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FINANCIAL AND MACROECONOMIC DETERMINANTS OF PROFITABILITY: EMPIRICAL EVIDENCE FROM THE BRAZILIAN BANKING SECTOR

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Abstract: The aim of this paper is to verify the economic-financial and macroeocnomic determinants of profitability in the Brazilian banking sector. The analysis period covers the first semester of 1995 until the second semester of 2009. This period was stratified in moments (between 1995 and 2002 and between 2003 and 2009) to check for possible differences in profitability determinants during the years under analysis. The sample comprised 252 financial institutions. For data analysis, correspondence analysis (ANACOR) and panel data analysis techniques were used. Based on the perceptual maps produced through ANACOR, the association between the banking profitability categories and economic-financial indicators can be verified exploratorily. The Hausman test showed that the fixed effects model adjusts best to the analyzed data. In general, the results evidence that the economic-financial variables related to liquidity, credit risk, operating expense, operational efficiency and leverage, and the macroeconomic conditions with regard to the economic activity, inflation and the basic interest rate are statistically significant to explain Brazilian banking profitability.

Keywords: Profitability. Brazilian Banks. Economic-financial Indicators. Macroeconomic Conditions.

Resumo: O objetivo do estudo é verificar quais fatores econômico-financeiros e macroeconômicos explicam a rentabilidade do setor bancário brasileiro. O período analisado compreende o primeiro semestre de 1995 ao segundo semestre de 2009. Esse período foi estratificado em momentos (de 1995 a 2002 e de 2003 a 2009), com a finalidade de se verificar eventuais diferenças nos determinantes da rentabilidade durante os anos investigados. A amostra utilizada foi composta por 252 instituições financeiras. Para análise dos dados, foram utilizadas as técnicas de análise de correspondência (ANACOR) e de análise de dados em painel. A partir dos mapas perceptuais gerados pela ANACOR pode-se verificar, de maneira exploratória, a associação entre as categorias da rentabilidade bancária e os indicadores econômico-financeiros. Da aplicação das técnicas de dados em painel, verificou-se que, segundo o teste de Hausman, o modelo de efeitos fixos é o que melhor se ajusta aos dados analisados. No geral, os resultados evidenciam que as variáveis econômico-financeiras referentes à liquidez, risco de crédito, despesa operacional, eficiência operacional e alavancagem, e as condições macroeconômicas concernentes à atividade econômica, inflação e taxa de juros SELIC, são estatisticamente significativas para explicar a rentabilidade bancária brasileira.

Palavras-chave: Rentabilidade. Bancos Brasileiros. Indicadores Econômico-financeiros. Condições Macroeconômicas.

1 INTRODUCTION

In the last two decades, the global banking sector has experienced significant transformations in its operating environment. External and internal factors have affected the banking sector and banks' performance. Banks' role is still central for economic activity funding in general, and also in different market segments. Besides, the solid profitability of the banking sector contributes to the stability of the financial market. Therefore, the study of banking performance determinants has aroused academic research, as well as bank administration, financial market and regulatory interests (Athanasoglou, Brissimis and Delis, 2008).

Maffili and Souza (2007) argue that understanding the dynamics and functioning of financial instituitons is of extreme social importance, as financial institutions permit a credit flow in the economy through depositors' resources, play a crucial role in resource allocation, transmit the effects of monetary policy and grant stability to the economy as a whole.

In that sense, in the attempt to contribute to discussions on banking profitability, this study attempts to answer the following research question: What economic-financial and macroeconomic factors explain the Brazilian banking sector's profitability? Thus, this paper aims to verify the economic-financial and macroeconomic determinants of the Brazilian banking sector for the period from 1995 and 2009.

One of the motivations for the study is to verify to what extent differences in banks' profitability derive from macroeconomic factors, that is, which are not under the institution's management control. Therefore, the research intends to analyze the contribution of economic-financial indicators, commonly used in Brazilian research, adding the possible macroeconomic impacts on the profitability of banks active in Brazil.

This research is structured in five sections, including this introduction. The second section presents the theoretical framework. In the third section, the method is discussed, including the description of variables, presentation of the econometric model and data analysis techniques. Section four describes and analyzes the study results and the final section presents the conclusions and recommendations for future research.

2 THEORETICAL FRAMEWORK

Various Brazilian academic studies have looked at bank profitability, including Oliveira (2008), Maffili, Bressan and Souza (2007), Gregório (2005), Schlottfeldt (2004), Ceretta and Niederauer (2001), as illustrated in Chart 1.

Chart 1 - Brazilian research on bank profitability

Author/Year	Research synthesis	Technique	Sample	Period
Oliveira (2008)	Assessed whether the profitability of the banking sector is uniform in terms of size, capital origins, and credit operations level. Found that the profitability of the banking sector showed non-uniform behavior in the analyzed interval and that only the size variables displayed uniformity for profitability.	ANACOR and HOMALS	215 banks	1996-2006
Maffili, Bressan and Souza (2007)	Analyzed possible relations between capital structure, credit and treasury operations, spread and return on equity (ROE) ratio of Brazilian retail banks, and found a statistically significant relation in the analysis period.	Panel Data	20 banks	1999-2005
Gregório (2005)	Compared the profitability (ROE) of the private banking sector with private non-financial sectors. Verified that, on average, the profitability of the banking sector was higher than that of non-financial sector and showed lesser volatility.	Comparison of means and standard deviations	Mean 40 banks per year	1997-2004
Schlottfeldt (2004)	Aimed to explore the relation between required capital and profitability of banks in Brazil. The results found did not evidence significant relations between profitability (ROE) and the Basel Ratio.	Panel Data	144 banks	1995-2003
Ceretta and Niederauer (2001)	Comparatively investigated the competitive position of financial clusters in the Brazilian banking sector through the profitability versus productive efficiency matrix. Found that large banks perform better and that small banks show low profitability and low operating efficiency.	Data Envelopment Analysis	144 banks	Second semester 1999

International studies have examined the determinant factors of bank profitability. Among these factors, explanatory variables are used, which represent bank and sector characteristics, macroeconomic conditions, structural and institutional aspects, etc. In addition, most studies analyze banks from different countries across a long period and mainly use panel data analysis. Some examples of international studies are shown in the following chart.

