

## **Analysis of the influence of leverage on the profitability of Brazilian banks listed on B3 from 2008 to 2017**

### *Análise da influência da alavancagem na rentabilidade dos bancos brasileiros listados na B3 no período de 2008 a 2017*

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#### **ABSTRACT**

Financial institutions move billions every day, investing, offering credit, among many other activities. Brazilian banks have one of the largest spreads in the world, being exposed to greater default risks. Taking into account the importance of commercial banks and the increase in defaults in the economy, the objective of the work was to identify the relationship between leverage and profitability in Brazilian banking institutions. As it is a study with a quantitative approach, the following methodological activities were carried out: i) calculation of leverage and profitability indicators; ii) creation of multiple regression models; iii) analysis with 18 banks and then with the 4 largest in the period from 2008 to 2017. It was concluded that for the 18 banks there is no relationship between leverage and profitability. However, when analyzing the 4 largest banks, it was found that there is a significant relationship between leverage and profitability, especially when ROE is related to GE, having a positive relationship.

**Key words:** financial indicators, leverage, profitability, banks, multiple regressions

#### **RESUMO**

*As instituições financeiras movimentam bilhões todos os dias, investindo, oferecendo crédito, entre outras inúmeras atividades. Os bancos brasileiros possuem um dos maiores spreads do mundo, estando exposto a maiores riscos de inadimplência. Levando em consideração a importância dos bancos comerciais e o aumento da inadimplência na economia, o objetivo do trabalho foi identificar a relação entre alavancagem e rentabilidade nas instituições bancárias brasileiras. Por ser um estudo de abordagem quantitativo, foram realizadas as seguintes atividades metodológicas: i) cálculo de indicadores de alavancagem e de rentabilidade; ii) criação de modelos de regressões múltiplas; iii) análise com 18 bancos e depois com os 4 maiores no período de 2008 a 2017. Concluiu-se que para os 18 bancos não há relação entre alavancagem e rentabilidade. Contudo, ao analisar os 4 maiores bancos, verificou-se que há relação significativa entre alavancagem e rentabilidade, em especial, quando se relaciona ROE com GE, possuindo uma relação positiva.*

**Palavras chaves:** indicadores financeiros, alavancagem, rentabilidade, bancos, regressões múltiplas

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## 1. INTRODUCTION

A financial institution's purpose is to optimize and allocate financial resources, taking into account risk, term and cost in order to serve its sponsors. Among the main financial institutions are Commercial Banks.

Banco Comercial's objective is to mediate the supply and demand for financial resources. It provides services such as deposit taking, loans, payment processing, credit and debit cards, etc. However, the biggest allocators of resources are the Multiple Banks and are considered Multiple Banks because they offer different products in addition to the activities offered by the Commercial Bank.

The bank's earnings are mainly due to the form of spreads, that is, the difference between the funding cost (how much the bank pays to the investor) and the amount charged to the consumer in a credit operation.

Although the spread in Brazil is the largest in the world (World Bank data for 2016), the risk of default is also high. According to Serasa Experian, "judicial recoveries hit a historic record in 2016 and bankruptcy filings were the highest in the last four years". Several factors contribute to the increase in the risk of default, such as, for example, economic crisis, lack of financial education and even cultural aspects such as the search for status or personal satisfaction.

According to Febranan (2017), "about 56% of the spread can be explained by the costs of default. In addition, there are tax, operational costs. Banks' profit is 23% of the total".

The degree of leverage can considerably increase the risk of default and thus can affect bank profitability.

Nunes and Arlete (2009) defines financial leverage:

The company's ability to work with third party resources (basically, loans, debentures, preferred shares, among others) in order to maximize the effects of the variation in operating profit (LAJIR) on the earnings per share of the owners of a company. The higher a company's GAF (degree of financial leverage), the greater its indebtedness and the greater its financial risk.

In view of the banking nature, especially in relation to the predominance of third party capital, we seek to verify whether there is a relationship between degree of leverage and profitability.

From this scenario, the main objective of this study is to identify the relationship between leverage and profitability indicators in Brazilian banking institutions listed on the Stock Exchange.

With that, through the studied bibliographic sources, it allowed to formulate the following research problem: In Brazilian banking institutions is there a relationship between financial leverage and profitability?

With profit records in recent years, banks have great relevance within the Brazilian economic scenario. On the other hand, banks have a high degree of leverage and thus increase their risk of default and may jeopardize the payment of their debts, putting the financial system at risk.

