

# The influence of recession and macroeconomic variables on sectorial capital structure

Vanessa Rodrigues dos Santos Cardoso<sup>1</sup>

 <https://orcid.org/0000-0002-2124-2282>

Email: vanessarscardoso@hotmail.com

Marília Cordeiro Pinheiro<sup>2</sup>

 <https://orcid.org/0000-0002-0168-530X>

Email: marilia.cordeiro90@hotmail.com

<sup>1</sup> Universidade de Brasília, Faculdade de Economia, Administração, Contabilidade, Economia e Gestão de Políticas Públicas, Departamento de Ciências Contábeis e Atuariais, Brasília, DF, Brazil

<sup>2</sup> Independent researcher currently unaffiliated, Brasília, DF, Brazil

Received on 11.27.2018 – Desk acceptance on 01.28.2019 – 4<sup>th</sup> version approved on 09.09.2019 – Ahead of print on 01.31.2020

Associate Editor: Fernanda Finotti Cordeiro Perobelli

## ABSTRACT

The aim of this paper is to analyze the influence of the recent recession and of macroeconomic variables over the indebtedness in Brazilian industry sectors. The gap derives from the preference for investigating the reaction of capital structure according to economic sectors. However, it has to be considered that industry sectors react differently to variations in the economic context, since they have different optimal points of capital structure composition. The relevance of the chosen topic lies in carrying out a sectorial analysis of the effect of recession and of macroeconomic variables on capital structure composition, identifying the most sensitive sectors. It is also relevant in terms of being based on classical financial theories applied to the current context, in order to help predict the proportion of debt given fluctuations in a set of macroeconomic variables. Standing out among the main contributions of this article are the analysis of the level of indebtedness of Brazilian companies given the occurrence of recession and variations in the macroeconomy, identifying sectors that are most exposed to modifying their capital structure due to these factors. Six research hypotheses were formulated and tested using multiple linear regression, with two-stage fixed effects based on panel data collected from 211 companies, classified into six sectors, with data relating to the first quarter of 2010 up to the first quarter of 2018. The results revealed that the recent Brazilian recession was relevant for the capital structure of the sectors studied, with inflation only being significant for the health sector. The level of indebtedness of the basic materials sector was shown to be the most dependent on economic fluctuations and that of telephony and utilities was shown to be the least dependent. In addition, it was verified that the company-specific variables have greater relevance in determining capital structure compared to the macroeconomic ones.

**Keywords:** capital structure, macroeconomic variables, recession, economic sectors.

## Correspondence address

Vanessa Rodrigues dos Santos Cardoso

Universidade de Brasília, Faculdade de Economia, Administração, Contabilidade, Economia e Gestão de Políticas Públicas, Departamento de Ciências Contábeis e Atuariais

Campus Universitário Darcy Ribeiro, Bloco A-2 – CEP 70910-900

Asa Norte – Brasília – DF – Brazil



## 1. INTRODUCTION

Modern capital structure theory has its roots in the work of Modigliani and Miller (1958), who argue that the sources of financing are irrelevant to company value. The theory was a benchmark in corporate finance as it gave rise to an enduring debate on the existence or not of an optimal capital structure. Initially, the academic production focused on qualitative models, with the aim of creating other theories that oppose or converge with that of Modigliani and Miller. Currently, the quantitative models have become dominant, and there is more focus on discovering factors that influence the costs of the sources of capital (Hackbarth, Miao, & Morellec, 2006).

Among the factors that can alter a company's average cost of capital weighted by its capital structure are macroeconomic variables, due to their direct relationship with the risk factor (Chen, 2010). It should be considered that the different economic cycles have an impact on organizational cash flows, which produces effects on the organization's default risk and, consequently, makes raising funds more or less costly. In crisis situations, credit becomes scarcer and more costly, risks increase, and investment opportunities are limited, affecting companies' decisions (Harrison & Widjaja, 2014; Vithessonthia & Tongurai, 2015). At the same time in which banks face liquidity problems, companies are more wary of leveraging due to the concern about how indebtedness may be interpreted by the markets (Zeitun, Temimi, & Mimouni, 2017).

Despite the importance of macroeconomic variables when choosing the form of financing, they can cause different effects on the way the capital structure composition can vary in relation to fluctuations in the interest and exchange rates or gross domestic product (GDP), for example. Depending on the context and on the macroeconomic policy adopted, these variables may or may not be relevant to the proportion of organizational third-party capital. Various studies have been conducted with the aim of determining the effects of macroeconomic fluctuations on capital structure composition. Terra (2007) investigated the economic factors that determine the capital structure of companies from seven Latin American countries for the period from 1986 to 2000. The results show that macroeconomic variables are not relevant to the level of indebtedness, but rather that the idiosyncratic factors of each country are the main determinants of capital structure. Subsequently, Martins and Terra (2014) carried out another study concerning the theme for the period from 1996 to 2000, containing the same countries plus the United States of America. The authors found evidence

of the significance of the interest rate and inflation rate variables on company leverage. Bastos, Nakamura, and Basso (2009) also investigated the effects of economic indices on organizational capital composition, but for five Latin American countries, from 2001 to 2006. The results were only significant for GDP growth and this increasing company indebtedness.

Therefore, as it depends on aspects such as the analysis period, sample, methodology, and economic environment, the topic is still being widely explored and there is unlikely to be a consensus on which variables are in fact relevant to capital structure composition.

Based on this context, this article aims to analyze the effect of the recent recession and of macroeconomic variables over the capital structure of the different Brazilian economic sectors. As a specific objective, the paper seeks to identify the relationship between sectorial capital structure and firm-specific variables (expected growth, current liquidity, profitability, size, and tangibility of assets). To fulfill the aim of the research, a multiple linear regression model was defined, where the level of indebtedness was the dependent variable, represented by two indicators (one at book value and another at market value), as well as macroeconomic and firm-specific variables as explanatory variables. The sample is composed of 211 publicly-traded companies, classified into two groups depending on their expected behavior in economic cycles, divided into six subgroups, according to the Brasil Bolsa Balcão (B3) stock exchange classification. The period analyzed, from March of 2010 to March of 2018, captures expansionary economic cycles (in the period from July of 2009 to March of 2014, returning after December of 2016) and recessionary economic cycles (from April of 2014 to the end of 2016) according to the Committee for Dating Economic Cycles (Codace) of the Getúlio Vargas Foundation (FGV, 2015, 2017).

The study stands out by focusing on analyzing capital structure, aiming to identify how different sectors behave in terms of sensitivity to alterations in the macroeconomic scenario and specific factors. From a methodological standpoint, achieving that objective is facilitated by choosing to estimate models for each subsector separately, thus differentiating the study from others whose sectorial approach involved using binary variables included in the models. Finally, this study is relevant as it is based on classical theories of finance applied to the current context, in order to help predict the proportion of indebtedness given fluctuations in a set of macroeconomic variables.

Consequently, the article contributes to a potential extension of the implications for the theory, regulatory bodies, and companies belonging to different economic niches, due to it investigating the optimal capital point variable between industries.

## 2. THEORETICAL FRAMEWORK

### 2.1 Main Capital Structure Theories

In 1958, based on the theory of investment, Modigliani and Miller explored the relevance of capital structure to a company's value. The authors divided sources of capital into third-party and own capital. The capital structure theory developed was based on two propositions: proposition 1 argues that a firm's market value is independent of its capital structure, while proposition 2 states that the premium required by the asset is related to the financial risk of the company's debt; that is, the cost of own capital increases with leverage.

Although the theory from Modigliani and Miller (1958) has been important for financial research, the paper has undergone a series of criticisms due to the restrictions imposed, especially in regard to the absence of taxation in the model. As a response to these questions, Modigliani and Miller (1963) included the effect of taxes on capital structure. Considering that income tax is reduced by debt, unlike remuneration from own capital, a correction of the previous paper was made. Due to the tax benefit generated, in periods of high taxation, companies tend to increase their level of debt, which provides a reduction in capital cost and increases their value. However, it should be added that taxes should not be seen as the dominant force in determining capital structure.