Chart 2 - International research on bank profitability

Author/Year	Research Synthesis	Technique	Sample	Period
Sufian and Habibullan (2009)	Examined the determinants of profitability in the Chinese banking sector during the post-reform period.	Panel Data	220 banks in China	2000-2005
Albertazzi qhe Gambacorta (2009)	Analyzed the link between economic cycle and profitability flotation in the banking sector, and how this link is affected by structural and institutional characteristics. They verified that bank profitability in Anglo-Saxon countries was structurally higher, despite differences in economic cycles, financial system and tax development.	Panel Data - Dynamic	10 countries	1981-2003
Athanasoglo u, Brissimis and Delis (2008)	Examined the effects of specific bank, sector and macroeconomic characteristics on bank profitability.	Panel Data - Dynamic	Greece	1985-2001
Demirgüç-Kunt and Huizinga (1999)	Found that the bank spread and profitability can be determined by bank characteristics, macroeconomic conditions, implicit and explicit taxing, regulation, financial structure and legal and institutional aspects. Also concluded that, in developing countries, banks under foreign control have higher financial intermediation and profitability margins than domestic banks.	Pooled Regression	80 countries	1988-1995
Molyneux and Thornton	Analyzed the determinants of bank performance through Bourke's method (1989). For European banks, they found a positive and significant relation between profitability and bank concentration, and also with the nominal interest rate.	Pooled Regression	18 European countries	1986-1989

3 METHODOLOGY

The study is characterized as explanatory, as its goal is to clarify what factors contribute to the occurrence of a given phenomenon, that is, bank profitability. Thus, with a view to obtaining the research goal, a quantitative approach was used.

3.1 Data Collection

The data are divided in two groups: economic-financial indicators and macroeconomic variables. The source of the financial data used to calculate the economic-financial indicators is the Accounting Chart for Institutions of the National Financial System (COSIF), which includes all multiple and commercial banks. The

analysis period ranges from the first semester of 1995 to the second semester of 2009, comprising 30 semesters.

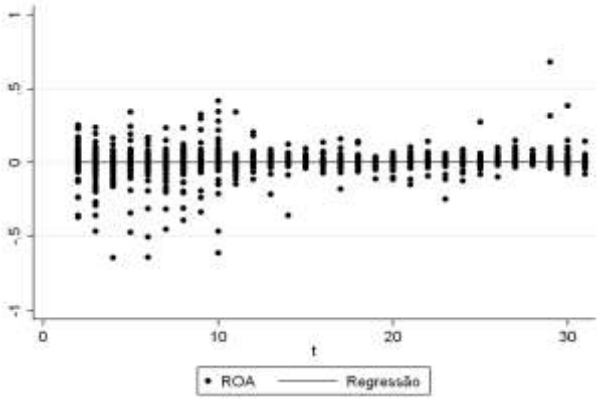
It should be highlighted that some facts marked 2003, which support the stratification of the sample in two moments. It is as from 2003 that the Lula government's monetary policy gains sufficient credibility to revert the main macroeconomic variables' pessimistic trends (exchange rate, interest rate, country-risk, inflation), which in turn starts a credit expansion cycle (Freitas, 2009). Thus, besides the full period, the sample was investigatd at two different times: from 1995 to 2002 and from 2003 to 2009.

3.2 The Sample

The number of banks acrossthe period is 252 and the sample constitutes a non-balanced panel, as a result of an intense process of sell-offs, mergers, acquisitions and the entry of new foreign banks, as well as the exit of other foreign banks and the sale of their portfolios. The study sample starts in the first semester of 1995 with 200 banks and ends in the second semester of 2009 with 103 banks.

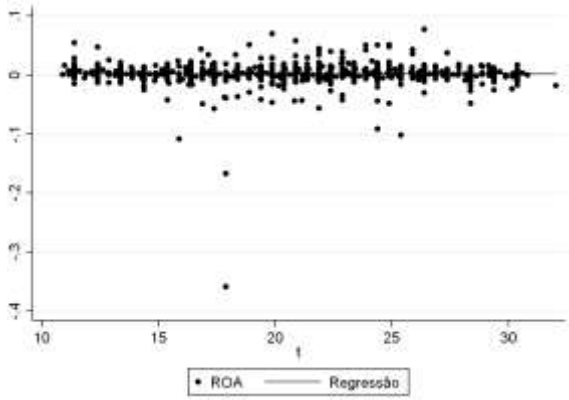
Each point in Graph 1 represents a return-month pair. The justification to adopt panel data models is related to the fact that some regressors do not change over time, while others, as a general trend, do not vary among companies. Most of them, however, can vary among companies and over time, as presented and discussed in section 4.

