DOI: 10.5902/1983465933892

DETERMINANTS OF INDEBTEDNESS OF BRAZILIAN COMPANIES LISTED IN B3 WITH AND WITHOUT INSOLVENCY RISK'

Determinantes do Endividamento de Empresas Brasileiras Listadas na B3 com e sem Risco de Insolvência

Submission: 24/07/2018
Accept: 23/04/2020

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ABSTRACT

Purpose – The objective of this paper is to identify and analyze if there are differences in the determinants of the capital structure of companies listed in B3 (Brazil, Stock exchange, Over-The-Counter), with and without risk bankruptcy.
Design/methodology/approach – We used the bankruptcy prediction index (Z2) of Altman, Baidya and Dias (1979) to separate companies with and without risk of bankruptcy, in addition to the multiple regression model estimated by OLS, in a sample consisting of 233 companies. The data used are secondary, of annual periodicity, obtained from financial statements taken from the Quantum Axis database, covering the period from 2011 to 2016.
Findings – We concluded that there is a difference in the determinants of indebtedness between companies with and without risk of bankruptcy. Companies with risk of bankruptcy present a positive relationship between long-term and total indebtedness, and profitability and risk. Healthy companies, long-term and total debt presented negative relation with profitability, and positive with risk and size.
Research limitations/implications – The limitation of this study is that it applies only to the companies investigated, so it is not possible to make generalizations.
Originality/value – As a whole, the evidence found corroborates the pecking order hypothesis, according to which the first source of funds to finance investments is retained earnings, in the assessment of the capital structure of healthy companies than in relation to companies at risk of bankruptcy. Thus, the research's contribution is in the empirical field, providing new evidence for a very controversial topic in finance theory.

Keywords: Capital Structure; Bankruptcy; Prediction of Bankruptcy; Indebtedness; Z-Score.

RESUMO

Objetivo – O objetivo deste artigo é identificar e analisar se existem diferenças nos determinantes da estrutura de capital de empresas listadas na B3 (Brasil, Bolsa e Balcão) com risco e sem de falência.
Design/metodologia/abordagem – Foi utilizado o índice de predição de falência (Z2) de Altman, Baidya e Dias (1979), para separar empresas com e sem risco de falência, além do modelo de regressão múltipla estimado via MQO, em uma amostra de 233 empresas. Os dados utilizados são secundários e anuais, obtidos de demonstrações financeiras retiradas da base Quantum Axis, abrangendo o período de 2011 a 2016.
Resultados – Constatou-se que há diferença dos determinantes do endividamento entre empresas com e sem risco de falência. Empresas com risco de falência apresentam relação positiva entre o endividamento de longo prazo e total e a rentabilidade e o risco. As empresas saudáveis, a dívida de longo prazo e total apresentou relação negativa com a rentabilidade e positiva com o risco e o tamanho.
Implicações e limitações da pesquisa – A limitação deste estudo é que ele se aplica apenas às empresas investigadas, não sendo possível fazer generalizações.
Originalidade/valor – Em linhas gerais, as evidências encontradas corroboram a pecking order theory, segundo a qual a primeira fonte de recursos para financiar investimentos é o lucro retido, na avaliação da estrutura de capital das empresas saudáveis do que em relação às empresas com risco de falência. Dessa forma, contribuição da pesquisa está no campo empírico, fornecendo novas evidências para um tema bastante controverso na teoria de finanças.

Palavras-chave: Estrutura de Capital; Falência; Previsão de Falência; Endividamento; Z-Score.

1 INTRODUCTION

The theory of Finance does not present, in an objective way, how managers define the level of indebtedness of companies, and the empirical literature, with respect to the discussions on capital structure, has not yet reached a consensus on the topic. One of the results of these discussions was the development of bankruptcy prediction models of companies, based on financial indicators to assess solvency and minimize the risk of default.

The seminal article by Modigliani and Miller (1958), defending the irrelevance of the capital structure, changed the paradigm of how it was seen, in opposition to the traditional view, defended by Durand (1952), that the capital structure has influence in the company's value. Since then, this theoretical field has been permeated by debates against and in favor of the existence of an optimal capital structure that would maximize the value of a company.

The seminal work of Modigliani and Miller (1958) was followed by several theories that try to explain the indebtedness of companies, with emphasis on: 1. pecking order theory (POT), which does not predict an optimal level of capital and states that companies follow a hierarchical sequence of preference by type of financing: internal or retained earnings, through debt and through the issuance of shares (Myers & Majluf, 1984); 2. trade-off (Trade-off Theory - TOT), states that companies pursue a pre-established capital structure defined as the confrontation between the cost of financial difficulties and the tax benefit when raising indebtedness; 3. market timing, defined as the act of issuing shares when they are overvalued and repurchasing when they are undervalued, exploring temporary fluctuations in equity (Baker & Wurgler, 2002).

In parallel to the evolution of the theoretical framework on capital structure, and, in a complementary way, models of companies' bankruptcy prediction were developed, whose focus is on the identification of the best financial indicators to assess the solvency capacity, thus minimizing the risk of default. Considerable advancement in this field of study was given by Altman (1968), who, through the use of statistical techniques, managed to identify / develop bankruptcy prediction indexes that use various indicators and have a high degree of accuracy.

Companies at risk of bankruptcy are typically characterized by low liquidity and the possibility of insolvency. This situation, internally, can harm activities, affect the behavior of managers and, in extreme cases, bring unintended consequences, in addition to losses for the company's various stakeholders. Externally, it can hinder access and increase the cost of indebtedness.

