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EXPLANATORY AND CAUSAL EVIDENCE IN THE CAPITAL STRUCTURE OF BRAZILIAN COMPANIES

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ABSTRACT

This study seeks to examine the relationship between key variables in the capital structure of Brazilian companies listed on the BM&FBovespa over the years 2009-13. The study sample is composed of 192 companies with data available to the public. Following the data collection phase, capital structure behavior across time was analyzed, staging the independent variable "Leverage" against the following dependent variables: (i) Tangibility; (ii) Profitability; (iii) Current Liquidity; (iv) Enterprise size or Growth opportunities; (v) Non-tax benefit and (vi) Firm size. The study is backed, in terms of theoretical foundation, by trade-off and pecking order theory. Econometric panel estimation modeling was applied for data treatment and analysis, initially by way of Hausman and Breusch-Pagan tests for the adequacy of the fixed effects model. Subsequently, Granger Causality testing was employed to ascertain the existence of causal relationships between the variables in question. The results showed that the variables LEV, PROF, ESG and SIZ are significant for explaining future capital structure behavior. In general, the results are in accordance with the arguments of pecking order theory, given the support provided for the claim that LEV behavior, along with PROF, TANG, NDT, ESG and SIZ assist in predicting capital structures in Brazilian companies.

Keywords: Capital structure; Capital structure determinants; Financial leverage.

Resumo

Este estudo analisa a relação entre variáveis explicativas da estrutura de capital das empresas brasileiras listadas na BM&FBovespa ao longo do período de 2009-2013. A amostra do estudo é composta por 192 empresas com dados disponíveis no período observado. Após a coleta de dados, o comportamento da estrutura de capital ao longo do tempo foi analisada, considerando a variável independente "Alavancagem" e as variáveis dependentes: (i) Tangibilidade; (ii) Rentabilidade; (iii) Liquidez Corrente; (iv) Dimensão da empresa; (v) Benefícios não-fiscais; (vi) Tamanho da empresa. O estudo é apoiado, em termos de fundamentação teórica, pelas teorias *trade-off* e *pecking order*. Para análise e tratamento dos dados utilizou-se a estimativa econométrica em painel, primeiramente pelos testes de *Hausman e Breusch-Pagan* identificou-se o modelo de efeitos fixos para a análise dos dados, posteriormente utiliza-se do teste de Causalidade de *Granger* para inferir acerca da relação de causa entre as variáveis. Os resultados demonstram que as variáveis ALAV, RENT, DIE e TE são significantes para explicar o desempenho da estrutura de capital das empresas. Em geral, os resultados estão de acordo com os argumentos da teoria *pecking order* e contribuem na análise preditiva acerca da estrutura de capital das empresas brasileiras.

Palavras-chave: Estrutura de capital; Fatores determinantes da estrutura de capital; Alavancagem financeira.

1 INTRODUCTION

In order to ensure profitability and continuity in the long term, maximizing the bottom line for investors and shareholders is one of the primary objectives of any company (HENDRIKSEN; VAN BREDA, 2009). Yadav (2014) stresses that finances are the lifeblood of business-type organizations: in order to create wealth and shareholder value to the utmost of their potential, financial management activities are necessary for continued business operations.

In the business world, the development of measurement tools in conjunction with the constant evaluation of performance illustrate the efforts made, on part of managers, toward creating wealth for investors and their effectiveness toward that end. Graham, Harvey and Raigopal (2006) and Chang, Chen and Liao (2014) highlight the need for, and importance of, performance measures that track and evaluate decisions affecting returns on shares and company capital structures.

A variety of factors affect a company´s management, such as the national economy, government regulations, social trends, local capital market conditions and the overall scenario of the industry, etc. When analyzing a firm´s capital structure, these must be taken into consideration and monitored regularly. Similar to decisions to either increase or reduce financial leverage, market conditions in different countries and investor and shareholder attitudes toward debt are elements that can interfere in both management and company capital structure (HANDOO; SHARMA, 2014).

Jong, Kabir and Nguyen (2008) indicate that financial leverage is directly related to a set of considerations, themselves tied to country-specific capital structure factors. Among these, creditor protection, stock and bond market development, and the country´s GDP growth rate pose significant impacts on capital structure. Additionally, the authors posit that these impede uniform capital structures across countries, and go on to suggest that companies operating in countries with regulatory and legal environments, and stable economic conditions, are more likely to take on debt, and, as a consequence, bear financial leverage.

In this context, discussions on capital structure composition as a problem common to many companies come to the forefront. Liu (2014) indicates that company-specific factors affect capital structure, justifying the theoretical base as a way to explain relationships between capital structure determinants. Prior studies such as Deesomsak; Paudyal; Pescetto (2004); Jong; Kabir and Nguyen (2008); Kayo and Kimura (2011); Correa, Basso and Nakamura (2013); Chang; Chen and Liao (2014); Acedo-Ramírez and Ruiz-Cabestre (2014); Liu (2014); Arqawi; Bertin and Prather (2014); Loncan and Caldeira (2013); Handoo and Sharma (2014); and Yadav (2014) have shown the unique traits of capital structures as seen in different samples of companies across countries, as well as the importance of analysis and research on the topic.

Two theories stand out in the ongoing debate on capital structures in companies and debt levels: Pecking Order and Trade-off theory. While the former points to a preference for using internal, rather than external, resources, the latter suggests that a hierarchy or optimal debt level for sustaining company capital structure does not exist (DROBETZ; et al., 2013; LIU, 2014).