Graph 1 - Evolution of Returns across the Study Period



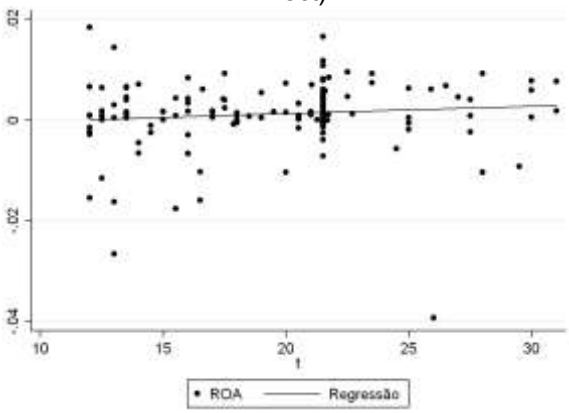
Graph 2 presents the profitability variation over time for each company, that is, it shows the profitability variations from each company's individual mean profitability (within variance).

Graph 2 - Profitability Deviation from Each Company's Mean Profitability over Time (Within Effect)



Graph 3 displays the profitability variation among companies, that is, it shows companies' profitability deviations from the general mean profitability for each moment (between variation).

Graph 3 - Company Profitability Deviations from General Mean for Each Moment in Time (Between Effect)



Section 4 analyzes the within and between variations of each of the regressors that will be taken into account in this study. According to Cameron & Trivedi (2009), the panel data models may permit endogenous regressors, due to the correlation with an error component that is invariable over time (fixed effects), or assume that the regressors are completely exogenous (random effects). Both estimators will be evaluated in this study.

3.3 Description of Variables

3.3.1 Dependent Variable

Return on Assets (ROA): indicates the profit obtained for each R$1 in assets, reflecting the bank's management capacity to use its financial and permanent resources to create profits. The formula used to calculate the return on assets considers the relation between the Profit Before Taxes (PBT) and the mean total assets. Rivard and Thomas (1997) suggest that ROA represents a better measure of the company's ability to generature returns based on its asset portfolio.

3.3.2 Explanatory Variables

The independent variables used to explain Brazilian banks' profitability were divided in two groups. The first represents economic-financial indicators, while the second covers economic conditions during the study period. Initially, the variables related to the economic-financial indicators are presented:

Liquidity (LIQ): calculated based on the relation between available cash and cash deposits. The voluntary savings identify the bank's immediate financial capacity to cover cash deposit withdrawals. Higher voluntary savings values enhance the institution's financial security but, at the same time, compromise profitable applications in loans and funding. Banks' normal trend is to keep available cash, which do not produce revenues, at the lowest possible level. According to the study by Molyneux and Thornton (1992), a negative relation is expected between the liquidity and profitability levels.

Size (SIZE): this variable was constructed through the bank's Total Assets in a given year, corrected by the Brazilian Consumer's Price Index (IPCA - baseline: Dec/2009) and extracting its logarithm. The hypothesis is that a positive relation exists between size – market power and scale economies – and bank profitability (Bourke, 1989; Molyneux andThornton, 1992).

Credit Risk (RISK): the relation between Allowance for Doubtful Debtors (ADD) and total credit operations is incorporated as an explanatory variable in the panel data regression analysis as a proxy of credit risk. A negative coefficient is expected, as bad credits bring down profitability. Miller and Noulas (1997) suggest that, the greater

the banks' exposure to high-risk loans, the greater the number of unpaid loans and the higher profitability would be. Besides, the authors add that, in many cases, decreasing these allowances represents the main catalyst to increase profit margins.

Operating Expense Rate (EXP): the ratio between operating expenses on total assets. The operating expense rate is used to provide information on the variations in the bank's operating costs. In most literature, it is argued that expense reduction improves efficiency and, consequently, increases financial institutions' profitability, which implies a negative relation between the operating expense and profitability rates (Bourke, 1989).

Operating Efficiency Ratio (EFFIC): the operating efficiency ratio relates the institution's operating expenses with their financial intermediation revenues. Revenues from credit operations, leasing, exchange, interfinancial liquidity applications, bonds and securities and derivate financial instruments are considered revenues from financial intermediation. The lower the ratio, the higher the productivity, that is, the bank demonstrates the need for a smaller operating structure to keep up its activities.

Leverage (LEV): was used as a proxy for levering net equity divided by total assets. According to Pasiouras and Kosmidou (2007), low leverage (high level of the indicator) is relatd with low risk and, consequently, with low return on equity rates. In this sense, a lower level of capital entails a relatively risky position, and a negative relation with ROE is to be expected. In case of higher capital level, hower, the cost of capital would be reduced, causing a positive impact on bank profitability (Molyneux, 1993 *apud* Sufian and Habibullan, 2009).

Individual Bank Spread (SPREAD): the proxy used for the bank spread was proposed in the study developed by the Institute for Accounting, Actuarial and Financial Research Foundation (FIPECAFI, 2005), on behalf of the Brazilian Federation of Banks (FEBRABAN). The equation below demonstrates how the bank spread was calculated.

$$BankSpread_{it} = \frac{CreditOperationsIncome_{it} - CaptationExpenses_{it}}{CreditOperationsIncome_{it}} \qquad (1)$$

Minsky (1986) argues that the banks, moved by the search for higher return rates, attempt to increase their scale of operations and raise the bank spread.

Therefore, they use two strategies: increasing the net profit per monitary unit of assets and increasing the relation between the bank's own capital and assets. Thus, the hypothesis is that, the greater the bank spread, the greater the bank profitability.