The trade-off theory (TOT) refers to a set of theories that considers that, besides the tax benefit, companies should also consider the effects of the costs of indebtedness, mainly concentrated in bankruptcy and agency costs. A company is capable of achieving its optimal capital composition when the marginal benefit of debt equals the marginal cost. The most well-known approach derived from the TOT family is the static trade-off (STO), which determines that the level of indebtedness is defined by the trade-off between tax benefit and bankruptcy cost in a period. According to a rereading of Modigliani and Miller (1963), as companies increase their indebtedness, they reduce their tax burden and, consequently, generate relief for cash flow. However, the increase in indebtedness also

The article is divided into four more parts besides this introduction. The next section presents the theoretical framework. The methodology used and the results are presented in sections three and four, respectively. The last section provides the concluding remarks.

raises the bankruptcy costs divided into the administrative and legal costs of the company's default. Even if bankruptcy is avoided, these costs tend to reduce the company's value, considering that leverage is interpreted as a risk factor by the market (Myers, 1984, 2003).

Although the TOT plays an important role in the studies on capital structure, the theory does not provide any guideline regarding what the ideal capital composition would be and whether this depends both on firm-specific factors and factors related to the economy in which the firm operates (Hackbarth, Hennessy & Leland, 2007). Thus, various theories have been and are still being developed with the aim of filling the gap left. One of the most influential alternatives consists of the pecking order theory (POT), which presents two main differences in relation to the TOT: according to the POT, more profitable companies tend to take on less debt, since they prefer to use retained earnings to develop new projects. In contrast, the TOT approach follows the premise that high profitability provides more debt capacity by taking the advantage of tax benefits into account (Fama & French, 2002). The second divergence consists of the hierarchy in the form of companies' financing, since they primarily prefer to carry out investments using internal funds, followed by debts and, as a last resort, by issuing shares (Tong & Green, 2005). These differences occur due to the effect of the informational asymmetry between investors and agents inside the company. Internal agents issue shares when these are overvalued. Aware of the information asymmetry, investors discount the new and old shares traded, leading to an underestimation of the company's value and deterioration in the present value of the new investment (Fama & French, 2002; Myers & Majluf, 1984).

The comparison between the POT and TOT is widely explored in the academic literature (Harris & Raviv, 1991; López-García & Sogorb-Mira, 2008); however there is no consensus on what the prevailing theory would be for company capital structure. Considering that the choice of funding depends on a series of factors that range from the tax code applied to characteristics of the sectors to

which the companies belong, it is to be expected that there is no consensus among the results. Thus, research topics have been developed aiming to identify which factors are relevant to the choice of capital composition, especially considering macroeconomic variables, given that the choice of the form of funding varies over time due to alterations in its costs and access to it.

## 2.2 Capital Structure and Macroeconomic Variables

The effect of fluctuations in economic indicators on access to credit remains a controversial topic. Considering the classical theory, in periods of recession, companies face difficulties in taking out loans, primarily due to the reduction in the value of their assets, increasing risk aversion and, consequently, the premium required by the loan (Gertler & Kiyotaki, 2010). From a lenders perspective, especially that of banks, financial crises increase their restrictions on granting credit, reducing the supply of capital and, consequently, increasing the cost of it. Although this is a general rule, the way companies and banks are affected is heterogeneous, since it depends on factors that are intrinsic to them. Banks focused on loans to small and medium companies, for example, face the additional problem of granting guarantees, which tend to significantly increase in economically turbulent scenarios, as occurred in 2008. Another relevant characteristic is the timeframe of balance sheet items. Companies with long-term assets and short-term liabilities tend to have less exposure to risk during economic recessions, and their cost of access to credit is less affected (Stiglitz, 2018).

In regard to own capital, economic cycles also play a relevant role, where the relationship between macroeconomic variables and asset pricing is one of the most studied finance topics. Periods characterized by an economic expansion tend to favor returns on assets, which implies a reduced cost of own capital, given that stocks would theoretically be overvalued. Consequently, companies tend to take advantage of the market's optimism and increase the proportion of own capital (Alti, 2006). Despite this, the sensitivity of the percentage of own capital also depends on intrinsic factors. According to Korajczyk and Levy (2003), companies with fewer financial constraints (more cash flow, more growth opportunities, lower agency cost) tend to prefer debt in periods of recession and issuing shares in periods of economic expansion, while companies with more financial constraints prefer the opposite. This type of behavior is explained by the flight-to-quality theory, in which market

agents tend to offload more risky investments, which reduces the price of their stocks in the financial market.

Various studies have been conducted with the aim of identifying how the economic scenario interferes in companies' financing decisions in the context of not only developed markets, but also emergent ones, given that the latter tend to have unstable economies. Tsoy and Heshmati (2017) investigated the effect of the 1997 Asian crisis and the 2008 global crisis on companies' capital structure. The results showed that, during the first crisis, the share of third-party capital was significantly reduced, while in the 2008 crisis the opposite effect occurred. It was also verified that the level of debt depends on firm-specific variables, such as size, tangible assets, and earnings. Iqbal and Kume (2015) also analyzed the effect of the 2008 crisis on capital structure, but for the UK, France, and Germany. The authors found evidence of an increase in debt during the pre-crisis, but with a dampened effect in the subsequent scenario. Balios, Daskalakis, Eriotis, and Vasiliou (2016) carried out a study in the context of the economic crises that occurred in Greece. The authors found that the effect of the determinants of capital structure does not alter during the crisis scenario, but that economic growth is positively related with the level of leverage. Although the results are not uniform, the studies indicate that capital structure varies throughout the cycles between companies, given that access to financing resources tends to respond to fluctuations in the economic scenarios, directly affecting financial decisions.

## 2.3 Expected Research Results

With the aim of analyzing the effect of recession and of macroeconomic variables on the capital structure of the sectors of companies with shares traded on the B3, six hypotheses are formulated for empirical tests.

The research hypotheses were built based on the traditional theories of capital structure, such that the expected relationship between the macroeconomic variables and the total level of indebtedness was determined by considering previous empirical studies. Five indicators were used, with the aim of covering different macroeconomic risk factors.

The first formulated hypothesis tests the impact of GDP on the proportion of third-party capital. The TOT and POT diverge in terms of the expected sign, as the former is based on the growth of opportunities given an increase in GDP, while the latter is based on the increase in companies' internal profits. Based on the TOT, the expected sign is positive, since economic expansion favors opportunities for new projects, as well as reducing bankruptcy costs,

which encourages companies to increase their level of debt (Huang & Ritter, 2009). The POT predicts the opposite effect, by considering that economic growth benefits companies' cash flows, meaning they finance their projects with internal resources, given the hierarchy in the form of financing (Bastos et al., 2009; Terra, 2007).

The second hypothesis to be tested is that of the impact of an alteration in interest rates on capturing third-party funds. The interest rate is associated with the concept of risk. Given that the basic interest rate of the economy is normally adopted as a benchmark for the risk-free asset, the interest rate charged when granting loans to companies is expected to be higher than that (Staking & Babbel, 1995). The effect of interest on capital structure is another point of disagreement between the POT and TOT. An increase in interest rates incentivizes the issuance of shares due to debt being more expensive, which, from a POT perspective, presupposes a direct negative relationship. In light of the TOT, an increase in interest rates causes a reduction in the company's value and also its long-term debts, however the former consequence occurs in a more accentuated way compared to the latter, which tends to raise the proportion of third-party capital in the capital structure; that is, there is a positive though indirect relationship (Frank & Goyal, 2003; Medeiros & Daher, 2008).

The third hypothesis is related with inflation. According to the TOT, high inflation rates can reduce the real cost of financing, encouraging the firm to increase its indebtedness (Frank & Goyal, 2009; Zeitun et al., 2017); that is, higher inflation has a positive effect on indebtedness, since companies choose to extend their debt, considering that the real values of the tax benefits are higher in this case. In contrast, using the interest rate as a tool for controlling prices, through the use of contractionary monetary policy, means a rise in interest rates inhibits consumption and, as a consequence, reduces the supply of capital in circulation (Galí, 2015). According to the law of supply and demand, capital becomes more expensive and the cost of raising funds increases. According to the POT approach, the relationship between debt and inflation is negative due to the economic uncertainty generated in inflationary scenarios, which deters companies from taking out long-term debts (Fan, Titman & Twite, 2012). Thus, capturing third-party resources becomes more costly, as well as consequently increasing the company's bankruptcy costs (Gungoraydinoglu & Öztekin, 2011).

