of the equation estimated are simply the elasticity of spread to each of these variables. In that context, what is most striking about the Central Bank study is the high sensitivity of banking spread to variations in bank overhead. Indeed, from the equation estimated by the Central Bank, a 1.0% reduction in bank overheads would yield a 1.55% reduction in the spread charged by banks. In addition, banks' net interest margin contributes substantially to spread composition.

Koyama & Nakane (2001) draw on the spread decomposition methodology adopted by the Central Bank in order to examine the expected impact on spread of alterations in any of its components, i.e. overhead, loan-loss expense, indirect taxes, direct taxes and bank net interest margin. In order to estimate a vector autoregression, they disaggregate banking spread into the following factors: (i) Selic interest rate, which is used as an approximation to banks' gross mark-up, given that time deposits and overnight rates behave similarly; (ii) a measure of country risk premium (C-Bond yield over a US Treasury bond yield of equivalent maturity); (iii) the ratio of overhead to credit volume; and (iv) indirect taxes.

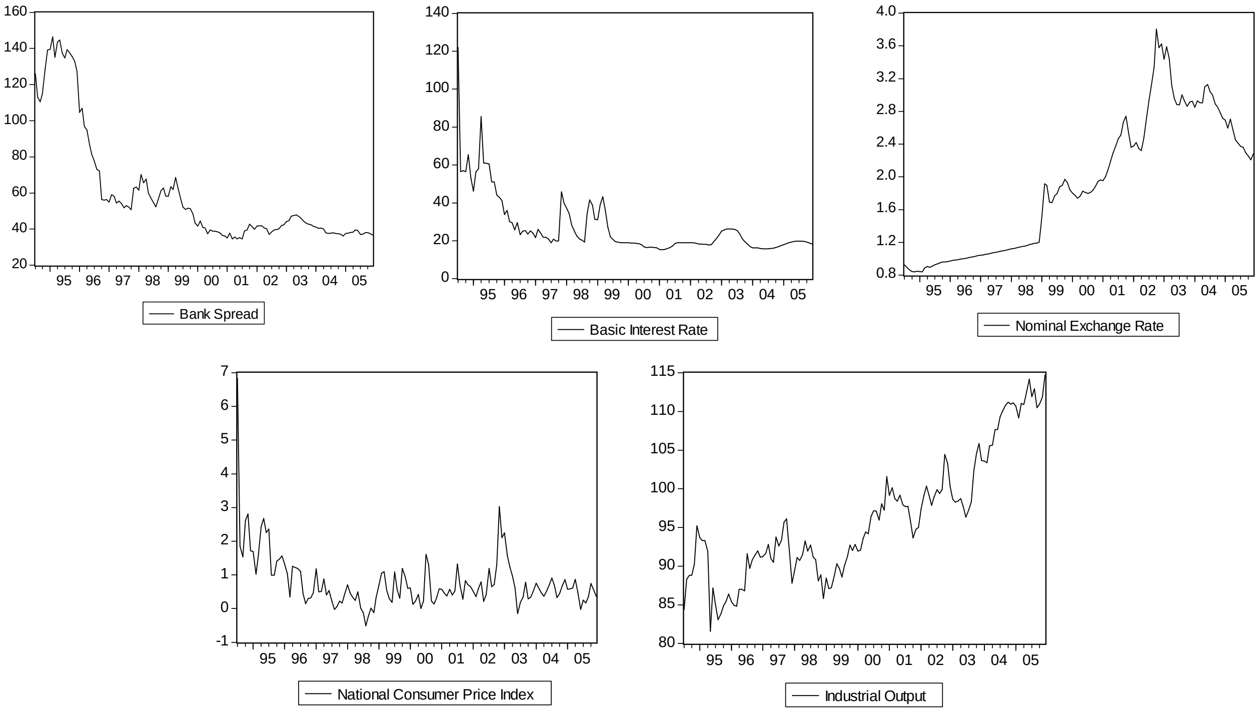
They test for co-integration among the variables and find the following relative values for September 2001: risk component (45%), overhead (20%), indirect taxes (19%) and Selic overnight rate (16%). In this analysis of banking spreads, risk-related variables played a greater part than loan-loss costs, as in the study carried out regularly by the Central Bank. This may be explained by the forward-looking nature of the risk-related variables with regard to future scenarios, while non-performance costs, relating to past losses, are retrospective. In this way, as 2001 was a year of uncertainty in Brazil's economy, the influence of the risk component in spread increased, as was to be expected. The importance of the Selic interest rate in determining spread may be understood differently. As, *a priori*, government bonds are risk free, then the basic interest rate determines an opportunity cost in relation to loans to the private sector (cf. Paula & Alves Jr., 2003, p. 361).