To measure the relation between the bank's economic and market conditions and profitability, the following macroeconomic variables were used:

Economic Activity (PROD): calculated by the logarithm of General Industrial Production. The series used as a proxy is the General Industrial Production in quantum, elaborated by the Brazilian Institute of Geography and Statistics (IBGE). An increase in economic activity is expected to lead to a higher demand for loans and funding, positively affecting profitability. In addition, Athanasoglou, Brissimis and Delis (2008) affirm that, during those periods when the GDP surpasses its trend, that is, the product gap is positive and, if profitability is pro-cyclical, the return is expected to increase. Similarly, when the GDP remains below the trend, profits are expected to drop.

Inflation (INFL): this control variable of macroeconomic conditions is related to current inflation of the cconsumer's price index, (the semi-annual variation in the IPCA, as elaborated by IBGE). Different studies, such as Bourke (1989) and Molyneux and Thornton (1992), have shown a positive relation between inflation and profitability.

Currency Supply (∆M1): the percentage variation in banknotes the public held at the end of the year (information from the Central Bank) was used as a proxy for the growth in the currency supply. According to Mamatzakis and Remoundos (2003 *apud* Sufian and Habibullan, 2009), the currency supply used as a measure of market size significantly affects bank profitability.

Interest Rate (INTEREST): is the variable that measures the Central Bank's interest instrument, proxied by the mean semi-annual Selic Rate, annualized in percentage points. The data source is the Central Bank of Brazil. Empirical evidence (Bourke, 1989; Molyneux and Thornton, 1992; Demirgüç-Kunt and Huizinga, 1999) indicates that the high interest rate is positively correlated with bank's higher profitability. Besides, Demirgüç-Kunt and Huizinga (1999) highlight that this relationship is stronger in developing countries.

Credit Market (CREDMAR): this explanatory variable was calculated through the logarithm of total credits granted to the public and private sectors, deflated by the IPCA. The variable is another tested proxy for the bank market size. The hypothesis

is that credit market growth positively affects bank profitability.

Chart 3 - Variables used in the model

Variable	Measurement	Notation	Signal
ROA	PBT/mean total assets	ROA	
Liquidity	Cash available/cash deposits	LIQ	-
Size	Log of total assets	SIZE	+
Credit Risk	ADD/credit operations	RISK	-
Operating Expenses	Operating expense/total assets	EXP	-
Efficiency Rate	Operating expense/financial intermediation revenues	EFFIC	-
Leverage	Net assets/total assets	LEV	-/+
Individual Banking Spread	(Operating credit income – capitation exp.)/ oper. cred. Income	SPREAD	+
Economic Activity	Log of General Industrial Production	PROD	+
Inflation	IPCA – semi-annual variation	INFL	+
Currency supply	Currency supply growth rate	∆M1	+
Interest rate	Semi-annual mean Selic Rate	INTEREST	+
Credit Market	Log of deflated total credit granted	CREDMAR	+

3.4 Data Analysis

3.4.1 Simple Correspondence Analysis

Simple Correspondence Analysis (ANACOR) is a multivariate analysis technique applied when one intends to study the association between two qualitative variables. Initially, to use the technique, the quantitative variables were transformed into qualitative ones through quartile distribution. Thus, based on the perceptual map, one can discover whether profitability is associated with each of the explanatory variables. It is highlighted that ANACOR is an exploratory but not confirmatory technique, so that results are not predictive, i.e. cannot be extrapolated to other banks, or even to the same banks in other time intervals. Besides, the identified associations do not determine a causal relation between profitability and other variables, but merely appoint signs of mutual associations. SPSS® 17.0 software was used for multivariate analysis in this research.

3.4.2 Panel Data Analysis

In panel data analysis, the same cross-sectional unit is analyzed over time. In this study, as one is working with a considerable number of financial institutions during several semesters, the panel data technique is indicated. Econometric tests

related to panel data analysis were performed in STATA® version 11.1. Fixed and random effect panel data models were tested. To decide between both models, the null hypothesis was tested that residues are not correlated with the explanatory variables, through the application of the Hausman test. In addition, for the three models tested, robust statistics were use for heteroscedasticity and serial correlation.

3.5 Research Restrictions

One of the disadvantages of using panel data analysis is the increased risk of incomplete samples or severe data collection problems. In this research, as different banks left the sample over time (due to sell-offs, mergers and acquisitions) and others emerged (through the entry of new foreign banks in the country), a non-balanced panel was used. Regarding the proxies used for the selected variables, the restrictions refer to their limitations to reflect a certain theoretical construct.

4 EMPIRICAL RESULTS

4.1 Descriptive Analysis

Initially, descriptive statistics are presented for the dependent variable and explanatory variables, as shown in Table 1.

Table 1 - Descriptive statistics of variables used

Variables	Obs	Mean	Standard Deviation	Min.	Max.
ROA	6257	0.003425	0.039232	-0.645147	0.682300
LIQ	4447	192682	6159802	0.000000	3.59E+08
SIZE	6257	9.212340	1.174485	-0.086141	12.89726
RISK	5394	2.448738	136.9184	-1604.166	8647.119
EXP	6257	0.063903	0.133737	0.000000	5.085016
EFFIC	6247	996.8317	57076.07	1.34E-09	3831671
LEV	6257	0.095797	0.260979	-6.760342	1.359999
SPREAD	5519	-4871932	3.51E+08	-2.61E+10	1.000000
PROD	6258	98.046310	13.248350	77.570000	129.520000
INFL	6258	3.878957	2.809712	-0.620187	12.197230
M1	6258	10.845300	23.111550	-22.617800	61.689490
INTEREST	6258	22.709030	11.237470	8.864844	58.539040
CREDMAR	6258	5.814150	0.104486	5.737566	6.126148

Next, correlation analyses were performed to check for a relation between the study variables, with a view to identifying possible signs of multicolinearity. Table 2 shows the correlation matrix of the research variables between 1995 and 2009. In general, no high correlation level (i.e. over 0.7) was found for the explanatory variables.