The fourth hypothesis corresponds to the effect of the dollar on the level of participation of third-party capital. The effect of the exchange rate on the cost of third-party capital is associated not only with capturing

foreign funds as a source of financing, but also with the perception of the internal risk in the face of external investors. The POT and TOT provide guidelines regarding the expected effect of the exchange rate on the debt level of companies, by assuming that this can be taken as a proxy for the country risk. From the POT perspective, the exchange rate has a negative relationship with the level of indebtedness due to two factors. Firstly, as expected, a devaluation in the local currency makes foreign debt more costly. In addition, the connection between the exchange rate and debt is also related with the agency theory, since, considering their association with country risk, agency costs become greater, which makes foreign lenders demand more returns on the debt. From the TOT perspective, the relationship between the level of debt and the exchange rate depends on a third factor, which consists of the local interest rate. The greater the difference between the interest rate and the exchange rate, the greater the level of indebtedness via foreign capital (Allayannis, Brown & Klapper, 2003).

The fifth hypothesis is that of the impact of the stock market on indebtedness. The capital market relationship is primarily addressed by the market timing theory, which refers to the practice of issuing shares at a high value and buying them back at low cost. This theory is associated with capital structure due to the fact that companies prefer issuing shares to issuing debt in periods in which investors are optimistic about future gains (Baker & Wurgler, 2002). Thus, according to market timing, the level of debt of companies is inversely proportional to the performance of the financial market, due to the reduced cost of own capital. When the analysis is made in light of the TOT, although at first a market boom has a negative relationship with the share of third-party capital, as companies gradually adjust to their optimal point of indebtedness, positive shocks do not have the long-lasting and impactful effect foreseen by market timing (Alti, 2006; Mahajan & Tartaroglu, 2008).

Finally, the effect of recession on capital structure will be tested. The variable seeks to capture the changes occurring in the Brazilian macroeconomic environment in general, considering the economic recession that took hold in Brazil in the period from April of 2014 to December of 2016, according to the FGV (2015, 2017).

According to the POT guidelines, positive economic shocks make the costs of dividing risk between internal and external agents lower than the costs of an internal incentive, which motivates companies to gradually replace debt with share issuances. For negative economic shocks, this effect is reversed and the agency costs become greater than the incentive costs. Thus, for a company to be able

to maintain its minimum cash flow at a lower cost, the proportion of debt grows in relation to the proportion of own capital. Hence, the relationship between leverage and economic expansion would be negative, but positive in relation to a recession, since this behaves in a counter-cyclical way (Levy & Hennessy, 2007). According to the TOT, the expected effect is the opposite, since turbulent economic scenarios are directly linked to financial volatility, which consequently affects the default risk and increases the costs of taking on debt. In this context, economic contractions increase the risk of default and, consequently, the bankruptcy cost, reducing the company's debt incentive (Hackbarth et al., 2006).

With relation to the sectorial analysis, the behavior of the level of indebtedness is expected to vary between the economic subsectors, considering their intrinsic particularities, such as demand/supply relationships or taxation, for example. Simply, considering the essence of the article, the sectors were divided according to their sensitivity to macroeconomic fluctuations into two large groups: cyclical and non-cyclical. The cyclical sectors' activities are more sensitive in relation to the economy in the occurrence of an expansion or recession. This group included the pro-cyclical sectors that have a direct relationship with economic expansion, since they are companies that respond in the short term to variations in income. Thus, they are companies that are vulnerable to economic recessions, since they sell less in unfavorable economic scenarios (Pindyck & Rubinfeld, 2014). The non-cyclical sectors, in turn, are not as exposed to economic fluctuations. They are companies that produce inelastic goods, such as goods linked to health or with natural monopoly characteristics (electrical energy, fixed telephony, gas, water, and sanitation), for example, and because of this they do not tend to experience alterations due to modifications in income (Pearce & Michael, 2006). The counter-cyclical sectors were included in this group, which are those that benefit when there is an economic retraction, and may even have positive performance, considering that the prices of the goods tend to increase, which leads to revenue growth. Therefore, based on the characteristics of the economic sectors, in light of the TOT, the subsectors belonging to the cyclical sector are expected to increase their debt given economic variations that characterize expansionary scenarios: an increase in GDP, a reduction in the interest rate, a reduction in the exchange rate, and a financial market boom. This factor occurs due to the determination of the theory that an

increase in earnings implies that a company would have a greater volume of taxable income which, in turn, would decrease with the increase in debt, resulting in a lower financial risk and, consequently, lower costs (Myers, 2003). In contrast, following the same logic, in the occurrence of a recession, debt is expected to be reduced.

Care should be taken in relation to growth in the inflation rate, which is characteristic of an economic expansion, since, as described, the cyclical industry is more sensitive and has less price-demand elasticity given an alteration in prices. With this, although the TOT predicts a positive relationship between inflation and debt, the initial impact on the cyclical sector is expected to be positive, however the coefficient is expected to decrease with the continued inflationary increase and its effect on company revenue and cash flow.

When the POT is considered, indebtedness is expected to present a negative relationship with GDP, the stock exchange index, and inflation, since, according to the theory, companies tend to increase their debt when they do not have sufficient cash flow to cover their investments. As the sector benefits from economic expansion, the companies will need fewer external funds in its occurrence. The reasoning is inverted in the case of an economic retraction, for which reason a positive relationship with the interest rate, exchange rate, and recession variables is expected.

For the non-cyclical sector, the analysis is more complex, given that the goods and services supplied are independent of macroeconomic fluctuations, and may even react positively in recessionary scenarios. Health and basic food industries, for example, present low elasticity, since their consumption remains independent of price variations (Pearce & Michael, 2006). Thus, considering the economic theory of supply and demand, GDP, interest rate, exchange rate, and financial market macroeconomic variables are not expected to be significant for the sector's level of debt, such that these have other determinants of capital structure.

For inflation, considering the low elasticity of the goods of this sector, it is expected to present a positive relationship in light of the TOT, since by maintaining a constant demand and increasing the prices of the goods, earnings grow and, consequently, companies are encouraged to raise third-party funds in the search for tax benefits. From the POT perspective, the expected sign is negative, given that profitable companies have sufficient funds to carry out their investments.

### 3. METHODOLOGY

The subsections below describe the criteria for selecting the sample, the model, and the method used to fulfill the aim of the research.

#### 3.1 Sample

The sample was made up of all the companies with shares listed on the B3, classified by economic subsector according to the criterion established by the exchange itself. The following companies were excluded from the sample: (i) ones that did not present sufficient data for

analysis; (ii) ones that presented negative net equity during the sampling period; and (iii) ones belonging to the financial sector due to them having specific regulations, which leads to a different capital structure in relation to other sectors. In order to ensure more diversification and a better quality sample, subsectors with fewer than 10 companies were not considered. According to these criteria, 211 companies and six subsectors were chosen, as shown in Table 1. The source of the accounting data on capital structure was the database of the Thomson Reuters Eikon software.

**Table 1**

*Economic subsectors –Brasil Bolsa Balcão (B3) classification*

Sector	Industry	Characteristics	Sample (n)
Cyclical consumption	Cyclical consumption (CC)	Fabrics, clothing, and footwear; commerce; travel and leisure; media; civil engineering; domestic utilities; hotels and restaurants; automobiles and motorcycles.	61
	Industrial goods (IG)	Machinery and equipment; transport; services, construction, and engineering; transport material; commerce.	42
	Basic materials (BM)	Mining; chemicals; wood and paper; steelmaking and metallurgy; various materials; packaging.	27
Non-cyclical consumption	Non-cyclical consumption (NCC)	Products for personal use and cleaning; drinks; processed foods; agricultural; commerce and distribution.	20
	Health (HE)	Medical-hospital services and diagnostic analyses; equipment, medicines, and other products; commerce and distribution.	13
	Telecommunications and public utility (TU)	Electrical energy; water and sanitation; gas; telecommunications.	48
Total			211

**Source:** *Elaborated by the authors.*

The choice of period, from March of 2010 to March of 2018, took into consideration Brazil's adoption of the new international accounting standards as of 2010, according to Instruction n. 457/2007 of the *Comissão de Valores Mobiliários* (CVM, 2007), the Brazilian capital market regulator, as well as the availability of quarterly data, as disclosed by the companies.