From this, the issue central to this study emerges: **What variables serve to explain the capital structure of Brazilian companies**? This guides the ensuing research, in order to achieve the general objective of the identifying determining variables that explain the capital structure of Brazilian companies listed on the BM&FBovespa via a comparative focus on Pecking Order and Trade-off theory.

Liu (2014) indicates that the composition of capital structure and the specific factors that affect it are mysteries that must be solved in the realms of both theory and practice. Yaday (2014) and Handoo and Sharma (2014) also point out the need for studies on capital

structure determinants. Jong, Kabir and Nguyen (2008) showed that changes take place in the determining factors of capital structure in different countries, thusly justifying an analysis on structures in a single country so as to provide a better understanding of its intrinsic factors and unique conditions.

Moreover, it bears mentioning that this study is not limited to the significance of the relationship between financial leverage, tangibility, profitability, current liquidity, non-debt tax shield, company size and growth; cause-and-effect relationships between these variables are also taken into consideration, setting the work apart from prior studies on capital structure in companies.

2. THEORETICAL ISSUES AND CAPITAL STRUCTURE DETERMINANTS

This section presents a discussion on determinants of company capital structure constructed upon Pecking Order and Trade-off theory, as well as variables related to capital structure and existing studies related to the same.

2.1. Capital structure theories

Beginning in the 1950s, financial economists have debated distinct theories to explain company capital structures. Despite the vast quantity of publications on the topic, a consensus as to an ideal financial structure does not exist, nor does one regarding the factors that influence the same (ACEDO-RAMIREZ; RUIZ-CABESTRE, 2014). Two theories have gained prominence in the discussion on company capital structure: Pecking Order and Trade-off (DROBETZ; et al., 2013; LIU, 2014; ACEDO-RAMÍREZ E RUIZ-CABESTRE, 2014).

The seminal work by Modigliani and Miller (1958) establishes that company value is constant, regardless of its capital structure, suggesting that it is meaningless in a perfect market. These arguments yielded various studies and debates on company investment and debt decisions related to tax savings and expected bankruptcy costs (ARQAKI; BERTIN, 2013; NAKAMURA et al., 2007; LIU, 2014).

The propositions made by Modigliani and Miller (1958) gave rise to Trade-off theory, which points to the existence of an optimal capital structure (i.e. an ideal balance between debt, bankruptcy costs and agency costs between either shareholders and the government, or mandatory tributes. In this sense, trade-off theory seeks to understand financing decisions made by companies and provide explanation for their capital structures, assuming that an ideal leverage ratio, itself based on market imperfections including taxes, agency costs, and bankruptcy costs, exists (JALILVAND; HARRIS, 1984; FRANK; GOYAL, 2000; ACEDO-RAMIREZ; RUIZ-CABESTRE, 2014).

According to trade-off theory, size also affects capital structures in companies, as larger firms bear a higher leverage ratio than smaller ones. Along with this, the former also tends to have more stable cash flows, a lower probability of bankruptcy, and less information asymmetry (MYERS; MAJLUF, 1984; CHANG; CHEN; LIAO, 2014; LIU, 2014).

Conversely, Myers and Majluf (1984) provide arguments contrasting trade-off theory, creating a space for a new discussion based on pecking order theory. When basing the issue in pecking order theory, an information asymmetry between firms and the capital market emerges, as does a disciplining effect, on behalf of the former, onto the latter. This leads companies to opt for internally generated resources more readily than outside ones, though the theory does not indicate that an ideal debt ration exists (MYERS; MAJLUF, 1984; FAMA; FRENCH, 2002; ACEDO-RAMIREZ; RUIZ-CABESTRE, 2014; LIU, 2014).

With that, pecking order theory assumes that financing sources are affected by information asymmetry, and as a result, companies use and initially prefer internal funds over outside ones. Should the need for outside financing exist, companies tend to issue debt capital (DROBETZ et al., 2013).

Correa, Basso and Nakamura (2013) observed that Pecking Order theory follows a financing hierarchy, with outside financing enjoying precedent over equity as a financing source. As such, company size and increases in sales tend to have a positive relationship with debt levels, while profitability and expectations for growth have a negative relationship with financial leverage. Chang, Chen and Liao (2014) find that increases in assets are a reflection of a company´s financial situation, given that they require equity investment to finance and guarantee their growth.

A company´s liquidation value could be referenced to support this notion: a firm with many fixed assets or real estate (land, buildings, facilities, etc.) would be liquidated for a very different price than one with a higher proportion of intangible assets (technology, human capital, brand image, patents, research and development, etc.) In the event of bankruptcy, intangible assets lose a substantial share of their value and, as a result, creditors have less guarantee (ACEDO-RAMÍREZ; RUIZ-CABESTRE, 2014).

In light of these circumstances, various studies have shown that a comprehensive theory, capable of explaining observable factors relating to variations in company leverage in a credible fashion, does not exist. However, Acedo-Ramírez and Ruiz-Cabestre (2014) highlight that leverage issues concerning capital structure merit attention so as to explain leverage and capital structure decisions.

Similarly, Drobetz et al. (2013), Yadav (2014) and Handoo and Sharma (2014) point out the need for studies on determinants of company capital structures, affirming that observable leverage factors tied to capital structure theories exist. This serves as a base for analysis on variables that might determine capital structures and be relevant to decision-making.