Although it is not possible to eliminate the risks generated by instability and uncertainty, through analysis of the financial information it is possible to reduce the financial impact on its activities.

Mantovani (2010) raised some relations between leverage and profitability for the period from 2001 to 2010. However, the uncertainties in recent years due to the instability of the political and economic scenario have increased the risk of default. Therefore, it is important to analyze whether the increase in credit risk influences the degree of leverage and, consequently, the profitability of banks.

## **2. LITERATURE REVIEW**

### **2.1. Financial institutions, commercial banks and multiple**

The Central Bank of Brazil defines the Financial System as a set of financial institutions and financial instruments that has the objective of transferring resources from surplus economic agents (people, companies, government) to the deficit.

Financial Institution is one that acts as an intermediary between the client and some type of service in the financial market, such as making investments, loans, financing, among other services.

There are numerous financial institutions: Commercial Banks, Development Banks, Credit Cooperatives, Investment Banks, Credit Societies, Financing and Investments, Brokerage Firms, Distribution Companies, Multiple Banks, etc.

Lopes & Rossett (1987) state that the National Financial System has four phases.

In a first phase, the National System was characterized by making financial intermediation between the coffee sectors and infrastructure implementation projects.

In 1914, the second phase begins, which runs until 1945 and is characterized by the expansion of the financial intermediation system, study for the creation of the central bank and the creation of the General Inspection of Banks (1920).

The third phase (1945-1964) is characterized by being a transition phase between a simple system to a complex one. There was the implementation of the normative, advisory, control and inspection body, SUMOC - Superintendence of Currency and Credit and also the creation of the National Bank for Economic Development - BNDE.

The last phase (1965) which enacted three laws: instituted monetary correction in contracts, defined characteristics and actions of financial institutions and disciplined the capital market. These laws fostered and diversified financial activity.

Financial institutions are regulated and have specific accounting and regulatory standards.

It is the competence of the National Monetary Council to define general accounting and statistical standards to be used by financial institutions. The attributions of the National Monetary Council are defined by Law 4,595, of March 31, 1964, in paragraphs I to VII of its article 3, namely:

- I - Adapt the volume of means of payment to the real needs of the national economy and its development process;
- II - Regulate the internal value of the currency, to prevent or correct inflationary or deflationary outbreaks of internal or external origin, economic depressions and other imbalances arising from cyclical events;
- III - Regulate the external value of the currency and the balance in the country's balance of payments, in view of the better use of resources in foreign currency;
- IV - Guide the application of the resources of financial institutions, both public and private; with a view to providing, in the different regions of the country, favorable conditions for the harmonious development of the national economy;
- V - Promote the improvement of financial institutions and instruments, with a view to greater efficiency in the payment system and resource mobilization;
- VI - Ensure the liquidity and solvency of financial institutions;
- VII - Coordinate monetary, credit, budgetary, fiscal and public, internal and external debt policies.

Commercial banks are private or public financial institutions whose main objective is to provide the necessary resources to finance, in the short and medium term, trade, industry, service providers, individuals and third parties in general. The capture of freely depositable demand deposits is a typical activity of the commercial bank, which can also collect time deposits. It must be incorporated in the form of a corporation and its name must include the expression "Bank" (CMN Resolution 2.099, 1994).

Purificação (1945) states that "the main characteristic of the commercial bank, as we know it today, is the creation of coins". This characteristic motivates banks to increase their level of indebtedness, increasing the result of financial intermediation.

Niyama and Gomes (2006) highlights that the operations that can be carried out by commercial banks are divided into operations: assets, liabilities, specials, ancillary and services.

There are also multiple banks in the banking market which, in Perini's (2009) view, are public or private financial institutions that carry out active, passive and ancillary operations through the following portfolios (regulated by specific legal rules on the subject): commercial, investment and / or development, real estate credit, leasing and credit, financing and investment. The development portfolio is an exclusive service of public banks.

## 2.2. Capital structure

Among the subjects covered by the theory of corporate finance, the part related to the capital structure and one of the most complex and controversial. Despite a series of theoretical and empirical research, this subject does not have a ready and unanimous answer as to what is the best or most appropriate capital structure for an organization (Myers, 1984; Bradley, Jarrell & Kim, 1984; Titman & Wessel, 1988; Rajan & Zingales, 1995; Shyam-Sunder & Myers, 1999; Hovakimian, Opler & Titman, 2001; Henrique, Silva, Soares, Silva 2018; Henrique, Soares, Saporito, Silva, 2020).