This interval captures different economic cycles since, according to the FGV (2015), there was a period of economic expansion of 20 quarters, occurring from July of 2009 to March of 2014, and another recessionary period, from the second quarter of 2014, which lasted up to the end of 2016 (FGV, 2017). The Brazilian Institute of Geography and Statistics (IBGE) corroborates this assessment by finding that, from 2009 to 2011, the Brazilian economy experienced an economic expansion,

entering into the post-expansion period by 2013. In 2014, the growth indices started decreasing, reaching a negative value at the end of 2015, a period characterized as a recession. According to the FGV, which has carried out measurements since 1980, the recession of the period from 2014 to 2016, together with the one occurring from 1989 to 1992, was one of the longest since the start of the series, with a cumulative loss of 8.6% of GDP in 11 quarters. However, the institution identified the occurrence of a trough in the Brazilian business cycle in the fourth quarter of 2016, which represented the end of the recession and the country's entry into a period of expansion starting in 2017 (FGV, 2017).

The macroeconomic variables data were collected from the webpages of the IBGE, the Central Bank of Brazil (BC), and the Applied Economic Research Institute (IPEA).

### 3.2 Model Definition

The use of data from different companies and periods enabled the panel data analysis, which allows for the incorporation of cross-sectional and time series information. By using this technique, it is implicitly assumed that the values of the variables and the relationships between them are constant over the time and cross-sectional units of the sample. Among the advantages is the fact that the combination of data helps to reduce multicollinearity problems, it avoids the loss

of degrees of freedom, and it reduces the impact of omitted variables.

Capital structure, the dependent variable, is composed of the proportion of own and third-party capital in the company's capital composition. For the purposes of this study, it is defined by the share of third-party capital in total capital. Based on the previous literature, the total book value of debt and total market value of debt were used as dependent variables (Cook & Tang, 2010; Frank & Goyal, 2009; Korajczyk & Levy, 2003; Lemmon, Roberts & Zender, 2008), which were calculated as specified in Table 2.

**Table 2**

*Dependent variables*

Variable	Formula
Book value of debt (DB)	$= \frac{\text{current liabilities} + \text{long-term liabilities}}{\text{total book value of assets}}$
Market value of debt (DM)	$= \frac{\text{current liabilities} + \text{long-term liabilities}}{\text{current liabilities} + \text{long-term liabilities} + \text{market value of net equity}}$

**Source:** *Elaborated by the authors.*

Thus, although the main objective of the research is to evaluate the relationship between the dependent variable, capital structure, and the macroeconomic independent variables, common to all the companies over time, firm-specific cross-sectional control variables were included, also with evolution in the same period, so that no inconsistent results were obtained due to the absence of data from the cross sections. The control variables were chosen based on the review of the previous literature

(Bastos et al., 2009; Erel, Julio, Kim & Weisbach, 2011; Frank & Goyal, 2009; Korajczyk & Levy, 2003; Martins & Terra, 2014; Nakamura et al., 2007; Terra, 2007).

The hypotheses for the signs of the angular coefficients according to the POT and TOT are presented in Table 3. However, although they are not the main focus of the research, these variables enabled it to be identified whether the sectors behave in a different way from that foreseen by the theories.

**Table 3**

*Specific variables*

Variables	Formula	Expected sign	
		POT	TOT
Expected growth (Market-to-Book - MTB index)	$\frac{\text{market value}}{\text{book value of net equity}}$	+ / -	-
Current liquidity (LIQ)	$\frac{\text{current assets}}{\text{current liabilities}}$	-	
Profitability (return on assets - ROA)	$\frac{\text{operating profit}}{\text{total assets}}$	-	+
Size (SIZE)	logarithm of total revenue	+ / -	+
Tangibility (TANG)	$\frac{\text{fixed assets}}{\text{total assets}}$	+	+

*POT = pecking order theory; TOT = trade-off theory.*

**Source:** *Elaborated by the authors.*

Using panel data, some studies on capital structure in Brazil, such as Bastos, Nakamura, and Basso (2009), Bastos and Nakamura (2009), and Martins and Terra (2014), have included economic sectors as binary variables in their regressions, with the aim of verifying whether capital structure is sensitive to the type of subsector in

which companies operate. In this aspect, this study differs by estimating the models separately for each sector, so that the sensitivity and the relationship between capital structure and the explanatory variables can be verified and compared by subsectors. To fulfill the aim of the research, equation 1 was defined.

$$DB_{it} = \beta_0 + \beta_1 GDP_t + \beta_2 INT_t + \beta_3 INF_t + \beta_4 EXC_t + \beta_5 IBOV_t + \beta_6 REV_t + \beta_7 MTB_{it} + \beta_8 LIQ_{it} + \beta_9 ROA_{it} + \beta_{10} SIZE_{it} + \beta_{11} TANG_{it} + \mu_{it} \tag{1}$$

in which  $DB_{it}$  is the level of indebtedness for each company  $i$  in period  $t$ , assuming the definitions of DB (book value of debt) or DM (market value of debt),  $GDP_t$  is the quarterly variation over the same quarter of the previous year in GDP at market prices, deseasonalized in period  $t$ ,  $INT_t$  is the quarterly variation in the annual interest rate of the Special System for Settlement and Custody (Selic) deflated by the Extended National Consumer Price Index (IPCA) in period  $t$  or  $t-3$ ,  $INF_t$  is the quarterly variation in the annual inflation rate measured by the IPCA in period  $t$ ,  $EXC_t$  is the quarterly variation in the annual effective real exchange rate (IPCA) in period  $t$ ,  $IBOV_t$

is the real quarterly variation in the annual return on the Bovespa index (Ibovespa) in period  $t$ ,  $REV_t$  is the dichotomous variable indicative of a recession, assuming 1 in the period from April of 2014 to December of 2016 and 0 for the other periods,  $MTB_{it}$  is the control variable “expected growth” for each company  $i$  in period  $t$ ,  $LIQ_{it}$  is the control variable “liquidity” for each company  $i$  in period  $t$ ,  $ROA_{it}$  is the control variable “profitability” for each company  $i$  in period  $t$ ,  $SIZE_{it}$  is the control variable “size” for each company  $i$  in period  $t$ ,  $TANG_{it}$  is the control variable “tangibility” for each company  $i$  in period  $t$ , and  $\mu_{it}$  is the random error of the regression.

## 4. RESULTS ANALYSIS

### 4.1 Descriptive Statistics

The evolution of the macroeconomic variables by economic cycle presented in Table 4 enables it to be determined that the longest recessionary period recorded in Brazil since 1980 (FGV, 2017), lasting 11 quarters, was characterized by a retraction of economic activity combined with high interest, exchange, and

inflation rates in relation to the previous and subsequent periods. The stock market, which already presented a negative average return before the recession, presented low nominal performance (becoming negative when deflation is discounted) in the recessionary period, with a considerable improvement after the reversion of the economic cycle to expansion starting in 2017, as found by the FGV (2017).

**Table 4**  
*Evolution of the macroeconomic variables by economic cycle*

Mean per period	GDP	INT	EXC	INF	IBOV
Expansion: January/2010 to March/2014	4.09%	9.63%	2.27%	5.88%	-6.36%
Recession: April/2014 to December/2016	-2.66%	13.09%	5.61%	8.17%	4.29%
Expansion: January/2017 to March/2018	1.03%	8.85%	-2.03%	3.15%	24.46%
Mean: January/2010 to March/2018	1.37%	10.69%	2.34%	6.25%	5.99%

*EXC: effective real exchange rate variation; IBOV: return on the Bovespa index (Ibovespa); INF: inflation measured by the Extended National Consumer Price Index (IPCA); GDP: variation in gross domestic product; INT: variation in the interest rate of the Special System for Settlement and Custody (SELIC).*

**Source:** Elaborated by the authors based on data from the FGV (2017).

Table 5 shows that the lowest mean indebtedness was presented by the health subsector and the highest was

presented by the industrial goods subsector, both for the book value indicator and the market value one.