2.2 Variables related to capital structure

Numerous studies concerning the discussion on explanatory variables in company capital structure analysis have supported both trade-off and pecking order theory. These have sought to contribute via arguments that might serve to explain company capital structure and pose predictive measurements for evaluating performance. Among the commonly used factors, the following measures merit attention:

Figure 1: Capital structure variables - definition and interpretation

Variable observed	Definition and interpretation	Theoretical base
Leverage	The ratio of debt or liabilities (current and non-current) to equity (LIU, 2014). Both trade-off and pecking order theory consider leverage a determining measure for understanding company capital structures (DROBETZ et al., 2014; HANDOO; SHARMA, 2014; LIU, 2014).	Trade-off and pecking order theory consider leverage to be an analysis factor in capital structure (LIU, 2014).
Profitability	The search for conditions that affirm information asymmetry leads investors to prefer internal financing sources initially, bearing in mind the financial cost of outside resources. From this, if the company is either profitable or endowed with its own resources, the need for third-party capital is reduced; in the event of scarce internal resources, the company will opt for attracting outside capital, as per pecking order theory (LIU, 2014). However, a positive relationship confirms trade-off theory, as low profitability can yield an increased risk of bankruptcy. This, while healthy companies display lower debt and risk indicators as a result of lower costs, lesser financial difficulties, greater protection for investors and higher profitability (KAYO; KIMURA, 2010; DROBETZ et al., 2014).	The relationship between profitability and leverage is negative, as per pecking order theory. However, when considering trade-off theory, a positive relationship between profitability and leverage is anticipated (Drobetz et al., 2014; LIU, 2014).
Tangibility	Asset tangibility represents a lower risk to creditors, given that resources are readily available before financial burdens, bearing a positive effect on leverage (LIU, 2014). Support for this claim is supported by the tendency for companies with fixed tangible assets to lose less value in the event of bankruptcy (DROBETZ et al., 2014).	Trade-off theory predicts a positive relationship between tangibility and leverage (DROBETZ et al., 2014; LIU, 2014).

Variable observed	Definition and interpretation	Theoretical base
Non-tax benefit - depreciation	Analysis of factors related to non-tax debt benefits, such as depreciation, allows for an understanding of its effects (costs and benefits of debt) in concerns to leverage (DEESOMSAK et al., 2004; LIU, 2014). Under trade-off theory, tax benefits stemming from debt display a negative relationship with the capital structure, given that it reduces the role of debt in minimizing tax burdens.	Non-tax benefit - depreciation have a negative effect on leverage, as per trade-off theory (LIU, 2014).
Current liquidity	Liquidity is defined as the capacity to convert assets into resources, seeking to transform them into cash and reduce the need to take on third-party capital; if the company can use its own capital in place of that of outsiders, there will be fewer financial obligations and expenses (LIU, 2014; HANDOO, SHARMA, 2014).	Under pecking order theory, liquidity bears a negative effect on leverage (JONG, KABIR, NGUYEN, 2008; LIU, 2014).
Enterprise size / Growth opportunities	Companies require capital investment in order to finance and guarantee growth. Companies with greater growth in assets tend to be more leveraged. Under trade-off theory, larger companies have higher leverage ratios than smaller counterparts, as well as more stable cash flows, lower chances of declaring bankruptcy and decreased information asymmetry (CHANG, CHEN, LIAO, 2014).	Trade-off theory predicts a positive relationship between leverage and growth, while pecking order suggests it to be negative (LIU, 2014; YADAV, 2014).
Firm size	Larger companies tend to have more stable cash flows and a greater ability to attract resources and a lesser chance of defaults than smaller ones, indicating that they are considered less risky. As such, firm size is measured using the total the assets under control (HANDDO, SHARMA, 2014; YADAV, 2014).	The scale of the company has a positive relationship with leverage, as suggested by pecking order theory (YADAV, 2014; LIU, 2014).

Source: Study authors using research data.

The relationship between capital structure explanatory variables, the definition and interpretation of the same, and the theoretical relationship to the interpreted results is shown in Figure 1, which sustains the latter as the focus of either trade-off or pecking order theory.

2.3 Related studies

Previously-completed studies contribute to the debate on capital structure, including Jong; Kabir and Nguyen (2008); Kayo and Kimura (2011); Correa, Basso and Nakamura (2013); Chang; Chen and Liao (2014); Acedo-Ramírez and Ruiz-Cabestre (2014); Liu (2014); Arqawi; Bertin and Prather (2014); Loncan and Caldeira (2013); Handoo and Sharma (2014) and Yadav (2014), showing the unique characteristics of capital structures drawn from companies around the world.

Jong, Kabir and Nguyen (2008) examined capital structures in a sample of 42 countries, split evenly between industrialized and developing nations, in order to analyze the role of various country-specific factors in the determination of company capital structure. The results indicated that the existence of varied elements impact capital structure, including tangibility, firm size, risk, growth and profitability. In general, the authors highlight the importance of country-specific factors in both capital structures and related decision-making.

Kayo and Kimura (2011) examined a sample of 40 countries comprised of 127,340 observations, ranging from 1997 to 2007. The results showed that a significant part of variance in leverage (approximately 42%) has an intrinsic relationship with company-specific factors; time accounts for 36% of leverage, while the level of the country but 3%. Along with this, the authors highlighted structural differences in financial behavior between companies located in developed and emerging nations.

Correa, Basso and Nakamura (2013) broached determining factors in debt ratios of the largest Brazilian companies, using pecking order and trade-off theory as base. Panel data analysis was carried out on the financial statements of the largest Brazilian companies, from 1999 to 2004. The results showed a negative relationship between the degree of asset tangibility and debt levels in the companies, as well as a negative relationship between profitability and debt. Further, the results suggested that industrial sector in which the companies operate is not statistically-significant as a determinant of debt ratios, despite the

fact that foreign companies were found to have more debt than Brazilian counterparts. These findings indicate that pecking order theory is more consistent than trade-off theory in terms of Brazilian companies´ capital structures.