Table 2 - Correlation matrix of variables used

	roa	liq	size	risk	exp	effic	lev	spread	prod	infl	m1	selic
liq	0.00	1										
size	0.02	-0.01	1									
risk	-0.01	0.00	0.01	1								
exp	-0.33	0.00	-0.25	-0.05	1							
effic	-0.29	0.00	-0.09	0.00	0.23	1						
lev	0.29	-0.01	-0.45	0.01	0.04	-0.04	1					
spread	0.00	0.00	-0.02	0.00	0.01	0.01	0.01	1				
prod	0.04	-0.02	0.35	0.01	-0.16	-0.01	-0.07	-0.02	1			
infl	0.04	0.05	-0.18	0.00	0.15	-0.02	0.08	0.00	-0.30	1		
m1	-0.03	-0.02	-0.03	0.01	-0.01	0.00	0.03	0.01	-0.30	-0.02	1	
interest	0.02	0.05	-0.34	-0.01	0.22	0.01	0.10	0.01	-0.65	0.67	-0.03	1
credmar	0.01	-0.02	0.24	0.00	-0.04	0.00	-0.02	0.00	0.66	-0.25	-0.01	-0.46

The correlation matrices for the periods from 1995 to 2002 and from 2003 to 2009 were also analyzed. In the first period, no high correlations were found either between the explanatory variables. Between 2003 and 2009, however, a negative correlation of 0.82 was found between the SELIC interest rate and the credit market variable.

The sum of within and between squares was broken down, showing that, for most of the variables, the variation between companies is smaller than the variation over time (within). It still cannot be stated, however, that the between estimate will result in efficiency loss, as the proportion between each variable's within and between variances differs and the statistical significane of each in the models is yet unknown.

4.2 Simple Correspondence Analysis

Before applying the ANACOR technique, the chi-square test was performed. This test was used to check for an association between profitability and each of the economic-financial variables. At a significance of 1%, there are signs leading to the rejection of the null hypothesis about independent variables, which permits the application of ANACOR. It is highlighted that symmetric normalization was used, in order to examine the differences and similarities among the variables.

Picture 1 displays the association between the bank profitability categories and economic-financial indicators, which indicates that:

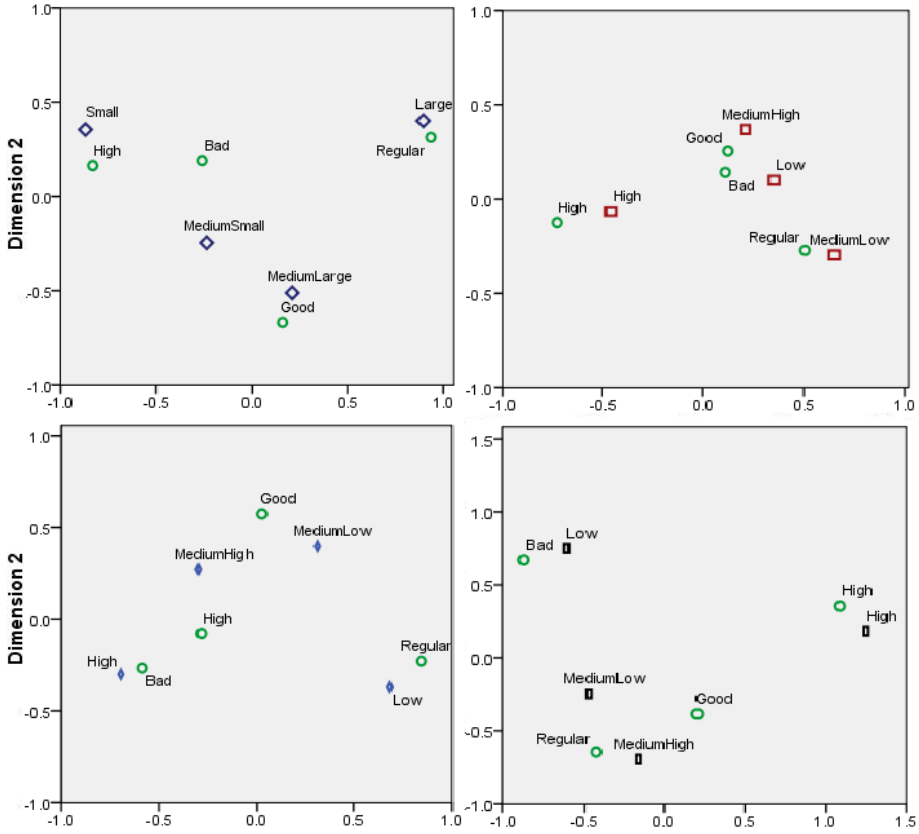
(i) Banks with **high profitability** are associated with small size, high liquidity, medium/high operating expense, high operating efficiency, high credit risk, high leverage and high bank spread;