**Table 5***Descriptive statistics of the dependent variables [book value of debt (DB) and market value of debt (DM)]*

	Subsector	DB	DM	MTB	LIQ	ROA	SIZE	TANG
Mean	IG	0.291	0.264	1.155	1.335	3.552	9.570	0.515
	CC	0.293	0.254	2.354	2.272	3.275	9.056	0.364
	NCC	0.324	0.261	2.836	1.781	3.357	9.588	0.463
	HE	0.263	0.151	2.609	1.874	-1.326	9.185	0.257
	BM	0.308	0.299	1.275	2.461	2.107	9.318	0.698
	TU	0.373	0.308	2.390	1.578	2.470	8.964	0.514
Standard deviation	BI	0.189	0.150	4.360	1.688	12.185	0.704	0.513
	CC	0.188	0.183	3.564	1.353	12.412	0.663	0.353
	CNC	0.191	0.186	5.718	3.504	12.685	0.873	0.246
	HE	0.519	0.117	2.510	0.908	24.610	0.791	0.157
	BM	0.192	0.180	1.115	1.817	6.304	0.794	0.253
	TU	0.305	0.176	6.263	0.964	7.520	0.736	0.303

**Note:** The subsectors are described in Table 1 and the variables are described in Table 3.

**Source:** Elaborated by the authors.

The area of health was also the one that presented the greatest dispersion of DB. Among the specific variables, observing the mean for the period, the greatest expected growth (MTB) was that of the non-cyclical consumption sector. The basic materials subsector presented the greatest current liquidity. The highest profitability was that of the industrial goods and the lowest, negative one was that of health, which also presented the greatest dispersion in this aspect. With relation to size, the biggest subsector is that of non-cyclical consumption and the most tangible one is that of basic materials.

## 4.2 Preliminary Tests

To verify the risk of multicollinearity, the first test was the correlation matrix between the variables for which a correlation greater than 0.8 was not identified, which according to Gujarati and Porter (2011) reveals a relevant risk. However, the variance inflation factor (VIF) analysis ( $VIF = (1 - R_k^2)^{-1}$ ) enables a more robust investigation regarding the question of multicollinearity. According to this test, when the VIF of the dependent variable, in relation to the other variables, is greater than 4, a more in-depth analysis is necessary. The results of the VIF tests indicated a weak possibility of the existence of multicollinearity, with indicators lower than 3 for all the variables. In addition, the hypothesis of the existence of a unit root was rejected for all the series by the augmented Dickey-Fuller (ADF) Fisher test.

Initially, all the estimations were carried out using the ordinary least squares (OLS) method with fixed effects together with the covariance of the seemingly unrelated

regressions (SUR) coefficients (panel corrected standard error – PCSE) cross-sectional method to control problems of heteroscedasticity and autocorrelation. Since there are three forms of panel data estimation (pooled regression, fixed effects, and random effects), the first step to support the most suitable choice was to carry out the redundant fixed effects test, whose null hypothesis is that the fixed effects are significant, which if confirmed indicates that the best method is pooled regression. The null hypothesis was rejected in all the cases, which indicates the pooled regression is not suitable.

Due to choosing the estimation by cross-sectional SUR (PCSE), the Hausman test was not carried out to support the choice between fixed and random effects, since the premises of that test are not compatible with the SUR estimation. However, all the estimations were also carried out with random effects, and what was observed was a small variation in the results in relation to the significances and signs of the angular coefficients, but a lower  $R^2$  in all cases. Thus, only the results of the fixed effects estimations are presented for analysis.

To check for simultaneity problems, the correlation between the random error terms of all the regressions and the dependent variables was verified, finding that some variables could be endogenous. For that reason, the estimations were carried out again using two-stage least squares with fixed effects and a SUR matrix. The exception was the BM subsector, in which no correlation of the error term with the dependent variable was verified, for which reason the models were estimated by OLS. Two models were estimated for the six economic subsectors already described: one with each dependent variable (DB and DM).

More details should be provided in relation to the interest rate variable, a monetary policy instrument used by the inflation targets regime in effect in Brazil. Taylor (1995) defines as a monetary transmission mechanism the process by which monetary policy decisions are transmitted to the real economy. Tomazzia and Meurer (2009) evaluated the monetary policy transmission mechanism in Brazil by sectors, identifying that the maximum effect of the reaction of the non-durable consumer goods subsector occurred between the eighth and the ninth month after alternations in the Selic. In the durable consumer goods, capital goods, and intermediate goods subsectors, the maximum effect took place between four and ten months, in six months, and between six and nine months, respectively. These findings corroborate the affirmation of the Brazilian monetary authority, which states that the effects of monetary policy are lagged (Central Bank of Brazil [BC], 2016).

In light of these findings, also in another context, that of capital structure, if the tests initially without a

lag did not find statistical significance of the interest rate variable, estimations were carried out with up to four lagged periods, where the best results were found with a lag of three periods (nine months) in the regressions with the DB dependent variable (basic materials and telecommunications and public utilities subsectors) and DM dependent variable (industrial goods, health, basic materials, and telecommunication and public utilities).

### 4.3 Empirical Results

Table 6 presents the results obtained based on the estimation of subsectors using fixed effects. It is verified that the global significance of all the models was proven by the F statistic at the 1% level. The statistical significance of the angular coefficient in most of the regressions demonstrates that there may be relevant variables for the behavior of capital structure that are different from those investigated in this study.

**Table 6**  
*Results of the estimations – Subsectors*

	Book value of debt (DB)						Market value of debt (DM)					
	Cyclical consumption			Non-cyclical consumption			Cyclical consumption				Non-cyclical consumption	
	IG	CC	BM	NCC	HE	TU	IG	CC	BM	NCC	HE	TU
C	-2.739 **	-0.11	0.956 **	-1.308 ***	1.761	0.596 **	-0.364	-0.486 **	1.724 ***	-0.44	1.631 ***	-0.379 **
GDP	0	0	-0.001 **	0	0	0	-0.001 **	0	-0.001 **	-0.001 *	0	0
INT <sup>1</sup>	0.016	0.004	-0.038 ***	-0.003	0.012	-0.03 *	-0.048 ***	0.009	-0.031 **	0	-0.069 ***	-0.025 **
EXC	-0.043	-0.053 **	0.113 ***	0.076 ***	0.276 **	-0.016	0.13 ***	0.025	0.103 ***	0.102 ***	0.185 ***	0.041 *
INF	0.085	-0.222	0.077	0.061	-2	-0.59	0.235	0.185	-0.133	0.224	-1.472 **	-0.128
IBOV	0.082	-0.108 ***	0.193 ***	0.041	0.03	-0.032	0.13 ***	-0.051 *	0.153 ***	0.076 **	0.111 *	0.007
REV	0.033	0.008	0.064 ***	0.032 ***	0.088 *	0.043 **	0.084 ***	0.035 ***	0.088 ***	0.029 **	0.117 ***	0.056 ***
MTB	0	0.002	0.027 ***	-0.002 **	0.011	0	-0.001 ***	-0.002	-0.017 ***	-0.002 **	-0.002	-0.002 **
LIQ	-0.008	-0.016 ***	0.006 *	-0.001 **	0.065 ***	0.024	0.009 *	-0.016 ***	0.003	-0.002 **	0.01	0.005 **
ROA	-0.01 ***	-0.003 ***	-0.004 ***	-0.002 ***	-0.016 ***	-0.011 ***	-0.007 ***	-0.003 ***	-0.004 ***	-0.003 ***	-0.001 **	-0.003 ***
SIZE	0.355 ***	0.053	-0.077 *	0.169 ***	-0.224	-0.03	0.079 **	0.086 ***	-0.152 ***	0.074 **	-0.153 ***	0.067 ***

**Table 6**

Cont.

	Book value of debt (DB)						Market value of debt (DM)					
	Cyclical consumption			Non-cyclical consumption			Cyclical consumption			Non-cyclical consumption		
	IG	CC	BM	NCC	HE	TU	IG	CC	BM	NCC	HE	TU
TANG	-0.092	-0.061	0.015	0.019	1.845	0.021	-0.124	-0.052	0.012	-0.026	-0.111	-0.002
	**	*			***	*	***	**				
R <sup>2</sup> Adj.	0.31	0.78	0.905	0.867	0.921	0.715	0.845	0.837	0.864	0.834	0.797	0.809
F stat.	8.41	59.51	134.78	84.36	94.68	38.16	85.48	85.61	90.09	65.11	35.85	64.1
Prob.	0	0	0	0	0	0	0	0	0	0	0	0
Obs.	808	1,104	507	358	201	704	757	1,104	572	358	192	704

**Note:** The subsectors are described in Table 1 and the variables in tables 3 and 4. Two-stage estimations, except for BM, in which ordinary least squares were used. Instruments: C, GDP, INT, EXC, INF, IBOV, REV, MTB, LIQ, ROA, SIZE, TANG, GDP(-1), INT(-1), EXC(-1), INF(-1), IBOV(-1), REV(-1), MTB(-1), LIQ(-1), ROA(-1), SIZE(-1), and TANG(-1).