Loncan and Caldeira (2013) studied the relationship between capital structure, cash liquidity and market capitalization, also working with a sample of Brazilian firms. The results of the study revealed a negative association between short and long-term debt and cash liquidity, as well as between cash liquidity levels and lower leverage ratios. Along with this, the authors found that companies with more financial restrictions keep larger cash balances.

Chang, Chen and Liao (2014) showed that increases in assets reflect in the overall financial situation of a company. Capital financing is necessary to enable and guarantee growth. Parallel to this, the authors state that financial restrictions affect capital structure decisions, drawing from a sample of Chinese firms.

A study by Acedo-Ramírez and Ruiz-Cabestre (2014) examined country-specific differences can affect capital structures, observing company-specific variables in five nations (France, Germany, Italy, Spain and the United Kingdom) during 1998-2008. The results of the study illustrated substantial differences in company capital structures, with particular emphasis on the contrast between the United Kingdom (itself a market economy) and the other European nations (bank or finance-oriented economies).

Liu (2014) analyzed determinants of capital structure in Dutch companies and their influence in related decision-making. The study sample was comprised of 54 companies, drawing data from 2011-13. The results suggested that liquidity and profitability have a negative relationship with leverage, thus confirming the assumption that internal financing (net of external debt) is preferred by Dutch companies.

Arqawi, Bertin and Prather (2014) affirmed that size and tangibility are positively related to leverage, while growth and profitability showed a negative relationship with the same. This, as shown from a sample of 261 Australian companies concerning 2007-10.

A study by Chang, Chen and Liao (2014) posed seven fundamental variables that explain 36% of capital structure in Chinese companies: profitability, as companies with higher ROA ratios tend to be less leveraged; average leverage, as firms with greater average leverage tend to be more leveraged; asset growth, as companies with greater increases in assets tend to be more leveraged; asset tangibility, with companies showing higher proportions of tangible assets tending to be more leveraged; size, as larger companies (in terms of assets) tend to be more leveraged; State control, with state-controlled enterprises showing lesser leverage ratios and shareholding, as companies with larger holdings of the largest shareholder tend to have lower leverage.

Handoo and Sharma (2014) identified determinants of capital structure in Indian companies, drawing from a sample of 870 firms over the years 2001-10. Ten independent, and three dependent, variables were tested. The results suggested that factors such as profitability, growth, asset tangibility, cost of debt, tax rates, and debt serving capacity impact leverage in Indian companies. Further, the results also included the following: (i) liquidity does not have a significant impact on total debt; (ii) asset tangibility has a significant impact on short-term debt; (iii) tax rates affects total debt, in both the long and short term; (iv) debt serving capacity has a significant impact on total debt; (v) company age does not have a significant impact on total debt; (vi) profitability yields a significant impact on total debt, and (vii) growth affects long-term debt.

Yadav (2014) investigated the relationship between financial leverage and determinants of capital structure in 50 Indian companies over 2002-12. The study sought to establish a relationship between financial leverage (dependent variable) and determinants of capital structure (independent variables), taking agency costs, information asymmetry, taxes and bankruptcy costs into consideration as possible determinants. Analysis showed the

following relationships between the determinants and leverage: profitability (positive), collateral value of assets (positive), uniqueness (negative) and business risk (negative). Further, the authors found that, taken together, all of the independent variables are significant to the observed leverage.

This compilation allows for the observation that diverse studies have contributed to analysis and investigation in regards to determinants of company capital structures, as well as the notion that the results derived from these either approach or diverge from one another as a result of samples, countries, or industries.

3 METHODOLOGICAL PROCEDURES

In terms of its methodology, this study is characterized as descriptive, employing a survey method for data collection and drawing observations from companies listed on the BM&FBovespa from 2009-13. The analysis is carried out under a primarily quantitative approach in terms of data collection and treatment procedures.

The study population is comprised of the 516 companies listed on the BM&FBovespa (2014) with data available in the *Economática*® database; however, the final sample contains 192 companies with data on the 2009-13 operating years available to the public, excluding financial-sector, holdings, and insurance firms.

The main variables observed were drawn from the data provided by the *Economática*® database, gathered from the financial statements of the companies in question. The included the following quantitative values: (i) Total assets, (ii) Current assets, (iii) Non-current assets, (iv) Property, plant and equipment, (v) Current liabilities, (vi) Non-current liabilities, (vii) Net Assets, (viii) Operating income, (ix) Depreciation expense, (x) Operating revenues/sales. Following the collection of primary-variable data, subsequent variables were also identified, which went on to comprise the dependent and independent variables of this study (Figure 2).

Using previous studies as a foundation, the seven variables of interest to the present investigation were compiled using the following approaches:

1) Leverage (LEV): calculated as the ratio of debts, or long and short term obligations (liabilities, to net assets (DEESOMSAK; PAUDYAL; PESCETTO, 2004; JONG; KABIR; NGUYEN, 2008; LIU, 2014).

2) Profitability (PROF): calculated as the ratio of operating revenues/sales to total assets. Operating revenue (also known as volume) refers to profit before interest, taxes and depreciation (DEESOMSAK; PAUDYAL; PESCETTO, 2004; JONG et al., 2008; LIU, 2014).

3) Tangibility (TANG): calculated as the ratio of fixed assets (property, plant and equipment) to total assets (HUANG; SONG, 2006; JONG; KABIR; NGUYEN, 2008; LIU, 2014).

4) Non-tax benefit - depreciation (NDT): calculated as the ratio of the absolute (accounting) value of depreciation to total assets (DEESOMSAK; PAUDYAL; PESCETTO, 2004; YADAV, 2014; LIU, 2014).