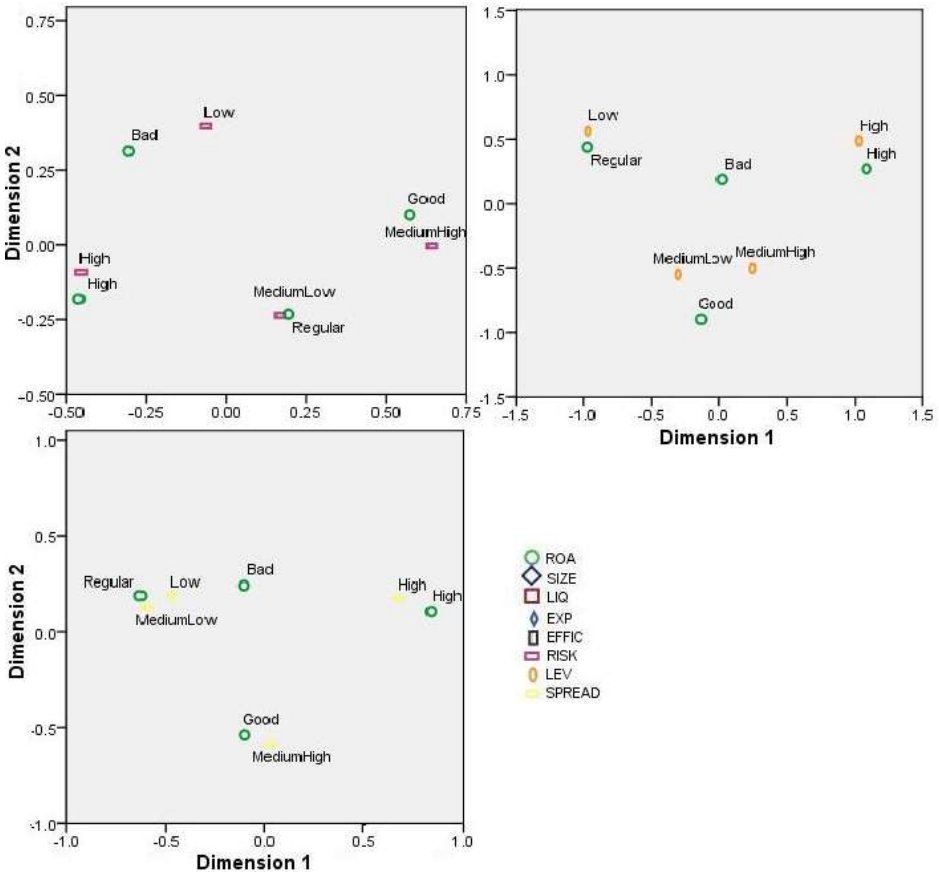
(ii) Banks with **good profitability** are associated with medium/large size, medium/high liquidity, medium/low operating expense, medium operating efficiency, medium/high credit risk, medium leverage and medium/high bank spread;

(iii) Banks with **regular profitability** are associated with large size, medium/low liquidity, low operating expense, medium operating efficiency, medium/low credit risk, low leverage and medium/low bank spread; and

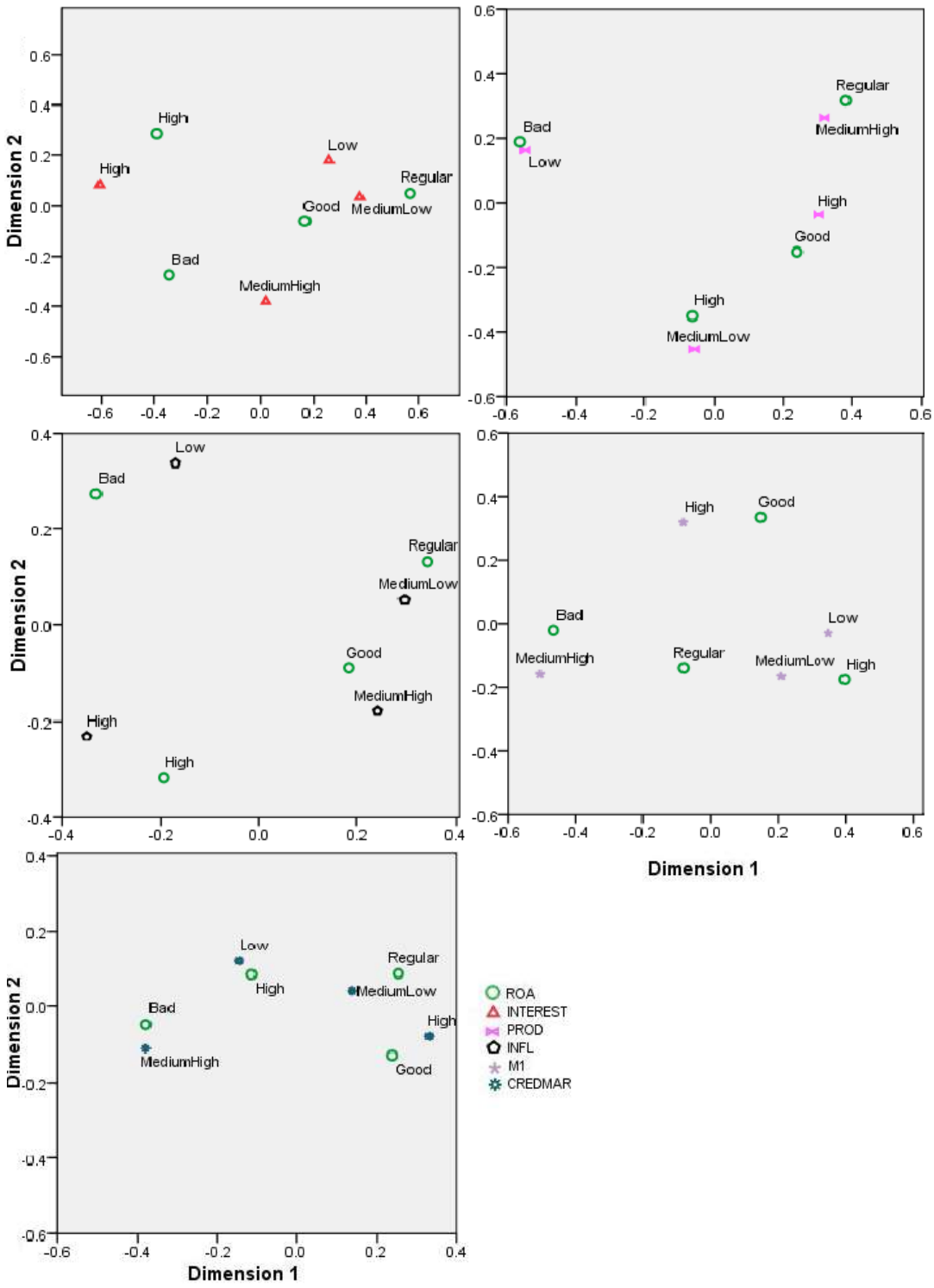
(iv) Banks with **bad profitability** are associated with small and medium banks, low liquidity, low operating expense and efficiency, low credit risk and bank spread.