<sup>1</sup> = INT variable lagged by three periods in the models with DB (BM and TU subsectors) and DM (IG, HE, BM, and TU subsectors).

\*\*\*, \*\*, \* = level of significance of the parameters at 1, 5, and 10%, respectively.

**Source:** Elaborated by the authors.

Initially, considering the 5% significance level, it is noted that the explanatory variables had a greater influence for DM than for the book value of debt. The possible explanation would be that the former is more susceptible to external fluctuations as it captures the expectations for growth or a reduction, while the latter reflects the assets already belonging to the company (Barclay, Smith & Morellec, 2006). The percentage of significant variables for the two debt measurements was greater for the group of specific factors, when compared with the macroeconomic factors. The results are consistent with those of Kayo and Kimura (2011) and Bernardo, Albanez, and Securato (2018), which suggest greater relevance of the characteristic aspects of companies due to their dynamicity and volatility, considering that economic indices tend to be more stable and long-lasting and may not immediately affect the optimal leverage level.

Among the macroeconomic indicators, recession was the most significant variable for sectorial capital structure, while inflation was the least relevant. Regarding the specific indicators, profitability was significant for all the subsectors and debt measurements, but growth and liquidity had the lowest number of significant coefficients.

GDP was significant for the market value of debt of the basic materials subsector and for both debts of the industrial goods subsector. For both, the coefficient was negative, indicating a preference for the use of internal funds as a form of financing due to the growth of these in the case of an economic expansion, which is sustained by the POT.

This result was expected from the viewpoint of the cyclical behavior of these two subsectors, together with that of cyclical consumption, which was not confirmed. It is noted that, for the non-cyclical subsectors, non-significance of GDP was expected, which was confirmed, given that companies are involved whose performance is barely influenced by macroeconomic variations, which is reflected in their financing decisions. In general, the results are consistent with those of Terra (2007), and there is little evidence of the explanatory power of this variable in regard to fluctuations in the levels of debt of the sectors.

The interest rate was significant for the industrial goods, basic materials, health, and telecommunications and public utilities subsectors, assuming negative coefficients, also converging with the POT. According to the theory, interest rates have a negative effect, considering that companies reach their debt capacity more quickly.

In light of the economic theory regarding the income elasticity of demand, it is observed that the statistically significant results support what was expected for the cyclical subsectors (industrial goods and basic materials), which have a negative relationship with an increase in interest rates, and for the non-cyclical consumption sector, for which it was expected that there would be no influence of interest rates on debt. Non-significance of the relationship between the interest rate and debt was also expected for the health and telecommunications and public utilities subsectors, which could not be found in the results. One possible explanation may be related to the fact that many subsectors, whose demand is inelastic, have

regulated tariffs or revenues, which ensures the stability of their cash flows, even in adverse economic conditions. This may guarantee that, at times of high interest rates, such companies manage to reduce their debt. In fact, the findings of the Institute for Applied Economics (IPEA, 2015) show that, even when the crisis had taken hold in the country, the activities of the electricity and gas, water, sanitation, and urban cleaning sectors rose by 1.1% in 2015, proving the relative macroeconomic insensitivity of these subsectors.

Another explanation regarding the behavior of capital structure in relation to interest rates may be given by Keynesian theory, in which an increase in the interest rate adopted by the monetary policy is used for the purpose of containing inflation, reducing the capital in circulation and, consequently, increasing the cost of capturing it.

The inflation variable showed little explanatory power in relation to the level of indebtedness, contrary to expected, given that, considering the relationship between consumption and inflation, companies belonging to the subsectors directly related to consumption would be expected to be affected. Terra (2007) explains that a large portion of debt contracts are linked to a price index, so that inflation interferes little in the leverage guidelines. With relation to the subsectors, inflation was only significant for that of health, with a negative coefficient, again corroborating the POT and the economic theory, since, considering that health goods present low elasticity of demand, the companies tend to benefit from a rise in prices.

The exchange rate was only not significant for the book value of debt of the industrial goods and telecommunications subsectors and the market value of debt of the cyclical consumption subsector. Contrary to expected, the relationship was mostly positive, which is not consistent with any of the theories presented. This effect may be explained by the devaluation of the real against the dollar, which incentivizes the inflow of foreign capital into the internal market. However, this analysis is limited when considering that the composition of the sample did not take into account the differentiation of companies financed by foreign capital. In addition, in regard to the cyclical subsectors, the fact that the variable is significant for the industrial goods and basic materials segments, but not for the cyclical consumption subsector, may be a reflection of some differentiation of the influence of exports, both on the revenue and cash flow and on the debt in foreign currency of the first two subsectors in relation to the third, given that, in this case, there would be exchange rate protection provided by the compatibility of flows in the same currency. As for the non-cyclical

sectors, whose positive relationship between the exchange rate and debt was not expected, a possible reason may be related to imports of equipment, access to lines of credit in foreign currency, or even some part of their cost being linked to the foreign currency, since these subsectors are apparently more dedicated to attending to internal consumption (health and network industries).

The stock market's performance was significant for the market value of the debt of the industrial goods, basic materials, cyclical consumption, non-cyclical consumption, and health subsectors, as well as for the book value of the debt of cyclical consumption and basic materials. The coefficients were also mostly positive, unlike what was predicted by market timing. The results corroborate those of Gajurel (2006) and Dincergok and Yalciner (2011), in which the market timing theory does not apply to emergent countries, so that these increase their debt in periods that favor the financial market. The relationship found was only negative for the cyclical consumption subsector.

With relation to the economic theory regarding the income elasticity of demand, it is perceived that the intensity of the relationship with the Ibovespa is different between the three cyclical subsectors. The response may be related to the share of exports in revenues and to the dependence on the internal market. In fact, the IPEA (2015) mentioned that during the internal crisis the growth of net exports dampened the impacts of the domestic retraction in GDP, since the slowdown in families' incomes caused a sharp fall in the demand for durable consumer goods. In contrast, also according to the IPEA (2015), it was only at the end of 2015 that the activity of the mining sector (basic materials) retracted for the first time, although the recession had been in place since April of 2014. In any case, the prices of these companies' products are sometimes quoted in dollars, as in the case of commodities. Therefore, it is considered that the performance of exports may explain the difference in the results of the cyclical subsectors. With relation to the non-cyclical ones, the expected results for that of telecommunications and public utilities were confirmed (non-significant relationship), but this did not occur for health and non-cyclical consumption, which presented a positive relationship.

Finally, the effect of the recession on the leverage of the subsectors was verified. The variable was only not significant for the book value of debt of industrial goods, cyclical consumption, and health. For the first two, considering they are subsectors of the cyclical consumption sector, the recession was expected to be relevant for the level of leverage. For the significant

coefficients, the values were positive, converging with those of Gertler and Gilchrist (1993) and Frank and Goyal (2009). For these authors, the increase in the debt in periods of recession is explained by the reduction in internal capital, a consequence of the monetary contractions that lead to the need to capture external funds. According to the POT, there is also the increase in bankruptcy costs. However, the recession variable was not able to differentiate the sectors into cyclical and non-cyclical in relation to debt, since it was the only one that had a positive effect for all the subsectors. For the non-cyclical sectors, it was not expected to be significant, which did not occur. The hypothesis is that, despite the income inelasticity of their demand, other items of their balance sheet or result were affected by the recession, such as costs and assets, among others. In addition, the assessment by the FGV (2017) regarding the recession addressed in this study is remembered: it was one of the longest since the start of the series, with a cumulative loss of 8.6% of GDP in 11 quarters. Its intensity may explain the relevance for the capital structure of all the subsectors.