5) Current Liquidity (LIQC): calculated as the ratio of total current assets to total current liabilities (DEESOMSAK; PAUDYAL; PESCETTO, 2004; JONG; KABIR; NGUYEN, 2008; LIU, 2014).

6) Enterprise size or Growth opportunities (ESG): calculated or defined as the natural log of total assets (DEESOMSAK; PAUDYAL; PESCETTO, 2004; CHEN, 2004; LIU, 2014; HANDOO; SHARMA, 2014).

7) Firm size (SIZ): calculated as the natural log of total sales (JONG; KABIR; NGUYEN, 2008; LIU, 2014).

Figure 2 displays the independent and dependent variables observed:

Figure 2: Study variables

	Observed variables	Formula	Source/Base
1	**Financial leverage (LEV)**	$\frac{Current\ Liabilities\ +\ Non-Current\ Liabilities}{Net\ Assets}$	BP/ Economática®
2	**Profitability (PROF)**	$\frac{Operating\ income}{Total\ assets}$	BP - DRE/ Economática®
3	**Tangibility (TANG)**	$\frac{Property, plant\ and\ equipment}{Total\ assets}$	BP/ Economática®
4	**Non-tax benefit - depreciation (NDT)**	$\frac{Depreciation\ total\ in\ the\ period}{Total\ assets}$	BP - DRE/ Economática®
5	**Current liquidity (LIQC)**	$\frac{Current\ assets}{Current\ liabilities}$	BP/ Economática®
6	**Enterprise size or growth opportunities (ESG)**	$Log\ of\ total\ assets$	BP/ Economática®
7	**Size (SIZ)**	$Log\ of\ total\ revenues/sales$	DRE/ Economática®

Source: Study data.

Those companies with observable values of the above variables during the five years in question were identified using the data drawn from the *Economática*®. This yielded 960 observations from the 192 non-financial companies listed on the BM&FBovespa during that timespan.

Bearing in mind the above-mentioned arguments provided by the literature, this study seeks to establish whether financial leverage is, in fact, related to other factors, such as those observed in prior research. As shown in the existing literature, the determinants of capital structure merit investigation –this, under the premise that independent variables serve to explain and contribute to analysis on the behavior of the same. The variable LEV is set as the independent variable, while PROF, TANG, NDT, LIQC, ESG and SIZ are the dependent variables examined here.

Considering the size of the sample and the fact that it contains varied companies to be analyzed over a period of time, panel data analysis is adopted as a methodological approach, given that it allows for an understanding of dynamic relationships in space and time (GUJARATI, 2000; WOOLDRIDGE, 2006). Two common methods for panel data estimation modeling are fixed effects and random effects models; in order to determine which of the two is best fitted to the characteristics of the sample in question, Hausman and Breusch-Pagan tests are applied. With this approach, the null hypothesis is the affirmation that the difference in coefficients of the fixed and random effects models is not systematic, meaning that, in the event of a difference, it is treated as grounds for employing the former model and thusly rejecting the null hypothesis of random effects (WOOLDRIDGE, 2006).

Following the identification of which model is better fitted to the traits of the data in question, the fixed effects model was used to analyze the relationship between the dependent and independent (LEV, PROF, TANG, NDT, LIQC, ESG, SIZ) variables. As such, in order to check for the existence of a relationship between these, the results provided by the model, as well as accompanying arguments based in trade-off and pecking order theories, are observed,

ultimately indicating a positive or negative relationship. Said analysis was carried out with Gretl software, which adopts the panel econometric estimation model and the Arellano and Bond (1991) estimator. This stage serves to scrutinize the results and make an adjustment to the sample, avoiding homoscedasticity in the data and a compromised analysis. Upon electing to use Gretl software, this adjustment takes place implicitly.

Aside from establishing the existence of a relationship between the dependent and independent variables observed, this study seeks to provide an understanding of the cause-and-effect relationship between the variables via Granger Causality analysis and using EViews software. The Granger Causality model incorporated 768 observations –fewer than the initial total, due to a lag applied to the panel data model.

Pindyck and Rubinfeld (2004) state that a common problem in economics is knowing if the changes in a given variable are caused by changes in another. With this, the null hypothesis of the Granger test for causality serves to anticipate whether variable X causes Y, in the Granger sense, thusly making X a useful indicator, or not, of Y´s behavior. This allows for an analysis of the causal relationship between the X and Y variables, as well as grounds for whether or not the predictive value of X contributes to an understanding of behavior in Y (STOCK; WATSON, 2004; KRUGER; PETRI, 2013).

As per Woodridge (2006), the Granger causality test will allow for the observation of whether LEV causes PROF, and vice versa. The Granger statistical test can be represented by the following model adapted from Gujarati (2000):

$$LEV = \sum_{i=1}^{n} \propto i\ PROF_{(t-1)} + \sum_{j=1}^{n} \beta j\ LEV_{(t-j)+\ U1t}$$

In the above model, the null hypothesis is set as "LEV does not Granger-cause PROF"; should it be rejected, the Granger causal relationship between LEV and PROF can be confirmed, as can the bilateral relationship between "PROF does not Granger-cause LEV". Using the results of the F-statistic, the causal relationship (or lack thereof) between the variables is identified, seeking to identify, via the Granger Causality method, whether the predictive value of the variables (PROF, TANG, NDT, LIQC, ESG, SIZ) can explain behavior in LEV, and vice versa.