Picture 1 - Percentage maps between profitability and economic-financial variables





Picture 2 - Percentage maps between profitability and macroeconomic variables



Regarding the association between bank institutions' profitability and macroeconomic variables, shown in Picture 2, it can be highlighted that:

(i) Periods when the SELIC interest rate is high, economic activity and currency supply range between low and medium, inflation is high and when the credit market is low are associated with **excellent profitability**;

(ii) Periods when the SELIC ranges between low and medium, industrial production is high, inflation ranges between medium and high, the currency supply is high and the credit market is low tend to show **good bank profitability**;

(iii) When the interest rate ranges between low and medium, general industrial production is medium/high, inflation is medium/low and the credit market is medium/low, **profitability** is concentrated in the **regular** level; and

(iv) Periods when the SELIC rate ranges between medium and high, economic activity is low, inflation is low, the currency supply is medium/higher and the credit market is medium/low are associated with **bad profitability**.

4.3 Analyis of Panel Data

Table 3 shows the test models for the period from 1995 to 2002, from 2003 to 2009 and for the full period.

Table 3 - Fixed effects model for dependent variable: profitability (ROA)

Explanatory Variables	Period: 1995 to 2002			Period: 2003 to 2009			Period: 1995 to 2009		
	Coef.	Stand.Err.	Sig.	Coef.	Stand.Err.	Sig.	Coef.	Stand.Err.	Sig.
LIQ	-2.87E-11	2.34E-11		5.15E-10	3.78E-10		-4.03E-11	2.27E-11	*
SIZE	2.35E-03	2.74E-03		-4.62E-03	1.75E-03	***	1.80E-05	1.62E-03	
RISK	-1.60E-05	5.72E-06	***	-4.68E-03	4.06E-03		-1.40E-05	5.41E-06	***
EXP	-7.69E-02	3.38E-02	**	-1.07E-02	6.14E-03	*	-6.39E-02	2.41E-02	***
EFFIC	-2.83E-03	1.24E-03	**	-1.80E-03	8.27E-04	**	-2.86E-03	1.00E-03	***
LEV	7.35E-02	3.00E-02	**	-5.89E-02	2.76E-02	**	5.84E-02	2.29E-02	**
SPREAD	3.61E-08	3.81E-08		3.97E-11	9.11E-11		7.64E-11	1.05E-10	
PROD	2.40E-04	1.36E-04	*	7.10E-05	4.10E-05	*	9.90E-05	4.90E-05	**
INFL	5.21E-04	2.37E-04	**	-3.04E-04	2.51E-04		6.13E-04	1.51E-04	***
M1	-2.20E-05	3.20E-05		-4.94E-06	1.40E-05		-2.30E-05	1.90E-05	
INTEREST	4.11E-04	8.80E-05	***	-4.92E-06	1.16E-04		3.20E-04	6.40E-05	***
CREDMAR	-1.56E-02	5.62E-02		4.71E-03	4.09E-03		7.38E-03	4.59E-03	
F test	6.48			2.55			6.14		
Prob. F	0.00			0.00			0.00		
R^2	0.17			0.11			0.15		
No banks	240			141			252		
No obs.	2660			1597			4263		

Obs.: *, ** and *** correspond to 10%, 5% and 1% significance levels, respectively.
Robust statistics for heteroscedasticity and self-correlation

Panel data models are not balanced, as they contain the banks that entered or left the market during the study period. To give an example, the sample starts in the first semester of 1995 with 200 banks and ends in the second semester of 2009 with

103 institutions. In addition, the total number of observations is 4263.

The Hausman test was used to identify what model, between fixed and random effects, that best adjusts to the data. For the three test models, the null hypothesis that the residues are not correlated with the explanatory variables was rejected, so that the fixed effects model is preferred.

By stratifying the sample in two periods, differences between the variable coefficients could be verified between the periods. This division clearly shows that the explanatory power and adherence to the study hypotheses are better for the model related to the period from 1995 to 2002 than for the period from 2003 to 2009.

It is highlighted that the F statistics of the three tested panel data model regressions revealed significance, as the p-value of the F Statistics is less than 0.01, that is, the hypothesis that the estimated parameters jointly equal zero is rejected. Likewise, the models' explanatory power (R^2) ranges between 11% and 17%.