It is expected that companies that are in this situation present a different (higher) leverage level than the others, which requires a review of the strategy and financial planning. In this context, the objective of this work is to identify and analyze whether there are differences in the determinants of the capital structure of companies listed on B3 (Brazil, Stock Exchange, Over-The-Counter) with and without risk of bankruptcy. Methodologically, the bankruptcy prediction index (Z-Score 2) of Altman, Baidya & Dias (1979) was used, which is structured in the multiple discriminant analysis to separate companies with and without risk of bankruptcy, in addition to the multiple regression model in a sample of 233 companies, considering the period from 2011 to 2016.

The empirical contribution lies in the interlocution of two themes based on the identification of the differences in the determinants of indebtedness between companies with and without risk of bankruptcy, providing a better understanding of the financial behavior of companies that are at risk of terminating their operations. The scope of this research is thus to fill this gap in the national literature.

In terms of practical contribution, the results and conclusions of this research can be useful to guide specific strategies to recover the financial health of Brazilian companies. In addition, they make it possible to verify whether the theories on capital structure explain the indebtedness of companies in different financial conditions. This work innovates, therefore, by distinguishing companies into two groups, according to financial health, and analyzing the explanatory power of the theories on indebtedness for the two groups separately.

The article has the following structure: after this introduction, section 2 presents the theoretical framework to support empirical research. The methodology and results are presented in sections 3 and 4, respectively. It ends with the final considerations in section 5, followed by references.

2 THEORETICAL FRAMEWORK

2.1 Capital Structure

Modigliani and Miller (1958), or simply MM, presented a new paradigm for understanding the capital structure which, until then, in the traditional view defended by Durand (1952), influenced the company's value. Using a theoretical model, MM demonstrated that the capital structure is irrelevant to the company's value. As a result, only investment decisions would be relevant to the company's valuation, concluding that there was no optimal capital structure, in contrast to the traditional view prevailing at the time. After severe criticism, Modigliani and Miller (1963) presented a correction of the original article, in which they recognized as advantageous the use of debt as a source of financing due to the tax benefit. But they also stressed that it should not be used to the fullest to compose the capital structure (bankruptcy risk), and that the use of retained earnings can also be advantageous under certain circumstances.

Discussing the effects of the principal-agent relationship on the capital structure, Jensen and Meckling (1976) argue that as the interests between external shareholders and company managers as well as between creditors and managers are not the same, agency costs will arise from this relationship. As creditors know that managers have an incentive to use third-party funds for higher-risk investments or with lower market value, they will tend to lend funds at increasingly higher

costs to the company. In this way, the tax benefits of debt will be compensated not only by the cost of bankruptcy, but also by agency costs.

Miller (1977), however, adds that bankruptcy and agency costs are much lower and would not be sufficient to match the tax benefits arising from indebtedness. DeAngelo and Masulis (1980) highlight that there is an optimal capital structure for each company, even if there were no bankruptcy or agency costs. There would be a maximum amount that companies could benefit from using debt to reduce income taxation. Thus, the optimal level of indebtedness would vary according to the benefit of the indebtedness, the amount of tax exemption and the tax credits that the company holds, as well as the bankruptcy and agency costs.

The hierarchy theory of funding sources (POT) proposed by Myers (1984), incorporates the information asymmetry between managers and shareholders to explain that there is a preference of companies in the order of choosing the sources of financing. As managers have more information than the market about the company's investment opportunities, the market interprets the search for financing by issuing new shares in a negative way (depending on the context). In this way, it does not predict an optimal level of capital, but rather that companies follow a hierarchy of preferences by type of financing: first using internal resources (retained earnings), then those raised through debt and, finally, through issuance of shares.

The market timing theory, developed by Baker and Wurgler (2002), is defined as the practice of issuing or repurchasing shares depending on how the company considers the value of those shares, that is, companies are more likely to issue shares when their value market value is high, in relation to its book value and / or its past market value, in addition to taking the opportunity to repurchase them when their market value is low. In other words, companies prefer to finance themselves by issuing shares when the cost of equity is low, and they prefer to issue bond debt otherwise (Alti, 2006; Huang & Hitter, 2009).

Theories on capital structure were developed for the context of markets with a high degree of development, mostly considering the North American market, which presents economic and institutional structures very different from developing countries. Thus, several Brazilian researches sought to test the theories for the Brazilian reality. Such works point to specificities of the Brazilian market that result in different outcomes than the theory predicts (Nakamura et al., 2007; Brito, Corrar & Batistella, 2007; Mitushima, Nakamura & Araújo, 2010; Machado & Godoy, 2013). Among these specificities, high interest rates stand out, as opposed to much lower rates of long-term public financing, strong credit restrictions, the restricted capital market and the concentration of corporate share control (Brito, Corrar & Batistella, 2007).

2.2 Bankruptcy Prediction Models

Liquidity and bankruptcy, as well as capital structure, are classic themes, but in constant debate in Finance theory. Insolvency occurs when the company is unable to pay its obligations on time, that is, when operating cash flow is insufficient to meet current obligations (Ross, Westerfield, Jaffe & Lamb, 2015). Bankruptcy can be divided into economic and legal categories. From an economic point of view, Almeida (2006) states that bankruptcy is the condition of a party that, having received credit, does not have the ability to repay the interest or the capital borrowed at the maturity. From the legal point of view, bankruptcy is a collective application process against the insolvent debtor, that is, a mechanism that brings together several litigants in a single process, connected by a union of interests.