5. Macroeconomic determinants of spread in Brazil: 1994-2005

5.1. Methodology of the empirical study

The econometric method reported in this paper is Vector Auto-Regression (referred to as VAR below), where a variable is defined as being a function of its own lagged values and of lagged values of the other variables in the model. According to Sims (1980), who developed the method, the basic hypothesis of the VAR model is that the series should be stationary, which macroeconomic series generally are not. Indeed, in order to decide the best specification for a model of this type, a trade-off must be made – loss of efficiency or loss of information. There are three possible solutions to the problem. The first, recommended by Sims, is to estimate with all level variables, even in the presence of a unit root, on the rationale that the intention of the analysis using VAR is to determine what relations exist among the variables and not the estimated parameters. However, this option is criticised for the loss of efficiency in the estimation. The second alternative is to make the series stationary, but the resulting efficiency gain in the estimation is achieved at the cost of information loss regarding long-term relationships among the series. The third option is to estimate the model with Vector Error Correction (VEC) when there is substantial evidence of co-integration relations among the variables. With such a specification, the estimation gains in efficiency without losing the important long-term relationships.

Figure 4. Selected Macroeconomic Variables



Ramaswamy & SlØk (1998), however, argue that this latter option does not always ensure the best results, because imposing co-integration restrictions can lead to tendentious results and thus bias the impulse-response functions. In the event there is no *a priori* theory to suggest either the number of long-run relationships or how they should be interpreted, it is best not to impose any corrective restriction on the VAR model. However, as shown in this paper, there seem to be theoretical and empirical reasons to believe that long-terms relationships do exist among the macroeconomic variables considered here, making it indispensable to impose corrective restriction on the VAR model so as not to incur specification error.

Thus, for the econometric exercise conducted here, the following monthly variables were used: (i) banking spread: defined as average banking spread related to operations with preset interest rate (data from Central Bank of Brazil); (ii) Central bank of Brazil's basic interest rate (Selic rate), (iii) industrial output, used as a proxy of the Brazilian economic activity (data from IBGE); (iv) nominal exchange rate (average monthly data from IPEADATA); and (v) broad national consumer price index – IPCA (data from IBGE). These variables were chosen largely following the results of Afanasieff *et al* (2002), which concludes that macroeconomic variables (basic interest rate and rate of inflation) are more influential in determining spread than microeconomic variables.

Figure 4 shows the behaviour of the selected variables in the period July 1994 to December 2005. The interval chosen corresponds to the period of price stability in Brazil through to more recent times.

5.2. Macroeconomic determinants of banking spread: recent empirical evidence

This section is directed to identifying the macroeconomic determinants of banking spread in Brazil. Among the variables believed to determine spread are: industrial output, rate of inflation, exchange rate and Selic interest rate.

For the empirical application, the stationary hypothesis for the economic series was tested by way of the Augmented Dickey-Fuller (ADF) test, graph analysis and the autocorrelation function diagram. However, none of the variables examined could be considered level-stationary[21].

Table 1. Augmented Dickey-Fuller Test Statistic [22]

Discrimination	Lag	Constant	Trend	t statistics	Critical value 1%
SPREAD**	0	Yes	No	-2.499733	-2.581951
GSPREAD*	1	Yes	No	-6.801178	-2.582204
INTER*	0	No	No	-4.311254	-2.581951
GINTER*	0	No	No	-13.11215	-2.582015
EXCHA	1	Yes	No	-1.307095	-3.478911
GCAMBIO*	0	No	No	-7.800221	-2.582204
GDP	0	Yes	Yes	-2.944967	-4.026429
GGDP*	0	No	No	-13.72341	-2.582076
IPCA*	0	Yes	No	-9.552496	-3.478547
GIPCA*	0	No	No	-10.13972	-2.582076

Source: Authors' elaboration using Eviews 5. Significance is indicated by * for the 1% level and ** for the 5% level.
Lag Length: Automatic based on Schwarz Information Criterion (SIC).