The liquidity level influences profitability in the full model only, with significance set at 10%. Besides, the signal of this variable is negative, as theoretically expected. Hence, an inverse relation exists with ROA.

As for size, the coefficient showed statistical significance only in the model for the period from 2003 to 2009, with a signal against expectations. As opposed to what was initially expected – that the effect of market power and scale gains would positively affect profitability – the negative relation for recent period reflects small and medium banks' successful domination of consigned loans, whose regulatory framework came into effect in September 2003. The success of small and medium banks led to a range of acquisitions by large banks, with a view to incorporate this competitive differential, as well as consigned credit portfolios (Oliveira, 2006)

Regarding the credit risk variable, the coefficient is negative, with statistical significance for the first period and for the whole one. This result is in line with expectations, as bad credits (high risk and high probability of non-compliance) can reduce bank profitability.

For the three panel regression models, the coefficients of the operating expense, operating efficiency and leverage variables were statistically significant, with signals according to the theoretical proposal. It should be mentioned that the leverage coefficient showed both positive (first and last model) and negative signs (second model), which was also verified in other studies, showing that the relation can be ambiguous.

Besides, economic activity showed a positive relation with profitability, indicating that the increase in the country's production of goods and services provokes higher profitability rates, in accordance with the hypothesis that a growing economy demands more credit and financial intermediation services, enhancing the result of the banking sector as a whole. The coefficient of the inflation variable also showed a positive sign and statistical significance in the first and last model. In the first analysis period, the inflation level and volatility in Brazil are higher. Historically, and mainly in the initial phase of monetary stabilization that started in 1994 with the Real plan, banks apply a large part of their resources in public debt notes, many of which index in inflation rates (NTN-Bs) and floating interest rates, based on the Selic rate (LFTs). This effect seems to have lost effect in the second period, but tests for the total period capture this effect.

These results are in line with the study by Demirgüç-Kunt and Huizinga (1999), which used data from 80 countries and found a positive relation between profitability, GDP growth and inflation.

The Selic interest rate showed a positive relation with profitability, which was significant in the first and last model. The analysis for the inflation variable applies in this case, as the relation derives from the fact that Brazilian banks invest in federal public bonds and that the Government practices high interest rates, which made public bonds attractive and guaranteed good profitability to banks.

It is highlighted that, out of 12 variables under analysis, only those related to bank spread, currency supply and credit market did not statistically contribute to explain profitability in any of the three models. Finally, Chart 4 summarizes the results of panel estimations.

Chart 4 - Summary of tested models

Explanatory Variables	Expected Signal	Period: 1995 to 2002		Period: 2003 to 2009		Period: 1995 to 2009	
		Observed signal	Sig.	Observed signal	Sig.	Observed signal	Sig.
LIQ	(-)	(-)		(+)		(-)	*
SIZE	(+)	(+)		(-)	***	(+)	
RISK	(-)	(-)	***	(-)		(-)	***
EXP	(-)	(-)	**	(-)	*	(-)	***
EFFIC	(-)	(-)	**	(-)	**	(-)	***
LEV	(-/+)	(+)	**	(-)	**	(+)	**
SPREAD	(+)	(+)		(+)		(+)	
PROD	(+)	(+)	*	(+)	*	(+)	**
INFL	(+)	(+)	**	(-)		(+)	***
M1	(+)	(-)		(-)		(-)	
INTEREST	(+)	(+)	***	(-)		(+)	***
CREDMAR	(+)	(-)		(+)		(+)	

Obs.: *, ** and *** correspond to 10%, 5% and 1% significance levels, respectively.

The first model, covering the period from 1995 to 2002, shows only two coefficients (for the currency supply and credit market variables) with signals different from theoretical expectations. The full model displays the largest number of significant coefficients (liquidity, credit risk, operating expense, operating efficiency, leverage, product, inflation and interest rate), whose signals were according to theory.

5 CONCLUDING REMARKS

The aim of this study was to verify the economic-financial and macroeconomic determinants of the Brazilian bank sector's profitability for the period from 1995 to 2009. The research sample included 252 banks.

The perceptual maps produced by ANACOR revealed the association between bank profitability categories and economic-financial indicators. To give an example, banks with high profitability are associated with small size, high liquidity, medium/high operating expense, high operating efficiency, high credit risk, high leverage and high bank spread.

Regarding the association between financial institutions' profitability and macroeconomic conditions, it is highlighted that, during periods when the Selic interest rate is high, economic activity and currency supply range between low and

medium, inflation is high and the credit market is low, profitability tends to be excellent.

In the full model, covering the period from 1995 to 2009, panel data analysis results evicence that the economic-financial variables for liquidity, credit risk, operating expense, operating efficiency and leverage, and macroeconomic conditions related to economic activity, inflation and the SELIC interest rate are statistically significant to explain Brazilian bank profitability. This was the model with the largest number of significant coefficients, all with signs according to theoretical expectations.

In addition, out of 12 explanatory variables under analysis, only three (bank spread, currency supply and credit market) did not statistically contribute to explain profitability in the three test models.

As a suggestion for future studies, Arellano-Bond's (1991) econometric dynamic panel method could be used for data analysis, in which the GMM technique contains the lagged dependent variable as a regressor. Another possibility would be to compare the results obtained for Brazilian bank profitability determinants with those of other countries, besides including other explanatory variables, such as regulatory and institutional variables, for example.

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