Although understanding the financial performance of a company makes it possible to foresee a situation of insolvency or future bankruptcy, many managers only realize the possibility of insolvency when the first symptoms of low liquidity appear, identified through continued default (Marques, 1995).

The first bankruptcy forecasting studies took place in the 1930s, using univariate analysis to determine financial indicators that distinguished bankrupt or healthy companies by their billing profile, such as the Fitzpatrick model (1932). Also using univariate data analysis, Beaver (1966) collected thirty indicators for seventy-nine pairs of bankrupt and non-bankrupt companies in the United States, selecting six variables from different financial groups that presented themselves as triggers to identify companies that failed to honor their obligations.

Altman (1968) developed the first bankruptcy forecasting model using a multivariate data approach (multivariate discriminant analysis - MDA), using data from US companies. This technique allows the composition of an ordinary least squares regression equation that combine the most significant variables interactively with the definition of weights for the regression coefficients and optimally predicting the dependent variable. With that, he created five financial indexes that derive the model he called Z-score, concluding on the financial status of the analyzed company.

Altman et al. (1979), in improvement of the original Z-score, created the Zeta model (Z-Score 2), which was more effective in classifying companies with possibility of bankruptcy up to five years earlier, in a sample of companies composed of manufacturers and retailers .

Several researchers influenced by the work of Altman (1968) on the application of discriminant analysis have explored ways to develop more reliable models of predicting financial difficulties. Later, new analytical techniques were applied for this purpose, such as logit or probit models (Ohlson, 1980; Zavgren, 1985; Lennox, 1999), multidimensional scale (Mar-Molinero & Ezzamel, 1991), artificial neural networks (Tam, 1991; Wilson & Sharda, 1994/1995), multinomial logit (Johnsen & Melicher, 1994), in addition to several others such as Levitan and Knoblett (1985), Mutchler (1985), Koh and Killough (1990) and Koh and Brown (1991).

Altman and McGough (1974) found that their model was 82% successful in predicting bankruptcies, while the other models used by audits showed only 46% assertiveness. These results were reaffirmed in a later study by Altman (1983), in which the average success of his model in predicting bankruptcy was 86% compared to 48% of the others.

In Brazil, Elisabetsky (1976) analyzing data from 373 Brazilian companies, 99 of which are bankrupt, created a model similar to that of Altman (1968). Kanitz (1978) also followed the same line when creating a scale with bands that determined the company's financial condition, based on five financial indexes, known as the Kanitz thermometer. The studies of Matias (1978) and Silva (1983) can also be cited in the national literature, both using the MDA.

More recently, Altman (2018) made an analysis of the various applications of the Z-score model, discussing its potentialities. Altman, Iwanicz-Drozdowska, Laitinen & Suvas (2017) evaluated the performance of the Z-score model in a sample of 31 European and three non-European countries, observing that the model performed very well in predicting bankruptcies. Ko, Fujita & Li (2017) used the model in the analysis of companies in the Taiwan solar sector. Salimi (2015) assessed the predictive capacity of the Z-score model in recent years.

In Table 1, it is possible to observe that in most recent Brazilian empirical studies, the multivariate data analysis technique was used, based on the models of Altman (1968), Elisabetsky (1976), Kanitz (1978) and Matias (1976):

Table 1 - Empirical literature on bankruptcy prediction in Brazil

Author / year	Sample	Technique Used / Conclusions
Sanvicente and Minardi (1998)	92 companies with shares on Bovespa* between 1986 and 1998	Using discriminant analysis, they obtained 80% accuracy, with liquidity indicators being the most predictive. The indicators of retained earnings, profitability, indebtedness and interest coverage increased the predictive power of the model. The asset turnover indicator contributed negatively to the function's forecast power.
Guimarães and Moreira (2008)	116 companies from 17 sectors, from 1994 to 2003	Using discriminant analysis, they obtained 88.6% of correctness. High discriminatory power for the variable's capital structure, asset structure, cash generation. The own resources variable made a negative contribution to the analysis.
Virgilitto and Fama (2008)	114 SERASA** - based companies between the years 1995 to 1998	Using a logistic regression model, they obtained a 76.67% accuracy rate with 20 indexes extracted from the balance sheets of 57 good (non-bankrupt) and 57 bad (bankrupt) companies. The final model consisted of four discriminating functions with the variables: liabilities, dry liquidity, return on equity and participation of financing in current assets.
Pinheiro and Pinheiro (2009)	174 non-financial companies listed on the Bovespa*, between 1995 and 2006	Using discriminant and logistical analysis, they found that the two techniques provided high percentages of success in the classification of solvent and insolvent companies, which were about 95% in the year before the failure and 80% in the second year before. The logit model presented results slightly superior to those of the discriminant analysis.
Brito and Assaf Neto (2009)	66 publicly traded companies between 1995 and 2006, 33 of which are in default	Using a logistic regression model, they found that business insolvencies can be predicted by a credit risk classification system based only on accounting ratios, evaluating the probability of the default event taking into account the variables: retained earnings on assets, financial indebtedness, net working capital and cash balance on sales.
Nascimento, Pereira & Hoeltgebaum (2011)	Airline companies: Gol and Tam	Using discriminant analysis, they found that GOL shows a more favorable economic and financial situation in the application of the models of insolvency of Elizabetsky (1976), Kanitz (1978), Matias (1976), Altman et al. (1979) and Silva (1982), than TAM in the analyzed period.
Silva Wienhage, Souza, Bezerra and Lyra (2012)	13 Brazilian companies that declared bankruptcy between 1997 and 2003	Using discriminant analysis, they found that Elisabetsky's (1976), Kanitz (1978), Matias (1978), Altman et al. (1979) and Silva (1982) are more functional and able to predict the discontinuity of companies.
Barros (2013)	Health plan operators in 2009 and 2012	Using discriminant analysis, they found that shareholders' equity can be used as a measure of insolvency for health plan operators. The models by Matias (1978) and Altman et al. (1979) can be used by the *stakeholders* of the supplementary health market and by ANS*** as another financial and strategic management tool in order to avoid or, at least, create a recovery plan.
Ferreira, Carmo, Martins and Soares (2013)	15 companies in the Brazilian airline industry from 2005 to 2010	In addition to ratifying the effectiveness of the Z-score model applied to the airline industry, they found that the companies Tam and Gol performed better among the companies in that segment, which allowed their economic and financial recovery, in relation to the economic crisis of 2008, already in 2009.