Analysis tests the relationship between LEV (dependent variable) and the independent variables, using Granger modeling in EViews software. The following null hypotheses are tested:

1) PROF does not Granger-cause LEV and LEV does not Granger-cause PROF;
2) TANG does not Granger-cause LEV and LEV does not Granger-cause TANG;
3) NDT does not Granger-cause LEV and LEV does not Granger-cause NDT;
4) LIQC does not Granger-cause LEV and LEV does not Granger-cause LIQC;
5) ESG does not Granger-cause LEV and LEV does not Granger-cause ESG;
6) SIZ does not Granger-cause LEV and LEV does not Granger-cause SIZ.

The results generated by the F-statistic allow for a Granger causality analysis on the variables in question, contributing with the panel model observed above, as well as corroborating existing studies on the determinants of company capital structure.

4 DATA ANALYSIS AND INTERPRETATION

Subsequent to data collection carried out in *Economática*® concerning the years 2009-12, which gathered the 192 non-financial companies listed on the BM&FBovespa with publically-available information, panel modeling and Hausman and Breusch-Pagan tests were used to determine whether the fixed-effects or random-effects models better describes the independent variables in question.

The results of the Hausman and Breusch-Pagan tests are displayed in Table 1, based on fixed-effects modeling performed in conjunction with *Gretl* software.

Table 1: Breusch-Pagan and Hausman Tests

Null hypothesis: Unit-specific error variance = 0	**Breusch-Pagan Test**	**Hausman Test**
Goodness of fit statistic: *Chi-squared (1)*	0.00343354	14.7893
p-Value Probability	0.953274	0.0219607

Source: Study data.

The results of the Breusch-Pagan test do not reject the null hypothesis of homoscedasticity, indicating, in this case that an alternative estimation method is not necessary, namely, one that would take such circumstances into account (GUJARATI, 2006). The Hausman test considers two hypotheses, as per Gujarati (2006):

(i) H_0: *p*-value >0.05 – indicates that the random effects model is consistent

(ii) H_1: *p*-value <0.05 – in contrast to the null hypothesis that the random effects model is consist, this result validates the existence of the fixed effects model (H_1).

Upon examining the combined results of the Breusch-Pagan and Hausman tests, the fixed effects model is shown to be adequate and consistent with the variables in question (LEV, PROF, TANG, NDT, LIQC, ESG, TE). Table 2 displays the results of panel data analysis on these same variables, carried out with Eviews software.

Table 2: Panel data analysis – Fixed effects model

Independent Variable:	**LEVFINAN**	
Dependent variables	***t-Statistic***	***p-Value***
CONST	2.225	0.0264**
PROF	-1.968	0.0494**
TANG	-1.394	0.1637
NDT	-0.1380	0.8903
LIQC	-0.7275	0.4671
ESG	-1.998	0.0461**
SIZ	1.647	0.0999*
R^2 **(LSDV)**	0.208562	

Source: Study data.

A significant relationship is shown between the variables LEV and PROF, ESG and SIZ, though the same could not be confirmed between LEV, TANG, NDT and LIQ, as per the p-values listed above. The R^2 value of the model is 0.208562, which suggests that the proposed model explains 20.86% of the behavior of LEV and the other variables –relevant in the context of panel data analysis.

4.1 Statistical analysis – Granger Causality

By way of EViews software, the Granger test for causality was applied to infer as to the causal relationship between the dependent variable (LEV) and the independent variables (PROF, TANG, NDT, LIQC, DE, SIZ). With this, the causal relationship between said variables was examined, drawing 768 observations from data on 2009-13.

Table 3 contains the results of the Granger causality test for the relationships between the variables LEV and PROF.

Table 3: Granger causality for the relationship between LEV and PROF

Granger causality (2009-2013) - 768 obs.

Variables	***F-statistic***	***p - probability***
LEV does not cause PROF	0.04394	0.83402
PROF does not cause LEV	0.88063	0.34833

Source: Study data.

As shown in Table 3, the results of the F-statistic test indicate that PROF values ostensibly do not contain information useful for anticipating changes in the companies' LEV. The results do not reject the hypothesis stating, "LEV does not cause PROF", and vice versa, sustained by the less-than-one value of the F-statistic. From this, the statement that PROF values cause LEV or contains information useful for predicting its behavior, and vice versa, cannot be supported.

Table 4 displays the relationship between LEV and TANG:

Table 4: Granger causality for the relationship between LEV and TANG

Granger causality (2009-2013) - 768 obs.

Variables	***F-statistic***	***p - Probability***
LEV does not cause TANG	1.12311	0.28958
TANG does not cause LEV	0.44579	0.50454

Source: Study data.

It merits attention that the results obtained from the f-statistic test and p-value provide grounds to reject the hypothesis that "LEV does not cause TANG", suggesting that TANG values are useful indicators for future LEV behavior, despite the relationship's not being bilateral: "TANG does not cause LEV" is not rejected.

The relationship between LEV and NDT was also analyzed using Granger causality:

Table 5: Granger causality for the relationship between LEV and NDT

Granger causality (2009-2013) - 768 obs.

Variables	***F-statistic***	***p - Probability***
LEV does not cause NDT	0.00863	0.92602
NDT does not cause LEV	2.38195	0.12316

Source: Study data.

As displayed in Table 5, the hypothesis "LEV does not cause NDT" is not rejected, with base in the F-statistic values -less than one-, as well as the p-value. However, the hypothesis "NDT does not cause LEV" is proved relevant and significant in light of the F-statistic -greater than one-, and the near-zero p-value. With this, the "NDT causes LEV" values can be affirmed, as can the notion that they contain useful information for predicting LEV behavior.

The results of the Granger causality test on LEV and LIQC are provided in Table 6:

Table 6: Granger causality test for the relationship between LEV and LIQC

Granger causality (2009-2013) - 768 obs.