In regard to the specific variables, the expected growth was significant for the non-cyclical consumption, basic materials, industrial goods, and telecommunications and public utilities subsectors, in which the signs obtained for these subsectors were mostly negative. Liquidity was significant for all the subsectors, with a positive relationship prevailing, which contradicts the POT, given that current liquidity reflects the available slack, where there is a preference for using internal funds to finance projects. Profitability was the most relevant variable in determining indebtedness, and was significant for all the subsectors, with a negative relationship, thus converging with the POT, and indicating that more profitable companies have fewer debts. Size was also significant for all the subsectors, but showed heterogeneous relationships.

## 5. CONCLUDING REMARKS

This article aimed to analyze the influence of recession and macroeconomic variables over the capital structure of the companies with shares traded on the B3. For this, multiple linear regression and panel data analysis were used. The companies in the sample were divided into six subsectors, adopting the B3 classification. The companies' level of debt, in book value and market value terms, was used as the dependent variable in the study.

First, corroborating previous studies, it was verified that factors intrinsic to the companies have greater explanatory power in capital composition than macroeconomic variables. Among the specific variables, profitability

The values were positive for industrial goods, cyclical consumption, and non-cyclical consumption, thus converging with the POT, and negative for basic materials and health, which is consistent with the TOT, which considers that bigger companies have ease of access to third-party funds. Finally, tangibility was only shown to be relevant for industrial goods, cyclical consumption, health, and telecommunications and public utilities. The coefficients were negative, converging with the POT.

In summary, the results among the subsectors were relatively homogeneous, with there being little divergence between the signs of the economic coefficients among the subsectors for each macroeconomic variable. The POT predominated for three of the six variables, showing an indication of a preference for using internal capital for the sectors of the Brazilian market, thus corroborating the studies of Medeiros and Daher (2008), Bastos et al. (2009), Bernardo et al. (2009), and Martins and Terra (2014). Although, in general, the macroeconomic variables showed importance, the specific variables showed greater explanatory power for determining the level of debt.

When the subsectors are compared, the level of leverage of basic materials belonging to the cyclical consumption sector showed the greatest dependence on the economic variables, while that of telecommunications and public utilities, belonging to the non-cyclical consumption sector, showed the least. This may be partly explained by the fact that the health and telecommunications and public utilities subsectors, as previously described, have companies with inelastic demand, are a natural monopoly (network industries, with barriers to entry and high capital requirements for new entrant investment), and have regulated prices, revenues, and activities. These characteristics appear to work as a shield for these sectors against macroeconomic variations, unlike the basic materials sector, for example.

was the one that showed the greatest influence and was significant for all the subsectors and for all the debt measurements. The second aspect observed was that the market value of debt was more dependent on the fluctuations in the study variables than the book value of debt, which is also consistent with previous studies, given that the former is priced by market expectations.

With relation to the macroeconomic variables, the results demonstrate that, considering the significant coefficients, for the GDP, interest rate, and recession variables, the sign of the parameters converged as predicted by the POT. Inflation showed low explanatory

power and was only significant for the health subsector. The exchange rate was the second variable with the highest number of significant coefficients, but presented a positive relationship with indebtedness, contrary to expected. The return on the Ibovespa presented mostly positive coefficients, going against the market timing theory, indicating that some of the funds raised by the market are used to capture third-party funds. Among the economic sectors, that of basic materials was the one with the highest number of significant variables, while that of telecommunications and public utilities was shown to be less dependent. In general, the macroeconomic variables presented a homogeneous effect on the companies' level of indebtedness, since, among the significant coefficients, the variation in the sign was small among the sectors. In addition, the context of recession was shown to be relevant in determining the debt of all economic subsectors studied, with a positive influence.

The article presents two limitations: the first is it does not consider the debt timeframes, so the results found could be different if the debts were segregated into short and long term; the second is due to the exchange rate variable, since the companies that use foreign funds and those that do not were also not segregated. Thus, the result could be seen from the perspective of using the exchange rate as a proxy for country risk.

As a proposal for future investigation, we suggest replicating the sectorial analysis of debt for other emergent countries, aiming to identify whether companies belonging to the same economic niche tend to follow the same pattern. Based on the results, it is also possible to compare the response, between countries with different levels of economic development, of the level of indebtedness in the event of economic crises. This would verify the differences between the vulnerability of companies from the same sector, but belonging to different countries.

## REFERENCES

- Allayannis, G., Brown, G. W., & Klapper, L. F. (2003). Capital structure and financial risk: Evidence from foreign debt use in East Asia. *The Journal of Finance*, 58(6), 2667-2710.
- Alti, A. (2006). How persistent is the impact of market timing on capital structure? *The Journal of Finance*, 61(4), 1681-1710.
- Baker, M., & Wurgler, J. (2002). Market timing and capital structure. *The Journal of Finance*, 57(1), 1-32.
- Balios, D., Daskalakis, N., Eriotis, N., & Vasiliou, D. (2016). SMEs capital structure determinants during severe economic crisis: The case of Greece. *Cogent Economics & Finance*, 4(1), 1-11.
- Banco Central do Brasil (Central Bank of Brazil). (2016). *Notice 1/2016-BCB. Open Letter that addresses the single paragraph of art. 4 of Decree n. 3,088, of June 21<sup>st</sup> of 1999*. Retrieved from <https://www.bcb.gov.br/htms/relinf/carta2016.pdf>
- Barclay, M. J., Smith, C. W., & Morellec, E. (2006). On the debt capacity of growth options. *The Journal of Business*, 79(1), 37-60.
- Bastos, D. D., & Nakamura, W. T. (2009). Determinantes da estrutura de capital das companhias abertas no Brasil, México e Chile no período 2001-2006. *Revista Contabilidade & Finanças*, 20(50), 75-94.
- Bastos, D. D., Nakamura, W. T., & Basso, L. F. C. (2009). Determinantes da estrutura de capital das companhias abertas na América Latina: um estudo empírico considerando fatores macroeconômicos e institucionais. *Revista de Administração Mackenzie*, 10(6), 47-77.
- Bernardo, C. J., Albanez, T., & Securato, J. R. (2018). Macroeconomic and institutional factors, debt composition and capital structure of Latin American companies. *Brazilian Business Review*, 15(2), 152-174.
- Chen, H. (2010). Macroeconomic conditions and the puzzles of credit spreads and capital structure. *The Journal of Finance*, 65(6), 2171-2212.
- Comissão de Valores Mobiliários (Brazilian capital market regulator). (2007). *CVM Instruction 457, of July 13<sup>th</sup> of 2007. Describes the elaboration and disclosure of consolidated financial statements, based on the international accounting standard issued by the International Accounting Standards Board (IASB)*. Retrieved from <http://www.cvm.gov.br/export/sites/cvm/legislacao/instrucoes/anexos/400/inst457consolid.pdf>
- Cook, D. O., & Tang, T. (2010). Macroeconomic conditions and capital structure adjustment speed. *Journal of Corporate Finance*, 16(1), 73-87.
- Dincerogok, B., & Yalciner, K. (2011). Capital structure decisions of manufacturing firms' in developing countries. *Middle Eastern Finance and Economics*, 12(7), 86-100.
- Erel, I., Julio, B., Kim, W., & Weisbach, M. S. (2011). Macroeconomic conditions and capital raising. *The Review of Financial Studies*, 25(2), 341-376.
- Fama, E. F., & French, K. R. (2002). Testing trade-off and pecking order predictions about dividends and debt. *The Review of Financial Studies*, 15(1), 1-33.
- Fan, J. P., Titman, S., & Twite, G. (2012). An international comparison of capital structure and debt maturity choices. *Journal of Financial and Quantitative Analysis*, 47(1), 23-56.
- Frank, M. Z., & Goyal, V. K. (2003). *Capital structure decisions* [Working Paper]. Social Science Electronic Publishing.
- Frank, M. Z., & Goyal, V. K. (2007). Tradeoff and pecking order theories of debt. In B. E. Eckbo. (Org.). *Handbook of Empirical Corporate Finance* (Vol. 2). (pp. 135-202). Oxford: Elsevier.
- Frank, M. Z., & Goyal, V. K. (2009). Capital structure decisions: Which factors are reliably important? *Financial Management*, 38(1), 1-37.
- Fundação Getúlio Vargas. (2015). *Comitê de Datação de Ciclos Econômicos (Codace)*. Retrieved from <https://portalibre.fgv>.