Note: (*) São Paulo Stock Exchange; (**) Brazilian Credit Research Firm; (***) Brazilian Health Agency.
Source: Adapted from Scalzer, Rodrigues & Macedo (2015).

The choice of Altman's (1968) Z-Score model for application in the present study is supported by its recognition and validation, by the various studies presented, as being a tested model that has been used in several different countries and in various configurations industry, managing to overcome country-specific corporate failure models (Holmen, 1988; Eidleman, 1995).

3 METHODOLOGY

This research can be classified according to: 1. as for the purposes, as applied; 2. as to the means, as empirical. It is also a descriptive research, conducted with a quantitative approach (Vergara, 2005).

In order to compare the determinants of the capital structure between Brazilian companies with and without bankruptcy risk, the bankruptcy prediction index prepared by Altman et al. (1979), named Z-score 2 (Z2), was calculated. This index was used to divide the analyzed companies according to their probability of bankruptcy.

3.1 Data and Sample

The data used are secondary, on an annual basis, obtained from the Quantum Axis database, which contains information from the financial statements of 347 publicly traded companies listed on B3. The period of analysis was from the year 2011 to 2016. The choice of this period was made, on the one hand, to avoid influences of the global financial crisis if the period went back more than 2011, and 2016, as it is the last year of availability of data when conducting the research.

The sample selection criteria were: 1. to be active listed in B3, with availability of data in the database consulted; 2. not be in the financial sector; and, 3. present information for all years of analysis. The result was a sample composed of 233 companies, with a total of 1,398 observations for the period, adjusted for inflationary effects in order to allow comparison between the years.

3.2 Analyzed Variables

Table 2 shows the dependent and independent variables. The dependent variables selected were: short-term debt, long-term debt and total debt. They reflect the company's financing decisions. The independent variables were: current liquidity, profitability, asset composition, risk, size and growth. According to the theories on capital structure, each of them must present a type of effect (expected sign) on the company's financing decision. All were obtained by building indicators from data extracted from the financial statements.

Table 2 - Dependent and independent variables analyzed

N°	Variable	Initials	Calculation	Operational Source
1	Short-term debt	DEB_ST	Short-term loans and financing / Total Assets	Bastos, Nakamura & Basso, (2009)
2	Long-term debt	DEB_LT	Long-term loans and financing / Total Assets	Bastos, Nakamura & Basso, (2009)
3	Total debt	DEB_T	(Short and Long Terms Loans and Financing) / Total Assets	Mitushima, Nakamura & Araújo (2010)
4	Liquidity	LIQ	Current Assets / Current Liabilities	Machado & Godoy (2013); Bastos, Nakamura & Basso, (2009)
5	Profitability	PROF	Net Income / Total Assets	Brito, Corrar & Batistella (2007); Bastos, Nakamura & Basso (2009)
6	Composition of assets	C_TA	Permanent Assets / Total Assets	Brito, Corrar & Batistella (2007); Mitushima, Nakamura & Araújo (2010)

7	Risk	RISK	Standard Deviation of Profitability	Brito, Corrar & Batistella (2007); Bastos, Nakamura & Basso (2009), (2009)
8	Size	SIZE	Neperian Logarithm of Net Revenue	Bastos, Nakamura & Basso (2009), (2009); Machado & Godoy (2013)
9	Growth	GROW	Net Revenue t_1 - Net Revenue t_0 / Net Revenue t_0	Nakamura et al. (2007)

Source: Elaborated by the authors.

Variables 1 to 3 appear in the model as dependent variables, while the other six (4 to 9) are explanatory. For each of the latter, its relation (hypothesis) with the companies' indebtedness was presented according to the different theories on the capital structure, presented in Table 3.

Table 3 - Expected Relation / Hypotheses of the Indebtedness Determinants

Variable	Expected relationship on the level of indebtedness following the theories on capital structure (hypotheses)			
	Pecking Order Theory	Trade-Off Theory	Information Asymmetry	Agency Theory
Liquidity	Negative	NA	Negative	NA
Profitability	Negative	Positive	Positive / Negative	Positive
Composition of assets	Positive	Positive	Positive	Positive
Risk	Negative	Negative	Negative	Negative
Size	Positive / Negative	Positive	Positive / Negative	Positive
Growth	Negative	Positive / Negative	Negative	Positive / Negative

Note - NA = not applicable.
Source: Adapted from Bastos & Nakamura (2009, p. 81).

As noted, the variables / determinants of indebtedness are explained by more than one theory, and in some situations, in an antagonistic way. They were selected based on empirical works in the literature on the topic (Machado & Godoy, 2013; Bastos, Nakamura & Basso, 2009; Bastos & Nakamura, 2009; Nakamura, et al., 2007; Brito, Corrar & Batistella, 2007; Ozkan, 1996; Titman & Wessels, 1988).