Variables	***F-statistic***	***p - Probability***
LEV does not cause LIQC	0.13024	0.71829
LIQC does not cause by LEV	0.26467	0.60708

Source: Study data.

Table 6 provides the results of the causality analysis on the variables LEV and LIQC. The results of the Granger causality test do not indicate that the behavior of LEV in the companies sampled can provide useful information for predicting variations in LIQC.

The hypothesis "LEV does not cause LIQC" is not rejected, as per the results of the f-statistic test -less than one- and the p-value. This indicates that LIQC values do not contain information useful for predicting variations taking place in company LEV, and vice-versa. The p-value, itself near 1, also suggests a lack of a causal relationship between the variables.

Table 7 displays the relationship between LEV behavior and ESG over 2009-13:

Table 7: Granger causality for the relationship between LEV and ESG

Granger causality (2009-2013) - 768 obs.

Variables	***F-statistic***	***p – Probability***
LEV does not cause ESG	0.86490	0.35266
ESG does not cause LEV	2.65068	0.10392

Source: Study data.

With base in the F-value statistical test and the p-value provided above, the hypothesis "LEV does not cause ESG" is not rejected, demonstrating that LEV values do not serve to predict future performance of ESG. Notwithstanding, the F-statistic value and the p-value do reject the hypothesis that "ESG does not cause LEV", providing the indication that the predictive values of growth in total assets (measured as ESG) help to explain LEV behavior. In this case, the relationship is not bilateral, or mutual, but there is evidence that ESG contributes to the LEV causal relationship.

Table 8 presents the relationship between the variables LEV and SIZ:

Table 8: Granger causality test for the relationship between LEV and SIZ

Granger causality (2009-2013) - 768 obs.

Variables	***F-statistic***	***p – Probability***
LEV does not cause SIZ	0.23657	0.62684
SIZ does not cause LEV	1.01046	0.31511

Source: Study data.

It merits mention that the results obtained from the f-statistic test and the p-value do not reject the hypothesis that "LEV does not cause SIZ", given that the results of the former are less than one, which in turn indicates that LEV values do not contain information useful for predicting variations in SIZ in the companies making up the sample. The p-value also shows that there is no causal relationship between the variables. Still, the statement that "SIZ is not caused by LEV" displays values suggesting that past SIZ behavior might explain future LEV in the companies examined.

Considering that the Granger causality test analysis, cause-and-effect relationships between LEV and PROF and LIQC cannot be confirmed during the years in question, nor can the notion that prior values of said variables contain information useful for predicting future LEV behavior in the companies making up the sample.

The causal relationship between LEV and tang, however, is confirmed: past LEV values contain information useful for predicting the future behavior of TANG, despite the bilateral relationship between the two (TANG values serve to predict future LEV behavior) is not proved by the results.

The results of the study also suggest that past behavior of NDT, ESG and TE help to explain the future behavior of LEV, given the causal Granger relationship shown in the analysis stage. Further, though the same relationship is not bilateral in nature, these findings

allow for examination of the behavior of said variables in relation to company capital structures.

4.2 Results analysis, with emphasis on trade-off and pecking order theory and related studies

The findings provided above are considered under trade-off and pecking order theory in Figure 3, which observes the match between the Brazilian companies sampled and the characteristics prescribed in the literature while also linking the results of this study to those of previous research in the field.

Figure 3: Interpretation of capital structure variables

Variables studied	Studies results in terms of trade-off and pecking order theories	Comparison to prior studies
LEV	The results indicate that LEV is a relevant variable in analysis of company capital structures, especially in terms of its relationship to other variables, as suggested by trade-off and pecking order theories.	Prior studies, including Deesomsak; Paudyal and Pescetto (2004), Liu (2014); Arqawi; Bertin and Prather (2014); Handoo and Sharma (2014), Yadav (2014) and Chang; Chen and Liao (2014) consider leverage as a determining variable in capital structure.
PROF	A significant relationship between LEV and PROF was observed in Brazilian companies, though negative in nature. This finding is consistent pecking order theory. Regardless, causality analysis between these variables did not support a causal relationship between LEV and PROF.	These results corroborate those of studies by Handoo and Sharma (2014), Arqawi, Bertin and Prather (2014) and Liu (2014), which also showed a negative relationship between PROF and LEV. They differ, however, from the findings of Yadav (2014), which indicated a positive relationship between the same.
TANG	Evidence of a significant relationship between LEV and TANG was not found, though a causal relationship between past LEV values behavior and TANG was shown (i.e. "LEV causes TANG"). In this case, the results contribute to discussions and arguments centered on trade-off theory, pushing them forward in light of analysis on the unilateral causality between these variables, as seen in Brazilian companies.	The results of the study do not allow for inferring the existence of a significant relationship. However, the causality relationship shown corroborates the results of Arqawi, Bertin and Prather (2014), Chang, Chen and Liao (2014) and Yadav (2014), all of which found a relationship between LEV and TANG, albeit not resulting from causality analysis between them, as was the case here.
NDT	The existence of a significant relationship between LEV and NDT cannot be affirmed in the case of Brazilian companies. However, a causal relationship between prior NDT behavior and LEV behavior can help to explain the latter, meaning that "NDT causes LEV". As such, these findings contribute to trade-off theory, indicating that a unilateral causal relationship between the NDT and LEV exists.	The study results do not provide grounds for a significant relationship, but a causal one was found between NDT and LEV. Liu (2014) points to a negative relationship between NDT and LEV in Dutch companies; Deesomsak, Paudyal and Pescetto (2004) also found a negative relationship between the same.
LIQC	The variable LIQC was not confirmed to be a useful predictor of LEV behavior in terms of its significance nor causal relationships, rendering it insignificant. The focus of pecking order theory therefore cannot be confirmed.	The results corroborate with the findings of Handoo and Sharma (2014), concerning Indian companies, in that liquidity does not yield a significant impact on LEV in Brazil. However, these findings differ from those of Yadav (2014), which indicated that LIQC has a positive relationship with LEV. Similarly, Liu (2014) found a negative relationship between LIQC and LEV.
ESG	The results confirmed a negative relationship between ESG and LEV, in accordance with pecking order theory. Further, a unilateral causal relationship between ESG and LEV was shown, as per Granger testing.	These results are aligned with those by Handoo and Sharma (2014) -ESG impacts LEV in Indian companies-, Arqawi, Bertin and Prather (2014), Yadav (2014) and Chang Chen and Liao (2014) –showing a positive relationship between ESG and LEV.
SIZ	The results confirm a positive relationship between SIZ and LEV, in conformity with the position of pecking order theory. Further, a unilateral causal relationship between SIZ and LEV was shown through Granger testing.	These results corroborate with the findings of Yadav (2014), and Handoo and Sharma (2014), indicating that SIZ is positively related to LEV. However, they differ from the results of Arqawi, Bertin and Prather (2014), which posited a negative relationship between the two.