The "Capital" are the resources that are available to the company. The capital structure is the way in which the company combines two types of capital: third party capital and equity.

Third party capital represents liabilities, that is, company obligations representing investments obtained through third party resources.

Equity is wealth that is available to company owners. It consists of share capital, profits and reserves.

Perobelli and Famá (2002) suggest that there are two currents about the capital structure: the traditionalist and the conventional.

Brito (2006) comments:

Traditional theory holds that the capital structure influences the company's value. According to this trend, the cost of third party capital remains stable until a certain level of indebtedness, from which it rises due to the increased risk of bankruptcy. As the cost of capital from third parties is lower than the cost of equity, the company should be indebted to the point that its total cost of capital reaches a minimum level. This point would represent the optimal capital structure, which would lead to the maximization of the company's value.

Modigliani and Miller (1958) argue that it is irrelevant how the company is financed for its value. They claim that the cost of capital is the same regardless of the company's capital structure and, therefore, there is no optimal capital structure. Therefore, a company's value is generated by its cash flows and not by its capital structure.

There are advantages and disadvantages in choosing third party capital.

According to Machado (2009), the use of high indebtedness to compose the capital structure can be a competitive advantage when the applications of the resources originating from this loan are applied at a rate higher than the cost of the debt. Otherwise, the company may be unstable and compromising its cash flow.

Still for Marion (1997):

There is no doubt that, especially during inflationary periods, it is attractive to work more with Third Party Capital than with Equity Capital. This trend is accentuated when most of the Third Party Capital is made up of 'inexpensive liabilities', that is, liabilities that do not explicitly generate financial charges for the company (there is no interest or monetary correction: suppliers, taxes, social charges payable etc.).

In addition to the two theories, Myers (2001) grouped three other theories: *The Static Tradeoff Hypothesis*, *The Pecking Order Theory* and *Free Cash Flow*.

Myers (2001) says that the basic idea of “*The Static Tradeoff Hypothesis*” is that the Optimal Capital Structure is a tradeoff between the debt benefit (the tax advantage earned by the interest on the debt) and the relative costs of the debt itself (such as financial insolvency and agency costs).

However, Myers (2001) realized that in the Tradeoff theory, all participants have equal expectations, that is, that everyone has the same information and that changes in operating profit are random. Thus, in Pecking Order Theory, Myers fills in the gaps left by the Tradeoff Theory model and portrays that the preference for the companies' form of financing depends more on the opportunities. In this way, it traces a hierarchy in which there is a preference for the use of internal and external resources. However, the use of internal resources or debts would not generate significant reactions in the market because informational asymmetry would not be considered. Still for Myers, the use of shares occurs only when the administrators have information about the future of the company that are not owned by the market.

The free cash flow is not really a theory, but it warns Myers about the consequences of high debts.

In a later work, Modigliani and Miller (1963) analyzed the effect of taxes on the capital structure of companies. When exploring the question of the tax benefit generated by the use of

debts, due to the fact that interest is deductible in calculating corporate income tax, they came to the conclusion that a higher level of indebtedness would lead to an increase in its value.

However, the increase in debt puts pressure on the company's cash flows arising from the obligation to pay interest and amortize the principal, increasing the likelihood of bankruptcy. Therefore, the tax benefit that could occur in indebtedness, can be canceled by the increased risk of bankruptcy.

There is also another theory that has implications for capital structure: the agency theory.

Cunha (2011) believes that agency theory:

It is based on the relationship between principal and agent, whereby the first hires the second to perform some type of service. If each of them seeks to maximize its utility, the agent's actions do not always serve the interests of the principal, thus generating agency conflicts. Thus, optimal debt is defined by minimizing the total agency cost (sum of the agency cost of external equity and the agency cost of debt).

Thus, to manage potential conflicts of interest as a result of the agency relationship, shareholders may assume additional costs. The main costs are related to monitoring or reward.

### 2.3. Economic and financial analysis

According to Assaf Neto (1997), the decision-making process:

It reflects the essence of the Administration concept. To manage is to decide, and the continuity of any business depends on the quality of the decisions made by its managers at the various organizational levels. And these decisions, in turn, are made with the data and information made possible by Accounting, raised by market behavior and the company's internal performance.