3.3 Econometric Model

The Z_2 model by Altman et al. (1979) consists of a multiple discriminant analysis test (MDA), which is adequate when the only dependent variable is dichotomous or multidichotomous, and, therefore, not metric. Multiple discriminant analysis is applicable when the total sample can be divided into groups based on a non-metric dependent variable that characterizes several known classes. The primary objectives of the MDA are to understand the differences in groups and to predict the likelihood that a company or group will belong to a particular class or group based on several independent metric variables (Hair Jr., William, Babin & Anderson, 2009).

The survey also calculated bankruptcy prediction index or Z_2 of Altman et al. (1979) to di-

vide companies between two groups, with and without risk of bankruptcy. Z_2 is calculated using the following equation:

$$Z_2 = -1{,}84 - 0{,}51X_1 + 6{,}32X_2 + 0{,}71X_3 + 0{,}52X_4$$

Where: X1 = (Current Assets - Current Liabilities) / Total Assets; X2 = EBIT / Total Assets; X3 = Equity / Liabilities; X4 = Net Revenue / Total Assets.

According to Altman et al. (1979) the critical point of the index is zero. Thus, companies with Z2 above zero are considered healthy, and those with values equal to or less than zero are at risk of bankruptcy. Therefore, a descriptive analysis of the statistics of these two groups of companies was carried out. Then, the same three equations of determinants of the capital structure were regressed, but for the two groups separately.

Before that, an analysis of the descriptive statistics of the selected variables for the determinants of the capital structure was carried out. To test the interrelationship between dependent and independent variables, a multiple linear regression was applied, using the ordinary least squares (OLS) method, first for the total of observations and then separately for the group of companies with probability of bankruptcy and the healthy business group. The results of the regressions were analyzed based on the theoretical framework and compared with the empirical literature. Three different regressions were performed, one for each dependent variable, so that the determinants of the three types of financing, short-term, long-term and total, could be observed separately. The model equations used were:

$$DEB\_LT = \alpha + \beta_1 PROF + \beta_2 C\_TA + \beta_3 RISK + \beta_4 SIZE + \beta_5 GROW + \beta_6 LIQ + \mu \quad (1)$$

$$DEB\_ST = \alpha + \beta_1 PROF + \beta_2 C\_TA + \beta_3 RISK + \beta_4 SIZE + \beta_5 GROW + \beta_6 LIQ + \mu \quad (2)$$

$$DEB\_T = \alpha + \beta_1 PROF + \beta_2 C\_TA + \beta_3 RISK + \beta_4 SIZE + \beta_5 GROW + \beta_6 LIQ + \mu \quad (3)$$

Tests of independence, homoscedasticity and multicollinearity of the residues were carried out and some of the results are presented in tables 4 and 5. Table 4 presents the correlation matrix of the independent variables.

Table 4: Correlation matrix of independent variables

	LIQ	PROF	C_TA	RISK	SIZE	GROW
LIQ	1					
PROF	0.0586**	1				
	(0.0284)					
C_TA	-0.3288***	-0.0208	1			
	(0.0000)	0.4380				
RISK	-0.0132	-0.0804***	0.0236	1		
	(0.6227)	(0.0026)	(0.3776)			
SIZE	-0.1971***	0.0554**	0.0179	-0.2682***	1	
	(0.0000)	(0.0383)	(0.5030)	(0.0000)		
GROW	0.0179	-0.0349	-0.0279	0.0281	0.0082	1
	(0.5028)	(0.1918)	(0.2978)	(0.2943)	(0.7596)	

Note: ***, **, * denotes statistical significance at 1%, 5% and 10%, respectively.
Source: Elaborated by the authors.

It is observed that the pairs of independent variables with the highest correlation are liquidity and composition of assets (-32.88%), liquidity and size (19.71%) and risk and size (26.82%). Thus, no variable overlapped the other in the analysis undertaken. Once the presence of homoscedasticity and autocorrelation of residues was identified (Table 5), it was decided to use robust estimators for cluster in all three equations.

Table 5 - Breusch-Pagan heteroscedasticity test and Wooldridge autocorrelation test

	Prob > chi2	Prob > F
DEB_ST	0.0000	0.0266
DEB_LT	0.0000	0.0000
DEB_T	0.0000	0.0000

Source: Elaborated by the authors.

4. RESULTS ANALISYS

The descriptive statistics of the dependent and independent variables of the capital structure model are presented in Table 6. As noted, companies have, on average, short-term debt of approximately 11%, varying between 0 and 164% of the total asset value. The average long-term debt is 33.2%, ranging from 0 to 649%, while the average total debt is 44.1%. Therefore, Brazilian publicly traded companies, between 2011 and 2016, were more indebted in the long run than in the short run. Companies showed an average growth of 15.4%, but the average profitability in the period was only 0.6%. The average liquidity was 1.89, on average 60% of the assets were of the permanent type and the risk was on average 10.4%.

