www.cya.unam.mx/index.php/cya

Contaduría y Administración 64 (1), 2019, 1-15

Contaduría y Administración
Accounting & Management

Capital structure of Brazilian public companies: Normality, global financial crisis and economic recession

Estructura de capital de empresas brasileñas: normalidad, crisis financiera global y recesión económica

Flavio Paulino Ramos Júnior[1], Isabela dos Santos[1], Luiz Eduardo Gaio*[2], Nelson Oliveira Stefanelli[1] and Ivan Carlin Passos[1]

[1]*Fundação Hermínio Ometto/Uniararas, Brazil*
[2]*Universidade Estadual de Campinas, Brazil*

Received 11 July 2016; Accepted 03 October 2017
Available online 4 December 2018

Abstract

This article aims to identify the determinants of the capital structure of Brazilian companies and compare it with financial theories. In addition, the normality periods (2007, 2009–2014) and financial crisis periods (2008 and 2015) will be considered in the analysis. The sample has 114 Brazilian public companies in the periods from 2007 to 2015. The methodology used for data analysis was multiple regression for panel data. The results showed that there are differences between the determinants of the capital structure in periods of crisis and of normality. Some of the hypotheses tested were accepted. These hypotheses relate financial theory to empirical analysis. Finally, the research contributed by demonstrating the main determinants of the capital structure in the analyzed periods, showing changes between such determinants.

JEL codes: G01, G15, G31
Keywords: Capital structure; Indebtedness; Corporate finance

*Corresponding author.
E-mail address: luiz.gaio@fca.unicamp.br (L.Eduardo Gaio)
Peer Review under the responsibility of Universidad Nacional Autónoma de México.

http://dx.doi.org/10.22201/fca.24488410e.2018.1152

http://dx.doi.org/10.22201/fca.24488410e.2018.1152

Resumen

Este artículo tiene como objetivo identificar los determinantes de la estructura de capital de las empresas brasileñas y compararlas con las teorías financieras. Además, los periodos de normalidad (2007, 2009-2014) y los períodos de crisis financiera (2008 y 2015) se considerarán en el análisis. La muestra tiene 114 empresas brasileñas en los períodos de 2007 a 2015. La metodología utilizada para el análisis de los datos fue la regresión múltiple para datos en panel. Los resultados mostraron que existen diferencias entre los determinantes de la estructura de capital en períodos de crisis y de normalidad. Algunas de las hipótesis probadas fueron aceptadas. Estas hipótesis relacionan la teoría financiera con el análisis empírico. Por último, la investigación contribuyó presentando los principales determinantes de la estructura de capital en los períodos analizados y evidenciando cambios entre estos determinantes.

*C*ódigos *JEL:* G01, G15, G31

Palabras clave: Estructura de capital, Endeudamiento, Finanzas corporativas.

Introduction

The capital structure has been gaining prominence over the years, and it is one of the most important and complex contents in corporate finance (Espinola, 2013). The concept of capital structure is related to the forms of financing of companies. There are two forms of financing, equity and debt. But there is not consensus in financial theory about the best form of financing (Santos *et al*., 2009).

Durand (1952) was one of the leading researchers in a problem in a quantitative form. However, Modigliani and Miller (1958) created the first theory of capital structure. They argued that the capital structure was not essential to measure the value of companies. Recently, authors refuted this theory. They proposed a new theory. It showed an increased value of the companies (Fama; Barros; Silveira, 2001).

There are several external elements that affect the form of financing of companies. Credit offers and interest rates are some examples of these external elements. However, Intrinsic organizational factors also have effects. Internal elements that affect the form of financing are size of company, operating margin, and leverage. Therefore, capital structure theories analyze the main causes of the companies' indebtedness. The main theories are Static Trade-off Theory, Agency Theory, Pecking Order Theory, and Market Timing Theory (Espinola, 2013).

Considering previous empirical studies about capital structure theory, this research attempts to answer the question: are the determinants of the capital structure in Brazilian companies different in times of crisis?

The main motivation for this paper is to assess whether there is a distinct behavior among the determinants of the capital structure in the above periods, in order to compare the results with the research hypotheses, which were built grounded on the four main theories of capital structure (Static Trade-off theory, Agency theory, Pecking Order Theory, and Market Timing Theory).

Finally, this paper aims to identify the determinants of the capital structure of Brazilian publicly-held companies and, specifically, through the results of the regressions, determine whether there were deviating behaviors between the periods. Therefore, the general hypothesis tested shows that companies may present different relationships in some determinants of the capital structure. It occurs in both periods, normality and crisis periods.

http://dx.doi.org/10.22201/fca.24488410e.2018.1152

Theoretical background

The capital structure research is grounded on a central issue that concerns the company's value in relation to the way it is financed. Numerous variations, innovations, and theoretical perspectives on indebtedness of organizations have emerged in opposition to the pioneer and classical theories of Modigliani and Miller (1958). There are four main theories (Static Trade-off Theory, Agency Theory, Pecking Order Theory, and Market Timing Theory), which try to consistently establish an optimal point of debt for companies to take full advantage of the benefits offered by debts (Brito, 2007).