After ascertaining the order of integration of the variables, Johansen's co-integration test was carried out, with linear deterministic trend in the data, intercept and no trend in the co-integration equation[23]. The trace statistics (LR_{trace}) and maximum eigenvalue ($LR_{\max}$) indicate the presence of a co-integration vector, as can be seen in Table 2.

Table 2 - Johansen Cointegration Rank Test: LR_{trace} and $LR_{\max}$

Null hypothesis	Alternative hypothesis	Eigenvalue	LR_{trace}	$CV_{trace,5\%}$	Prob**
$r=0$	$r>0$	**0.374345**	**104.9376***	**69.81889**	**0.0000**
$r\leq 1$	$r>1$	0.171706	41.62855	47.85613	0.1694
$r\leq 2$	$r>2$	0.068009	16.19631	29.79707	0.6984
$r\leq 3$	$r>3$	0.030479	6.687948	15.49471	0.6142

Null hypothesis	Alternative hypothesis	Eigenvalue	$LR_{\max}$	$CV_{\max,5\%}$	Prob**
$r=0$	$r=1$	**0.374345**	**63.30900***	**33.87687**	**0.0000**
$r=1$	$r=2$	0.171706	25.43225	27.58434	0.0919
$r=2$	$r=3$	0.068009	9.508357	21.13162	0.7894
$r=3$	$r=4$	0.030479	4.178729	14.26460	0.8400

Source: Authors' elaboration using Eviews 5.

[21] Although the ADF test signalled that the series IPCA, SPREAD and INTER (interest rate) are stationary, the graph analysis, and particularly the correlogram analysis, pointed in the opposite direction; for these reasons, they were not considered level-stationary.
[22] The letter G before of each variable means variation rate.
[23] This specification seems to be the most appropriate for the macroeconomic series analysed in this study.

Note: * Denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Although a long-run relationship does exist among the variables, some short-term imbalances may occur. In that case, a model with error correction must be estimated, i.e. VAR including a co-integration vector to correct for these short-term imbalances so as to bring it into long-run equilibrium. This study, therefore, requires estimating a restricted VAR (with an error correction mechanism) in order to correct the short-term deviations in long-term equilibrium.

In order to develop a suitably specified model it is necessary, among other things, to choose an appropriate number of lags for estimation. This was done on the basis of the Schwarz Information Criteria (SIC)[24]. The statistic indicated that the number of lags to be included in the VAR is one (Table 3):

Table 3 – Lag Order Selection Criteria

Lag Length	Schwarz Information Criteria
1	**-5.88906**
2	-5.48896
3	-5.26309
4	-4.74989

Source: Authors' elaboration using Eviews 5.
Note: Data from July 1994 to December 2005.

Considering that the errors are orthogonalized by the Cholesky decomposition in estimating the VEC, ordering the variables becomes significant to analysing the impulse-response function and the variance decomposition. For this purpose, the Granger (1969) time-precedence test was used. This is one way of ranking the variables from "most exogenous" – those affected contemporaneously only by their own structural shock – to the "most endogenous" variables – affected contemporaneously by all the shocks. That said, the results are shown in Table 4:

Table 4 – Granger Causality Test

VEC (1)			
Null Hypothesis:	Obs	F-Statistic	Prob
GINTER does not Granger Cause GIPCA	136	0.13832	0.71055
GIPCA does not Granger Cause GINTER		1.67346	0.19804
GGDP does not Granger Cause GIPCA	136	0.00775	0.92998
GIPCA does not Granger Cause GGDP		0.06274	0.80260
GSPREAD does not Granger Cause GIPCA	136	1.85078	0.17599
GIPCA does not Granger Cause GSPREAD		1.22444	0.27049
GEXCHA does not Granger Cause GIPCA	136	2.41605	0.12247
GIPCA does not Granger Cause GEXCHA		0.81543	0.36815
GGDP does not Granger Cause GINTER	136	0.84506	0.35962
GINTER does not Granger Cause GGDP		15.7833	**0.00012**

[24] The formula is as follows: SIC = - (l/T) + klog(T)/T, where l is the log-likelihood function with k parameters estimated using T observations. Analysis of the number of lags was based on the Schwarz Criterion and on the analysis of the lack of serial correlation of the residuals.