Table 6 - Descriptive statistics for dependent and independent variables

Variable	Mean	Standard Deviation	Minimum	Maximum
DEB_ST	0.1095	0.1348	0.0000	1.6410
DEB_LT	0.3315	2.5727	0.0000	64.9995
DEB_T	0.4411	2.5783	0.0000	65.1603
LIQ	1.8962	2.2896	0.0059	30.6117
PROF	0.0064	0.4217	-5.6727	11.8886
C_TA	0.6003	0.2238	0.0114	0.9999
RISK	0.1039	0.3957	0.0056	5.8424
SIZE	14.0420	2.1126	5.3209	19.8116
GROW	0.1538	3.2304	-2.3361	103.6334

Note - The variables used are: short-term debt (DEB_ST), long-term debt (DEB_LT), total debt (DEB_T), liquidity (LIQ), profitability (PROF), asset composition (C_TA), risk (RISK), size (SIZE) and growth (GROW).
Source: Elaborated by the authors.

Table 7 shows the Z2 statistics. It appears that the mean and median of the bankruptcy predictor are negative and that only 318 observations show a healthy situation for the company.

Table 7 - Z-score2 statistics

Statistics	Mean	Standard Deviation	Median	Maximum	Minimum	>0	<=0
Zscore2	-0.1689	5.5047	-0.6406	105.8145	-11.8662	318	1,080

Source: Elaborated by the authors.

The Brazilian economy grew 2.3% in 2013 and in 2014 closed the year slightly up 0.1%. It was the worst result for the country's economy since the fall of 0.2% in 2009, the peak of the global financial crisis. Which meant a drop of 0.7% in the Gross Domestic Product (GDP), in volume, in relation to 2013. In the following years it was no different, noting that in 2015 the economy shrank 3.8% in relation to 2014, and in 2016 the retraction was 3.6% in relation to 2015, leaving the GDP with negative variation of -3.8 %, and in 2016 of -3.6% (POCHMANN, 2015). The Brazilian interest rate jumped from 10.66% a year, in 2010, to 14.15% in 2016, and historical inflation (The Extended National Consumer Price Index - IPCA) went from 5.91% in 2010 to 10.67% in 2015. The slowdown in the Brazilian economy, linked to the effects of reduced consumption and combined with the high interest rate and inflation over the past few years, certainly influenced the results of the research presented, both in the classification of healthy companies with risk of bankruptcy, and in the determinants of the capital structure.

Table 8 shows the descriptive statistics for the variables in the regression model, separated between the group of companies with and without risk of bankruptcy. Companies with negative Z2 have, on average, greater short-term debt. On the other hand, healthy companies have greater long-term and total leverage, although the difference in this case is not statistically significant. Healthy companies have greater liquidity and higher profitability (2.84% and 6.64%, against 1.62% and -1.70%, respectively). Firms at risk of bankruptcy have a higher share of permanent assets over total assets and are larger than those without risk of bankruptcy. Companies with Z2 equal to or below 0, have a lower risk (9.3% against 14.07%), that is, their profitability shows less variation, although, as noted, the average profitability was much lower in this period. Healthy companies, on average, grew less (8.01% versus 17.6%), however, this difference was not statistically significant.

Table 8 - Statistics of dependent and independent variables for companies with and without risk of bankruptcy

	Mean		Standard Deviation		Minimum		Maximum	
Variable	*Zscore*>0	*Zscore*<=0	*Zscore*>0	*Zscore*<=0	*Zscore*>0	*Zscore*<=0	*Zscore*>0	*Zscore*<=0
DEB_ST	0.0533	0.1261	0.1018	0.1388	0.0000	0.0000	0.8507	1.6410
DEB_LT	0.3957	0.3126	4.1611	1.8658	0.0000	0.0000	64.9995	45.0628
DEB_T	0.4491	0.4387	4.1673	1.8722	0.0000	0.0000	65.1603	45.2052
LIQ	2.8410	1.6181	3.3021	1.8008	0.0107	0.0059	30.2183	30.6117
PROF	0.0864	-0.0171	0.4601	0.4069	-5.6727	-2.6653	2.2173	11.8886
C_TA	0.5550	0.6137	0.2467	0.2149	0.0114	0.0130	0.9982	1.0000
RISK	0.1407	0.0930	0.5746	0.3244	0.0056	0.0056	5.8424	5.8424
SIZE	13.5406	14.1897	2.3000	2.0319	5.3209	5.6930	18.8037	19.8116
GROW	0.0801	0.1755	0.5622	3.6628	-0.9991	-2.3361	6.6703	103.6334

Note - Table 8 shows the result of the statistics of the dependent and independent variables for companies with and without risk of bankruptcy considering all companies in the sample, in the period from 2011 to 2016. Zscore<=0 denotes companies with risk of bankruptcy, while Zscore>0 denotes healthy companies. The variables used are: short-term debt (DEB_ST), long-term debt (DEB_LT), total debt (DEB_T), liquidity (LIQ), profitability (PROF), asset composition (C_TA), risk (RISK), size (SIZE) and growth (GROW).
Source: Elaborated by the authors.

The coefficients of the independent variables were estimated using the Ordinary Least Squares model for pooled data, which used the entire database. The coefficients with their levels of significance for the models with short-term, long-term and total indebtedness are shown in Table 9. It is observed that the model for short-term debt has low explanatory power (Adjusted R2 = 15.5%), however, the explanatory power is higher for the long-term and total indebtedness models (Adjusted R2 of 59.4% and 59.3%, respectively).