- [br/data/files/12/17/48/F4/978FE410F9AC5BD45C28C7A8/Comite%20de%20Datacao%20de%20Ciclos%20Economicos%20-%20Comunicado%20de%204\\_8\\_2015.pdf](http://br/data/files/12/17/48/F4/978FE410F9AC5BD45C28C7A8/Comite%20de%20Datacao%20de%20Ciclos%20Economicos%20-%20Comunicado%20de%204_8_2015.pdf)
- Fundação Getúlio Vargas. (2017). *Comitê de Datação de Ciclos Econômicos (Codace)*. Retrieved from [https://portalibre.fgv.br/data/files/F3/C1/F8/E8/A18F66108DDC4E66CA18B7A8/Comite%20de%20Data\\_\\_o%20de%20Ciclos%20Econ\\_micos%20-%20Comunicado%20de%2030\\_10\\_2017%20\\_1\\_.pdf](https://portalibre.fgv.br/data/files/F3/C1/F8/E8/A18F66108DDC4E66CA18B7A8/Comite%20de%20Data__o%20de%20Ciclos%20Econ_micos%20-%20Comunicado%20de%2030_10_2017%20_1_.pdf)
- Gajurel, D. (2006). *Macroeconomic influences on corporate capital structure*. Retrieved from <https://ssrn.com/abstract=899049>.
- Galí, J. (2015). *Monetary policy, inflation, and the business cycle: An introduction to the new Keynesian framework and its applications*. Princeton, NJ: Princeton University Press.
- Gertler, M., & Gilchrist, S. (1993). The role of credit market imperfections in the monetary transmission mechanism: Arguments and evidence. *The Scandinavian Journal of Economics*, 95(1), 43-64.
- Gertler, M., & Kiyotaki, N. (2010). Financial intermediation and credit policy in business cycle analysis. In B. M. Friedman & M. Woodford (Orgs.), *Handbook of monetary economics* (Vol. 3) (pp. 547-599). Oxford: Elsevier.
- Gujarati, D. N., & Porter, D. C. (2011). *Econometria básica* (5<sup>th</sup> ed.) Porto Alegre, RS: AMGH.
- Gungoraydinoglu, A., & Öztekin, Ö. (2011). Firm-and country-level determinants of corporate leverage: Some new international evidence. *Journal of Corporate Finance*, 17(5), 1457-1474.
- Hackbarth, D., Hennessy, C. A., & Leland, H. E. (2007). Can the trade-off theory explain debt structure? *The Review of Financial Studies*, 20(5), 1389-1428.
- Hackbarth, D., Miao, J., & Morellec, E. (2006). Capital structure, credit risk, and macroeconomic conditions. *Journal of Financial Economics*, 82(3), 519-550.
- Harris, M., & Raviv, A. (1991). The theory of capital structure. *The Journal of Finance*, 46(1), 297-355.
- Harrison, B., & Widjaja, T. W. (2014). The determinants of capital structure: Comparison between before and after financial crisis. *Economic Issues*, 19(2), 55-82.
- Huang, R., & Ritter, J. R. (2009). Testing theories of capital structure and estimating the speed of adjustment. *Journal of Financial and Quantitative Analysis*, 44(2), 237-271.
- Instituto de Pesquisa Economia Aplicada (Applied Economic Research Institute). (2015). *Carta de Conjuntura n. 29*. Retrieved from [http://www.ipea.gov.br/portal/index.php?option=com\\_content&view=article&id=26918&Itemid=3](http://www.ipea.gov.br/portal/index.php?option=com_content&view=article&id=26918&Itemid=3)
- Iqbal, A., & Kume, O. (2015). *Impact of financial crisis on firms' capital structure in UK, France, and Germany*. Retrieved from [https://papers.ssrn.com/sol3/papers.cfm?abstract\\_id=2472669](https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2472669)
- Kayo, E. K., & Kimura, H. (2011). Hierarchical determinants of capital structure. *Journal of Banking & Finance*, 35(2), 358-371.
- Korajczyk, R. A., & Levy, A. (2003). Capital structure choice: Macroeconomic conditions and financial constraints. *Journal of Financial Economics*, 68(1), 75-109.
- Lemmon, M. L., Roberts, M. R., & Zender, J. F. (2008). Back to the beginning: Persistence and the cross-section of corporate capital structure. *The Journal of Finance*, 63(4), 1575-1608.
- Levy, A., & Hennessy, C. (2007). Why does capital structure choice vary with macroeconomic conditions? *Journal of Monetary Economics*, 54(6), 1545-1564.
- López-García, J., & Sogorb-Mira, F. (2008). Testing trade-off and pecking order theories financing SMEs. *Small Business Economics*, 31(2):117-136.
- Mahajan, A., & Tartaroglu, S. (2008). Equity market timing and capital structure: International evidence. *Journal of Banking & Finance*, 32(5), 754-766.
- Martins, H. C., & Terra, P. R. S. (2014). Determinantes nacionais e setoriais da estrutura de capital na América Latina. *Revista de Administração Contemporânea*, 18(5), 577-597.
- Medeiros, O. R. D., & Daher, C. E. (2008). Testing alternative theories on the capital structure of Brazilian firms. *Revista de Administração Contemporânea*, 12(1), 177-199.
- Modigliani, F., & Miller, M. H. (1958). The cost of capital, corporation finance, and the theory of investment. *The American Economic Review*, 48(3), 261-297.
- Modigliani, F., & Miller, M. H. (1963). Corporate income taxes and the cost of capital: A correction. *The American Economic Review*, 53(3), 433-443.
- Myers, S. C. (1984). The capital structure puzzle. *The Journal of Finance*, 39(3), 574-592.
- Myers, S. C. (2003). Financing of corporations. In G. M. Constantinides, M. Harris & R. M. Stulz (Orgs.), *Handbook of the economics of finance* (Vol. 1) (pp. 215-253). Oxford: Elsevier.
- Myers, S. C., & Majluf, N. S. (1984). Corporate financing and investment decisions when firms have information that investors do not have. *Journal of Financial Economics*, 13(2), 187-221.
- Nakamura, W., Martin, D., Forte, D., Carvalho, A., Costa, A., & Amaral, A. (2007). Determinantes de estrutura de capital no mercado brasileiro: análise de regressão com painel de dados no período 1999-2003. *Revista Contabilidade & Finanças*, 18(44), 72-85.
- Pearce II, J. A., & Michael, S. C. (2006). Strategies to prevent economic recessions from causing business failure. *Business Horizons*, 49(3), 201-209.
- Pindyck, R., & Rubinfeld, D. (2014). *Microeconomics GE*. Camberwell: Pearson Australia Pty.
- Staking, K. B., & Babbel, D. F. (1995). The relation between capital structure, interest rate sensitivity, and market value in the property-liability insurance industry. *Journal of Risk and Insurance*, 62(4), 690-718.
- Stiglitz, J. (2018). The theory of credit and macroeconomic stability. In A. G. Dastidar, F. Malhotra & V. Suneja (Eds.), *Economic theory and policy amidst global discontent* (pp. 145-201). New Delhi: Routledge.
- Taylor, J. B. (1995). The monetary transmission mechanism: An empirical framework. *Journal of Economic Perspectives* 9(1), 11-26.

- Terra, P. R. S. (2007). Estrutura de capital e fatores macroeconômicos na América Latina. *Revista de Administração*, 42(2), 192-204.
- Tomazzia, E. C., & Meurer, R. (2009). O mecanismo de transmissão da política monetária no Brasil: uma análise em VAR por setor industrial. *Economia Aplicada*, 13(4), 371-398.
- Tong, G., & Green, C. J. (2005). Pecking order or trade-off hypothesis? Evidence on the capital structure of Chinese companies. *Applied Economics*, 37(19), 2179-2189.
- Tsoy, L., & Heshmati, A. (2017). *Impact of financial crises on dynamics of capital structure: Evidence from Korean listed companies*. Retrieved from [https://papers.ssrn.com/sol3/papers.cfm?abstract\\_id=2923637](https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2923637)
- Vithessonthia, C., & Tongurai, J. 2015. The effect of firm size on the leverage – Performance relationship during the financial crisis of 2007-2009. *Journal of Multinational Financial Management*, 29(1), 1-29.
- Zeitun, R., Temimi, A., & Mimouni, K. (2017). Do financial crises alter the dynamics of corporate capital structure? Evidence from GCC countries. *The Quarterly Review of Economics and Finance*, 63(1), 21-33.