Iudícibus (1998) considers some conditions for the analysis of an accounting statement to be effective:

- Accounting must be carried out efficiently and carefully.
- The financial statements need, if possible, to be audited by an independent auditor or by an internal audit.
- If possible, the statements should be corrected taking into account the purchasing power of the currency.

Iudícibus (1998) adds by saying that the first analysis should be done with summarized groups and in the problem areas, analyze in more detail.

Matarazzo (1998) financial analysis aims to use the information in the statements so that management makes better decisions.

Silva (2005) highlights that the analysis process basically has the following steps:

- **Collection:** Obtaining the financial statements and important information about the sector, product, technology, etc.
- **Conference:** Verify that the information is understandable, reliable and complete.
- **Preparation:** Reclassification of the statement as required by the analysis.

- **Processing:** The information is processed for issuing the analysis report.
- **Analysis:** Analysis of reports and information.
- **Conclusion:** Identification, ordering and presentation of the main points and recommendations.

Stickney (2010) comments that it is not possible to answer questions about a company's profitability and risk based only on the raw data of the financial statements. Comparing, for example, profit with liquid assets will generate more useful information. In this way, the analyst expresses relationships in the form of indexes or indicators by summarizing the data in a format that is more understandable and easier to interpret and compare.

## 2.4. Financial indicators

Matarazzo (1998) the relationship between accounts or group of accounts in the Financial Statements, which aims to highlight a certain aspect of a company's economic or financial situation.

Sato (2007) comments that normally, the indices are grouped into four major groups: liquidity indices, debt indices, activity indices and profitability indices.

The liquidity indices seek to measure the soundness of a company's financial base, that is, they show the company's solvency in the event of the closure of activities.

The debt ratios serve to define its capacity to honor the financial commitments assumed.

The profitability indexes show how much the investments yielded, what was the economic success. These indicators include profitability indicators on sales and stock analysis.

Activity indices measure the efficiency of asset utilization, being linked to the operating cycle such as inventory turnover, trade receivables and payables.

Matarazzo (1998) says that "the important thing is not the calculation of a large number of indexes, but of a set of indexes that allows to know the situation of the company, according to the desired depth of analysis". In addition, the researcher also mentions three basic ways of evaluating an indicator:

- Intrinsic significance: individual analysis of each indicator.
- Comparison of various periods: in order to reveal trends and opinions.
- Comparison with other companies' indicators: in order to compare standards.

### 2.4.1. Profitability

At the end of each fiscal year, the companies prepare the Statement of Income for the Year, which informs whether the partners' investments are being profitable.



However, Marion (2009) states that “in managing the company's scarce resources available, management may or may not be efficient. The success of this management will undoubtedly be measured by comparing the income for the year (obtained by the Income Statement for the Year) with the amount invested in Assets and / or with the capital invested by the owners (Shareholders' Equity) ”.

Here are some profitability indicators:

Table 1 - Profitability Indicators

Macro indicators	Indicators	Acronyms	Formulas	Concept	Researchers
Profitability	Return on Assets or Investment	ROA	Average Operating Income / Total Assets	measures a company's performance in using assets to generate profits, regardless of how it financed the acquisition of those assets.	Stickney (2010)
	Return on Equity or Shareholders	ROE	Operating Profit / Average Total Shareholders' Equity	measures the company's ability to generate returns, indicating how much the company makes a profit for each R \$ 1.00 of equity.	Azzolin (2012)
	Operating margin	MO	Operating Profit / Sales Revenue	measures the proportion of each monetary unit of sales revenue that remains after deducting all costs and expenses, not including interest, taxes and dividends on preferred shares.	Gitman (2004)

Source: prepared by the authors.

Therefore, profitability indicators such as Return on Assets, Return on Equity and Operating Margin will be used to assess the performance of the companies analyzed.

#### 2.4.2. Leverage

Garrison, Noreen & Brewer (2013) define financial leverage as “the result of the difference between the rate of return that the company obtains on investments in its own assets and the rate of return that the company has to pay its creditors”.

Dutra (2011) presents as an organization's leverage the degree of total indebtedness and adds that:

the lower the debt, the lower the risk that the company will be offering to the capital offerers. However, it must be considered that certain companies live very well with relatively high indebtedness, especially when the indebtedness has a long-term profile, or when the Short-Term Liability is not costly, but the result of an adequate management of terms with suppliers.