GSPREAD does not Granger Cause GINTER	136	4.57062	**0.03435**
GINTER does not Granger Cause GSPREAD		6.14345	**0.01444**
GEXCHA does not Granger Cause GINTER	136	4.3457	**0.03902**
GINTER does not Granger Cause GEXCHA		1.95435	0.16445
GSPREAD does not Granger Cause GGDP	136	2.8919	**0.09136**
GGDP does not Granger Cause GSPREAD		1.41018	0.23714
GEXCHA does not Granger Cause GGDP	136	0.54734	0.46071
GGDP does not Granger Cause GEXCHA		1.15918	0.28359
GEXCHA does not Granger Cause GSPREAD	136	1.81582	0.1801
GSPREAD does not Granger Cause GEXCHA		0.89514	0.34581

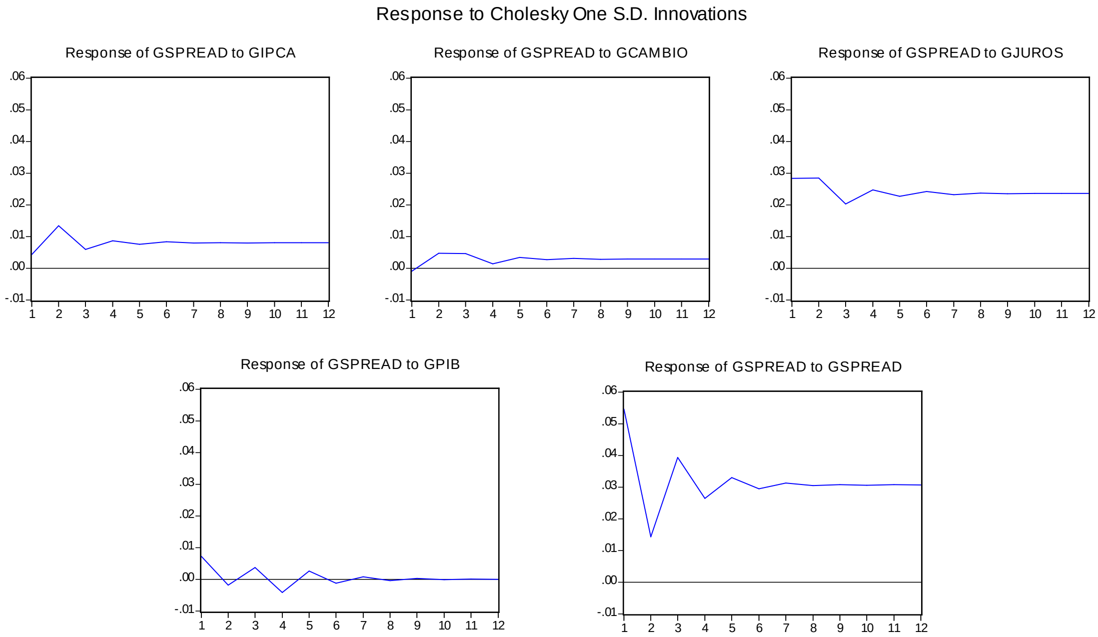
Source: Authors' elaboration using Eviews 5.

According to these criteria, the suitable order is the following: GIPCA (inflation rate), GEXCHA (exchange rate), GINTER (interest rate), GGDP (GDP) and GSPREAD. Thus the banking spread variation rate (the variable of interest to this study) is the most endogenous, and responds contemporaneously to variations in output, inflation rate, exchange rate and interest rate.

It is common to analyse the results of the (restricted or unrestricted) VAR model by way of the impulse-response function and decomposition of variance. Given the monthly frequency of the data, a 12-month period after the shocks occurred was used in the analyses.

The impulse-response function is used to test the sensitivity of certain variables to certain shocks, and is useful mainly for ascertaining the time, direction and reaction pattern of responses to one standard deviation impulses (shocks) in contemporary and future values of the endogenous system variables. In that context, system response to shocks is shown in Figure 5.

Figure 5. Impulse Response Function of a Change in Spread Growth over Growth of Other Macroeconomic Variables.