Table 9 - Regression coefficients using the complete database

Variable	DEB_ST	DEB_LT	DEB_T
LIQ	**-0.0203****	-0.0199	**-0.0403*****
PROF	**-0.0291***	**0.8941*****	**0.8650*****
C_TA	**-0.1636*****	0.5558	0.3922
RISK	-0.0020	**5.0657*****	**5.0636*****
SIZE	-0.0107	**0.0766*****	**0.0659*****
GROW	**-0.0013*****	**-0.0157****	**-0.0170****
Constant	**0.3672***	**-1.8107*****	**-1.4434****
R^2	0.1587	0.5958	0.5948
R^2 Adjusted	0.1545	0.5937	0.5928
F test	18.57	3,825.0	16,896.0

Note: ***, **, * denotes statistical significance at 1%, 5% and 10%, respectively. Table 9 presents the coefficients of the variables from the three regression models considering all companies in the sample, in the period from 2011 to 2016. The dependent variables are: short-term debt (DEB_ST), long-term debt (DEB_LT), total debt (DEB_T). The independent variables are liquidity (LIQ), profitability (PROF), asset composition (C_TA), risk (RISK), size (SIZE) and growth (GROW).
Source: Elaborated by the authors.

The growth and profitability variables are the only ones statistically significant in the three models, therefore, which explain short and long-term debt. Liquidity and asset composition have explanatory power in the short-term debt model, but not in the long-term, and liquidity is also an explanation of total debt. The risk and size factors are determinants of long-term debt and total debt, but are not significant in the short term.

Liquidity had a negative relationship with short-term and total indebtedness, which indicates that more liquid companies use the availability of resources in the short term to finance their assets. This result corroborates POT, according to which the first source of funds to finance investments is retained earnings (Myers & Majluf, 1984).

Profitability should have a negative relationship with the level of indebtedness according to the POT (Myers & Majluf, 1984). However, this relationship is only seen in short-term debt. In the long run, the coefficient is positive, which indicates that companies with higher profitability have greater availability of resources to face adversities, which allows them to better finance their investments with third party resources.

The negative coefficient of asset composition for short-term debt is in line with the theory, as companies with more permanent assets are better able to borrow in the long term, using less short-term debt (DeAngelo & Masulis, 1980). Although the coefficient of asset composition in the long run was not significant, it was positive, pointing out that the relationship is in line with expectations.

The risk presented an opposite result than expected, since the coefficient has a positive relationship with indebtedness. Risky companies have less stability in their cash flow and, therefore, are more likely to fail to honor their obligations to third parties. This opposite result may have occurred because the risk was measured by the standard deviation of profitability and the companies with the most dispersion of profitability may have been exactly those with the highest profitability. An indication of this causality is the result of the average profitability and risk of companies with Z_2 greater than zero and those with Z_2 less than or equal to zero. Healthy companies have significantly higher risk and profitability than companies at risk of bankruptcy. In addition, since the risk is measured by the standard deviation of the company's profitability in the sample, there is only one risk observation for each company, which harms the results found by the model regarding this variable.

Although the present study used the standard deviation proxy of Net Income / Total Assets, Moraes (2005) used the standard deviation proxy for EBITDA / Total Assets for the same variable, his study did not present statistical significance in the coefficients found in the regressions performed. The same occurred in the studies by Titman and Wessels (1988), who used the operating profit / revenue standard deviation for the risk variable, and Canda (1991), who used standard deviation of return / assets.

This result is opposite to that found in other studies on the capital structure of Brazilian companies, such as those by Brito et al., (2007) and Bastos et al., (2009), and may be due to the serious Brazilian economic situation from 2014 to 2016, mentioned above. The same result occurred for Toy et al. (1974) when considering for the variable risk coefficient of variation of EBIT / Total Assets. In addition, as will be seen below, profitability showed a distinct relationship with indebtedness between healthy companies and those at risk of bankruptcy.

The size variable was related to long-term and total indebtedness as explained by the theory (Titman & Wessels, 1988). Larger companies are more able to honor their debts and at the same time have easier access to credit in the market. The growth variable also showed behavior in accordance with the agency and bankruptcy costs theories, with the fastest growing companies having a lower level of indebtedness, both in the short and long term (Jensen & Meckling, 1976).

Finally, three regressions were made for groups of companies at risk of bankruptcy and healthy ones separately in order to assess whether there are differences in the determinants of the capital structure between them. The results presented in Table 10 show that even when the companies are separated according to the financial situation, the independent variables are related to the dependent variables that obey the same direction as the regression coefficients for the set of all companies.

An exception is the profitability that should reverse signals in companies without risk in relation to those with risk of bankruptcy and in relation to the general model. That is, if for companies analyzed together and for companies at risk of bankruptcy, profitability has a negative relationship with short-term debt and positive with long-term and total debt, for healthy companies' profitability has a positive relationship for the short-term and negative for long-term and total leverage. This shows that for healthy companies there is a possible predominance of the behavior predicted by the POT, in which companies prefer to finance their investments with retained earnings (Myers & Majluf, 1984). For companies at risk of bankruptcy, greater profitability means, in general, greater debt capacity. It should be noted that the profitability variable is not significant for the short-term debt model.

There are also changes in the behavior of the risk variables for companies at risk of bankruptcy in relation to short-term debt and for the growth variable for healthy companies in relation to short-term debt, but the coefficients are not statistically significant in these two cases.