Table 2: shows the leverage indicators:

Macro indicators	Indicators	Acronyms	Formulas	Concept	Pesquisadores
Leverage	Degree of Financial Leverage	GAF	ROE / ROA	if the rate of return on the company's total assets exceeds the rate of return the company pays to its creditors, its financial leverage will be positive.	Garrison, Noreen e Brewer (2013)
	Degree of Total Debt	GE	Capital de Terceiros / Ativo Total	expresses the proportion of third party funds financing the Asset.	Dutra (2011)

Source: prepared by the authors.

The indicators proposed in this study will be part of the analysis to be built on the research methodology and its results transcribed in the Search Result section.

### 3. METHODOLOGY

The research methodology was outlined as follows: i) classification of the research; ii) data collection; iii) data interpretation.

#### 3.1. Search ranking

The research has a quantitative bias, as it will use variables extracted from the available financial statements seeking to measure the hypothesis that there is a relationship between leverage and profitability through numbers.

In the view of Sampieri (2006), the focus of quantitative research uses data collection and analysis to answer research questions and test previously established hypotheses, and relies on numerical measurement, counting and often using statistics to accurately establish a population's behavior patterns.

The research is also classified as a correlational study because of the evaluation between two concepts.

Sampieri (2006) states that quantitative correlational studies “measure the degree of relationship between two or more variables (quantify the relationships), that is, they measure each presumably related variable and then measure and analyze the correlation. Such correlations are expressed in hypotheses that are tested”.

#### 3.2. Data collect

The sample extracted was based on the companies listed on the São Paulo Stock Exchange (B3 - Brasil Bolsa Balcão).

B3 has 24 (twenty-four) institutions classified as “Bank”, however, 18 (eighteen) institutions were used in the research, as 6 (six) of them did not have enough information for the entire period analyzed. Institutions are:

Table 3 - Banks participating in the survey

BANESTES S.A. - BCO EST ESPIRITO SANTO	PARANA BCO S.A.
BCO ABC BRASIL S.A.	BCO INDUSVAL S.A.
BCO ALFA DE INVESTIMENTO S.A.	BCO MERCANTIL DE INVESTIMENTOS S.A.
BCO AMAZONIA S.A.	BCO MERCANTIL DO BRASIL S.A.
BCO BRADESCO S.A.	BCO NORDESTE DO BRASIL S.A.
BCO BRASIL S.A.	BCO PINE S.A.
BCO ESTADO DE SERGIPE S.A. - BANESE	BCO SANTANDER (BRASIL) S.A.
BCO ESTADO DO PARA S.A.	BRB BCO DE BRASILIA S.A.
BCO ESTADO DO RIO GRANDE DO SUL S.A.	ITAU UNIBANCO HOLDING S.A.

Source: prepared by the authors.

Subsequently, the four largest banks considered in Exame's report in relation to market value were also analyzed separately. They are Itaú Unibanco, Bradesco, Banco do Brasil and Santander.

To compose the research, annual data were analyzed over a ten-year period (2008 to 2017). From the sample, leverage and profitability indicators were calculated. Being them:

Profitability:

- Return on Assets:  $ROA = \text{Operating Profit} / \text{Average Total Assets}$
- Return on Equity:  $ROE = \text{Net Profit} / \text{Average Equity}$
- Operating Margin:  $\text{EBITDA (Earnings before interest, taxes, depreciation and amortization)} / \text{Financial Intermediation Revenue}$

Leverage:

- Degree of Financial Leverage:  $GAF = ROE / ROA$
- Degree of Total Indebtedness:  $\text{Funding of Third Parties (Liabilities, deposits, liabilities for repo operations, funds from exchange acceptances, bills)} / \text{Total Assets}$

### 3.3. Interpretation of data

To analyze the relationship between leverage and profitability, the statistical regression technique was applied.

Linear regression analysis is an equation that aims to estimate the value of one variable Y given the values of other variables X.

As there are more than one independent variable at work, the multiple regression technique was used. The regression function can be transcribed below:

$$Y_i = a + \beta_1 X_{2i} + \beta_2 X_{2i} \dots + e$$

Where:

- $a$ : the expected value of  $Y$  when variables  $X$  are null;
- $\beta_1$ : expected variation of  $Y$  when  $X$  increases by one unit keeping the other variables constant
- $\beta_k$ : expected variation of  $Y$  when  $X_k$  increases by one unit keeping the other variables constant
- $e$ : error that is not explained by the model

At work, the profitability indicators represent the dependent variables ( $Y$ ) and the leverage indicators represent the independent variables ( $X$ ).