The first graph shows that an inflation rate growth shock tends to cause a persistent rise in banking spread growth. This result agrees with the result obtained by Aronovich (1994), who showed that inflation rate rises are associated with increases in banking sector mark-up. The following graph shows the effect of an exchange rate growth shock on banking spread growth, which was also positive although of little significance. The last graph in the first row shows the positive effect of a shock in growth of the interest rate on growth in spread; this can be considered the shock that had greatest impact on growth in banking spread. This result confirms the hypothesis of banks preference for liquidity (cf. Paula & Alves Jr, 2003), according to which – in view of the existence of a risk-free application combining liquidity and profitability (indexed public bonds) – banks in Brazil came to build a high liquidity premium into their loan-making operations. Added to this, as mentioned in Section 2, Selic interest rate rises may lead to greater variation in real output levels and business profitability, thus raising credit risk, which can result in higher loan rates and increased spreads.

Before explaining the results of the following graph, note that the negative impact of GDP on banking spread can be attributed to the “default effect”, in that greater (lesser) growth in output and national income result in a reduction (increase) in bank default (and credit risk), which tends to incur a reduction (increase) in spread, while the positive impact on spread growth is probably due to the bank “market power” effect. In the latter case, banks may respond to a context of growing demand for credit by raising the loan rate and maintaining the deposit rate unchanged.

That said, in the first of the second row of graphs, a GDP growth rate shock can be seen to cause a convergent-oscillating effect on the banking spread growth rate – which seems to reveal contradictory effects in the relationship between these two variables. The second graph in the second row shows the impact that a positive banking spread shock tends to cause on the banking spread variable itself. Note that, as with other economic variables, there is a strong inertial component to spread, which is demonstrated by the fact that shocks to this variable (or to its growth rate) at time *t* affect the variable’s values in subsequent periods.

Table 5 shows the decomposition of variance, which is designed to identify the importance of a given variable in relation to observed error in the values forecast for another variable. The results were obtained from a Monte Carlo simulation with 1000 iterations. Note that growth in the inflation rate accounted for approximately 4% of the variance in banking spread growth. The results show interest rate growth to be the most significant variable, because it has a strong (i.e. around 33%) influence on variance in banking spread growth. As regards the importance of banking spread growth in explaining banking spread itself, this was found to be about 61%, confirming the hypothesis that there is a strong inertial component. The other variables were found to be of negligible relative importance as regards spread growth.

Table 5. Forecast Error Variance Decompositions (%) - Rate of Change in Banking spread

Period	GIPCA	GEXCHA	GINTER	GGDP	GSPREAD
1	0.490944	0.023440	20.94865	1.377739	77.15923
2	3.956152	0.464427	31.87199	1.109975	62.59746
3	3.324432	0.627901	28.57153	0.996260	66.47988
4	3.658873	0.549939	31.05942	1.033745	63.69802
5	3.625943	0.573453	31.02841	0.928944	63.84325
6	3.748606	0.561272	31.95413	0.820816	62.91518
7	3.773342	0.565717	32.20051	0.727486	62.73295
8	3.820436	0.560330	32.59733	0.652313	62.36959
9	3.846327	0.559770	32.83500	0.590334	62.16857
10	3.874389	0.558033	33.06895	0.538990	61.95964
11	3.894406	0.557093	33.24848	0.495813	61.80421
12	3.913239	0.556036	33.40838	0.459029	61.66331

Source: Authors’ elaboration using Eviews 5

Note: Ordem Cholesky GIPCA, GEXCHA, GINTER, GDP and GSPREAD

All in all, the recent evidence seems to indicate that basic interest rate (Selic) is the most significant variable for explaining growth in banking spread in Brazil. In addition, inflation rate was found to have a positive effect on banking spread growth, a result that is associated with increased bank sector mark-up, but which cannot currently be considered one of the major determinants of high banking spread in Brazil. As regards the other variables – growth in exchange rate and in industrial output – there is no evidence that these are significant in determining the banking spread charged in Brazil in the period under consideration.

6. Conclusion

The results obtained in this study – in agreement with the empirical literature – provide evidence that macroeconomic factors are important in explaining how banking spread is determined in Brazil. Particularly noteworthy are (i) the interest rate level, which serves both as a basic level for loan rates and an "opportunity cost" for loan operations, because part of the public debt in Brazil is indexed to the Selic interest rate; and (ii), to a lesser extent, the rate of inflation, because increases in the inflation rate are associated with increases in bank sector mark-up.

Lastly, for the purposes of proposing policies to reduce banking spread in Brazil, the results of this study seem to indicate that a reduction in the Selic interest rate is a necessary condition for obtaining any pronounced and lasting reduction in spread in Brazil.

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