Table 10 - Regression coefficients by Z-score2 result

Variable	DEB_ST		DEB_LT		DEB_T	
	Bankruptcy Risk	Healthy	Bankruptcy Risk	Healthy	Bankruptcy Risk	Healthy
LIQ	-0.0241	-0.0085	-0.0182	-0.0144	-0.0424	-0.0229
PROF	-0.0429	0.0033	1.9870***	-1.2516*	1.9441***	-1.2483*
C_TA	-0.1997	-0.0796	0.2681	0.7665	0.0684	0.6869
RISK	0.0292	-0.0027	3.7406***	4.9189***	3.7697***	4.9161***
SIZE	-0.0134	-0.0033	0.0184	0.0867***	0.0049	0.0834***
GROW	-0.0018	0.0347	-0.0033	-0.1506	-0.0051	-0.1159
Constant	0.4457**	0.1406	-0.5285	-2.0744**	-0.0828	-1.9338**
Obs.	1.080	318	1.080	318	1.080	318
R^2	0.2001	0.1188	0.7525	0.5966	0.7473	0.5948
R^2 Adj.	0.1949	0.0988	0.7509	0.5875	0.7456	0.5857
F test	450.0	310.0	292.0	4.6e+05	919.0	4.7e+05

Note: ***, **, * denotes statistical significance at 1%, 5% and 10%, respectively. Table 10 shows the results of the three Z-score 2 models estimated for the three dependent variables: short-term debt (DEB_ST), long-term debt (DEB_LT), total debt (DEB_T) and the respective coefficients of the explanatory variables liquidity (LIQ), profitability (PROF), asset composition (C_TA), risk (RISK), size (SIZE) and growth (GROW).
Source: Elaborated by the authors.

It appears that the regression model is not very adequate to explain the short-term debt for companies with negative and positive Z2 separately. The model had low explanatory power (Adjusted R2 of 19.49% and 9.88%) and, mainly, none of the independent variables obtained a significant coefficient.

However, the regression model for long-term debt and total debt showed a high explanatory power for companies with and without bankruptcy risk. In this case, it is observed that profitability has a different relationship to indebtedness for companies with a prediction of negative or positive bankruptcy, as previously mentioned. The results also reveal that size is a variable that explains the long-term and total indebtedness of healthy companies, but not that of companies at risk of bankruptcy. It is also noteworthy that liquidity and growth are no longer significant to explain the indebtedness of companies in the model that groups them by bankruptcy prediction index.

Finally, a summary of the main results shows that Brazilian public companies, between 2011 and 2016, were more indebted in the long term than in the short term. Companies with negative Z2 (with risk of bankruptcy) have, on average, greater short-term debt. On the other hand, companies without risk of bankruptcy have greater long-term and total leverage. Companies without bankruptcy risk have greater liquidity and higher profitability (2.84 and 8.64%, respectively, against 1.62 and -1.71% for those at risk). As for the composition of assets, companies at risk of bankruptcy have a higher share of permanent assets over total assets and are larger than healthy ones. Companies with Z_2 equal to or below 0, have a lower risk (9.3% against 14.07%), that is, their profitability shows less variation, although, as noted, the average profitability was much lower in this period.

5 FINAL REMARKS AND CONCLUSIONS

This study sought to analyze whether there are differences in the determinants of the capital structure of companies listed in B3 with and without risk of bankruptcy. As one of his contributions, we highlight the interlocution of the themes of capital structure and bankruptcy prediction, which is little explored in the national literature.

The results for the long-term and total debt models show that the determinants of the capital structure are different between companies with and without bankruptcy risk. Companies at risk of bankruptcy become more indebted in the long run as their profitability increases, with the opposite effect occurring with healthy companies, which take on less debt the more profitable they are. Thus, there is stronger evidence of the POT hypothesis, according to which the first source of funds to finance investments is retained earnings, in the assessment of the capital structure of healthy companies than in relation to companies at risk of bankruptcy.

The size proved to be decisive to explain the indebtedness of healthy companies, but not of companies at risk of bankruptcy. The company's growth, in turn, is no longer a significant determinant to explain indebtedness when the model was used separately for the two groups of companies. The risk proved to be significant to explain the indebtedness, however, the positive relationship between the company's debt and risk was contrary to expectations, which can be explained by the use of the standard deviation of profitability as a proxy for the risk variable. Furthermore, the composition of assets is not a significant factor in explaining the indebtedness of companies, regardless of their financial situation.

It is worth noting that the results not explained by the study may have been caused by factors not considered in the analysis, such as political, regulatory and economic influences that occurred in the analyzed period, given the limitations of the models used.

Finally, it is worth noting that the objective of this study was achieved, since it was found that there is a difference in the determinants of long-term and total indebtedness between companies with and without risk of bankruptcy. It was also found that the determinants of the capital structure change in relation to the analysis of the companies as a whole. Companies at risk of bankruptcy have a positive relationship between long-term and total indebtedness and profitability and risk. In the case of healthy companies, long-term and total debt has a negative relationship with profitability and a positive relationship with risk and size.

The main limitation of this study is that it applies only to the companies investigated, so it is not possible to make generalizations. It is also limited by the use of the bankruptcy prediction model of Altman et al. (1979), without tests having been carried out to verify which bankruptcy prediction index is the most appropriate for the sample. Other models of bankruptcy prediction mentioned in this work apply techniques such as logistic regression and neural networks, which present more complex methods and with other approaches.

For future studies, it is suggested the analysis of other models for the identification of healthy and at-risk companies, and in different periods, for comparison with the results found in this research, in order to validate or contest them.

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1. Definition of research problem	√	√	√	
2. Development of hypotheses or research questions (empirical studies)	√	√	√	
3. Development of theoretical propositions (theoretical work)	√	√	√	
4. Theoretical foundation / Literature review	√	√		
5. Definition of methodological procedures	√	√	√	
6. Data collection	√	√		
7. Statistical analysis	√	√		
8. Analysis and interpretation of data	√	√	√	
9. Critical revision of the manuscript			√	
10. Manuscript writing	√	√		
11. Other - translation to English			√	