For each profitability  $y$  variable, a regression model was assembled on an Excel spreadsheet where the significance of the model was tested using the  $F$  test with a 95% significance index. That is, when  $F$  was greater than 5%, the model is not significant and, therefore, does not explain the variable  $Y$ .

After the significance test, the variables were analyzed individually and also, the  $R$ -square that calculates the percentage that is not explained by the model.

## 4. PRESENTATION AND DATA ANALYSIS

### 4.1. Result for the total sample

To answer the research objective, the ANOVA test of the samples presented was performed to test the level of significance of the model.

Table 4 shows the test for the dependent variable ROA.

	$gl$	$SQ$	$MQ$	$F$	<i>Significance F</i>
Regression	2	0.00	0.00	0.38	0.686616
Residue	177	0.01	0.00		
Total	179	0.01			

Source: prepared by the authors.

As the  $F$  is greater than 0.05, it is concluded that the model is not significant and, therefore, cannot be considered.

Even with a model whose explanatory power is not significant, Table 5 presents the results of significance for each variable in the model.

TABLE 5 - Regression coefficients - ROA

	<i>Coefficients</i>	<i>Standard error</i>	<i>Stat t</i>	<i>value-P</i>
Intersection	0.00	0.00	0.81	0.42

GAF	0.00	0.00	0.58	0.56
GE	0.00	0.00	0.61	0.54

Source: prepared by the authors.

Analyzing the independent variables individually through Table 5, it is also found that they are not significant, as they have a p-value greater than 0.05.

Table 6, on the other hand, changed to the dependent variable ROE, as follows:

TABLE 6 - ANOVA for the ROE indicator

	<i>gl</i>	<i>SQ</i>	<i>MQ</i>	<i>F</i>	<i>Significance F</i>
Regression	2	0.00	0.00	1.64	0.20
Residue	177	0.18	0.00		
Total	179	0.18			

Source: prepared by the authors.

The result of multiple regression performed with the model that makes up the dependent variable ROE is shown in Table 6, in which the ANOVA test found a significance index greater than 0.05 and, therefore, the model is not significant, that is, it does not explain the relationship between ROE and GAF and GE independent variables.

Table 7 analyzed the variables individually and concluded that they are not significant, as they have a p-value greater than 0.05.

TABLE 7 - Regression coefficients - ROE

	<i>Coefficients</i>	<i>Standard error</i>	<i>Stat t</i>	<i>value-P</i>
Intersection	0.00	0.02	0.20	0.84
GAF	0.00	0.00	0.04	0.97
GE	0.04	0.02	1.80	0.07

Source: prepared by the authors.

The ANOVA test was applied to the Operating Margin, obtaining a significance index greater than 0.05 and, therefore, the model is not significant, as shown in Table 8.

TABLE 8 - Anova for Operating Margin indicator

	<i>gl</i>	<i>SQ</i>	<i>MQ</i>	<i>F</i>	<i>Significance F</i>
Regressão	2	0.04	0.02	0.57	0.56
Resíduo	177	6.15	0.03		
Total	179	6.19			

Source: prepared by the authors.

Then, the indicators were analyzed individually in Table 9 and it is concluded that they are not significant, as they have a p-value greater than 0.05.

TABLE 9 - Regression coefficients - Operating Margin

	<i>Coefficients</i>	<i>Standard error</i>	<i>Stat t</i>	<i>value-P</i>
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Intersection	0.05	0.11	0.44	0.66
GAF	0.00	0.00	0.64	0.52
GE	0.10	0.12	0.82	0.41

Source: prepared by the authors.

Table 10 presents the summary of the models. It is noticed that the models are not statistically relevant. The most significant model is the dependent variable ROE, as it has the largest R-Square (explanatory power) in the value of 0.01815, that is, the model explains the variable ROE in 1.8%.

TABLE 10 - Statistical summary of regression

<i>Regression statistics</i>	<i>MO</i>	<i>ROE</i>	<i>ROA</i>
Multiple R	0.08025	0.13473	0.06511
R-Square	0.00644	0.01815	0.00424
Adjusted R-square	- 0.00479	0.00706	-0.00701
Standard error	0.18645	0.03198	0.00619
Comments	180	180	180

Source: prepared by the authors.