Source: Study authors, using research data.

Overall, Figure 3 displays a variety of studies contributing to analysis and investigation concerning determining factors in company capital structures, as well as the proximity to, or distance between, the results of this study and those of prior research in the field, with differences stemming from samples, countries, and operating sectors. These contributions are in accordance with this study and the determining factors that can assist analysis on capital structure in Brazilian companies, as well as previous studies, under both trade-off and pecking order theory.

Correa, Basso and Nakamura (2013) state that decision-maker behavior prevails over the logic of pecking order theory (e.g. flexibility and control); however, the authors suggest that trade-off theory is more consistent when seeking to explain capital structures in Brazilian companies, given the dynamics of short-term debt. The results achieved in this study agree with this assertion, given the analysis carried out on the variables via panel data methods and Granger Causality statistical testing. The relationship between LEV and PROF, ESG and SIZ displays characteristics presented by pecking order theory, while the relationship between LEV and TANG and NDT are more indicative of trade-off theory.

In general terms, these results allow for the inference that LEV behavior in Brazilian companies contributes to analysis on capital structure, as well as on the variables PROF, TANG, NDT, ESG and SIZ, which were shown to be capable of predicting the future behavior of LEV.

5 FINAL CONSIDERATIONS

This study sought to identify key variables that explain capital structures in Brazilian companies listed on the BM&FBovespa, adopting a comparative perspective based in pecking order and trade-off theory. In order to achieve this, a sample of 192 non-financial companies listed on the Exchange were selected, drawing data from available data ranging from 2009-13.

Fixed-effects panel data modeling established significance between the variables in question: LEV, PROF, TANG, NDT, LIQ, ESG and SIZ. Additionally, the variables LEV, PROF, ESG and SIZ were found to be significant for explaining capital structure behavior in the companies examined.

Further, the causal relationships between the variables comprising the model were analyzed using Granger Causality testing, which produced the following findings:

1) PROF does not Granger-cause LEV and LEV does not Granger-cause PROF;
2) TANG does not Granger-cause LEV;
3) LEV does not Granger-cause NDT;
4) LIQC does not Granger-cause LEV and LEV does not Granger-cause LIQC;
5) LEV does not Granger-cause ESG;
6) LEV does not Granger-cause SIZ.

However, the following hypothesis in the Granger Causality model were rejected:

7) LEV does not Granger-cause TANG;
8) NDT does not Granger-cause LEV;
9) ESG does not Granger-cause LEV;
10) SIZ does not Granger-cause LEV;

As such, the results provided by this study allow for the inference that LEV has a causal relationship with TANG, and NDT, ESG and SIZ have a causal relationship with LEV, as per Granger testing. Though the causal relationships are not bilateral, these findings provide new evidence in concerns to determining factors in capital structures in Brazilian companies, serving as a justification for the relevance of this study.

These findings bear resemblance to the arguments of pecking order theory *vis-à-vis* explanation for capital structures in Brazilian companies, as well as allowing for the

observation, with base in the variables in question (panel data and Granger Causality statistical testing), that prior behavior in NDT, ESG and SIZ are predictors of use for explaining future LEV behavior. Moreover, LEV was shown to be a useful predictor in the sense of explaining TANG in Brazilian companies. Additionally, the variable PROF as displayed a significant relationship in the model developed here, despite the lack of evidence to suggest a causal relationship between it and LEV. Among the variables examined, LIQC alone did not show significance in the model, while also not showing a causal relationship to LEV, and vice versa.

Overall, these findings warrant the claim that LEV behavior in Brazilian companies contributes to analysis on capital structure and the variables PROF, TANG, NDT, ESG and SIZ. Further, these variables were shown to be predictors for evaluating the future behavior of LEV, thusly supporting the points presented by pecking order theory.

For subsequent studies, a longer timeframe is recommended for analysis, as well as the inclusion of new dependent variables that might assist in the construction of a new analysis model. In the context of Brazilian companies, further research on the topic could compare financial and non-financial performance measures.

In summary, the importance of analysis on explanatory factors in the makeup of company debt is highlighted here. This, in order to provide arguments that improve predictive analysis on the same, given that these are incorporated into decision-making processes. Along with this, causal relationships, or the absence of the same, remain compelling indicators of company performance and capital structures.

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