Considering the data in Table 10, it was found that the Leverage indicators do not significantly explain the ROA, ROE and Operating Margin Profitability indicators, as they present values of 0.6%, 1.8% and 0.4%, respectively.

## 4.2. Result for the four largest banks

To complement the study, the models proposed for the four largest banks listed on Bovespa (Banco do Brasil, Bradesco, Itaú and Santander) were analyzed, according to Revista Exame.

Table 11 presents the ANOVA test whose proposed models involve the dependent variables ROA, ROE and MO, with the respective independent variables GAF and GE with data from the four largest banks.

TABLE 11 - ANOVA for 4 largest banks

	<i>gl</i>	<i>SQ</i>	<i>MQ</i>	<i>F</i>	<i>Significance F</i>
ROA	2	0.00	0.00	3.46	0.04
ROE	2	0.00	0.00	11.05	0.00
MO	2	0.03	0.02	3.39	0.04

Source: prepared by the authors.

It is concluded that the leverage indicators are significant with the three profitability variables (ROA, ROE and MO), because they have a significance index lower than 0.05.

Then, Table 12 presents the indicators individually for each of the three models.

TABLE 12 - Regression coefficients - 4 largest banks

		<i>Coefficients</i>	<i>Standard error</i>	<i>Stat t</i>	<i>value-P</i>
ROA	Intersection	0.01	0.01	1.01	0.32
	GAF	0.00	0.00	2.57	0.01
	GE	-0.01	0.01	-0.45	0.66
ROE	Intersection	- 0.21	0.05	- 3.88	0.00
	GAF	0.00	0.00	0.55	0.59
	GE	0.28	0.06	4.69	0.00
MO	Intersection	0.16	0.26	0.60	0.55
	GAF	0.00	0.00	2.60	0.01
	GE	- 0.01	0.29	- 0.04	0.97

Source: prepared by the authors.

When it comes to the variable ROA as a dependent variable, it is noticed that the independent variable that explains ROA in the proposed model is GAF, whose relationship between both variables is undefined, since the coefficient is 0.00; the independent variable GE is not significant.

When relating ROE to GAF and GE, it was found that GAF has a non-significant result because it has a p-value greater than 0.05; however, GE is significant with a positive relationship with ROE.

The model where MO is related to GAF and GE, it appears that GAF has a significant result to the relationship although it has an indefinite relationship (coefficient equal to 0.00); the independent variable GE is not significant in the model.

TABLE 13 - Statistical regression summary - 4 largest banks

<i>Regression statistics</i>	<i>ROA</i>	<i>ROE</i>	<i>MO</i>
Multiple R	0.40	0.61	0.39
R-Square	0.16	0.37	0.15
Adjusted R-square	0.11	0.34	0.11
Standard error	0.00	0.01	0.07
Comments	40	40	40

Source: prepared by the authors.

For the ROA variable, the model explains 16% of its variation. For the ROE variable, the model explains 37% of its variation. And for the Operating Margin variable, the model explains 15% of its variation.

The results found are in accordance with the study carried out by Mantovani (2012) that used data from 2001 to 2010 in which it shows the diversity of results obtained taking into account the size of the company.

## 5. CONCLUSION

The objective of this work was to verify the influence of financial leverage on the profitability of companies listed on B3 in the period from 2008 to 2017.

They were analyzed using multiple regressions, where the independent variables were the leverage indicators (Degree of Financial Leverage and Degree of Debt) and the dependent variables were those related to profitability (Return on Assets, Return on Equity and Operating Margin).

It was found that the models are not significant when the 18 (eighteen) B3 banking institutions are inserted and, therefore, the proposed independent variables do not explain the dependent variables.

However, when the cut is made with the four largest banks listed in B3, it appears that the leverage indicators are significant in order to explain the profitability variables.

The most significant model is the one that links ROE with the independent leverage variables, with 37% of explanatory power, with emphasis on the variable GE whose relationship is positive with ROE.

The diversity of the data shows us that there is no standard in the sector and that the size of the analyzed institution can influence whether or not leverage can be significant to explain profitability, although size was not used as a variable but as a criterion for choosing companies. institutions for analysis.

What can explain why leverage is significant for the profitability variation in large companies is that they have greater asset management, therefore, greater liquidity and can better use the use of third parties to lend at a higher rate and, therefore, obtain greater profitability.

This research suggests new variables for future studies, such as the size of institutions.

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