Static trade-off theory

The theory presents the idea that there is an optimal capital structure. There is a combination of equity and debt that is able to increase the value of the company. Debt utilization generates two opposite implications: tax benefit (positive effect) and bankruptcy costs (negative effect) (Santos *et al*., 2009). It is necessary for companies to seek a capital structure that will maximize the benefits and minimize debt costs (Bastos; Nakamura, 2009).

According to Myers (1984), companies should gradually replace equity with debt and vice versa to an equilibrium point at which it is possible to reduce the costs and increase the value of the company.

Asymmetric information and Pecking Order Theory

Pecking Order theory is the approach that determines the optimal capital structure. It is based on minimizing inefficiency in the companies' investment decisions (Myers; Majluf, 1984; Myers, 1984).

The idea presented by Myers and Majluf (1984) is based on information asymmetry between managers and investors, i.e., managers have more and better information on investment options and financing, to the point of prioritizing the opportunity that will bring lower risk to the company.

Thus, Myers (1984) developed the Pecking Order Theory that determines a hierarchy in the sources of funding: firstly, using the retained earnings as sources of financing; secondly, acquiring new debt; and, ultimately, issuing shares to obtain resources. This structure is maintained even if the shares are overvalued.

Market timing theory

In a globalized environment it is clear that a range of factors can influence the value and the capital structure of an organization, and according to Frank and Goyal (2009) managers follow two lines regarding capital structure decisions: suspend the financing decision for as long as possible if the conditions are not favorable or take advantage of unusual opportunities even if there are no needs.

The Market Timing Theory explains that a company with greater financial leverage obtains funds when its market value is low. Companies that show lower leverage capture external resources when the market value is high (Baker; Würgler, 2002). Hovakimiam (2006) stated that in a warm market the issuance of shares that are held exerts no influences on capital structure. In contrast, Alti (2006) shows that in a warm market companies enjoy the opportunity to issue more shares, overvaluing them and reducing debt. However, after overvaluation period companies increase their debts.

http://dx.doi.org/10.22201/fca.24488410e.2018.1152

However, Alti (2006) also shows that the theory is an important determinant of financing activity, but only for the short term.

Agency theory

Debt utilization is key to the emergence of conflicts of interest between shareholders and managers (Ross; Westerfield; Jaffe, 2002). Thus, because of such conflicts, Mendes et al. (2009) show that the agency theory can be understood as the costs that come from the purpose of resolution of these conflicts, since managers and shareholders intervene in defense of their own interests.

Grinblatt and Titmman (2005) elucidate that high company debt may be more favorable for shareholders as it would limit managers to adopt effective measures in personal terms and to expand the company more rapidly than advisable. On the other hand, managers prefer a smaller debt than the optimal point because it reduces the bankruptcy risk and also does not restrict management.

According to this theory, the optimal debt is defined by minimizing the total agency cost (Mendes et al., 2009).

The economic crisis variable

Effects of the globalization of economic crises have many critical consequences for public companies (Berger; Turtle 2011). According to Espinola (2013) the cause of crisis is related to financial bubbles. They create macroeconomic effects in chains that affect several countries. Their influence is negative on companies. This causes insolvency, affects interest rate, growth, and other microeconomic factors.

The study indicates financial innovations as one of the determinants of crisis. This is related to the nature of innovation in the competitive financial services industry (Thakor, 2012). More generally, Mitchell (1941) pointed out that the scope of business crises is due to the fact they are an intrinsic part of the corporate market.

Therefore, global financial crises make it difficult for companies to maintain their capital structures. It can make companies make the wrong decisions (Espinola, 2013).

Methodology

This methodology was based on papers about public companies' capital structure. The objects of study were companies listed in the Brazilian stock exchange from 2007 to 2015. The sample consisted of all public companies in the aforementioned period. However, companies which had no financial statements available for the entire period of analysis were eliminated from the sample, therefore remaining 114 companies. The panel consists of 1,026 observations: 228 in crisis periods (2008 and 2015) and 798 in normality periods. The data were taken from the Bloomberg database.

Considering the research focus on evaluating the determinants of the capital structure in financial crisis periods, Brazilian companies were considered because of the crises that the country faced in 2008 (financial crisis) and 2015 (political and economic crisis).

Operational definition of variables

Variables analyzed in the present study were divided between dependent and independent variables.

http://dx.doi.org/10.22201/fca.24488410e.2018.1152

Dependent variables

Regarding the dependent variables, the research was based on previous studies such as Shyam Sunder and Myers (1999), Frank and Goyal (2003), Leary and Roberts (2010), and Espinola (2013). Debt indicators were treated at book value.

Table 1
Dependent variables and formulas

Dependent Variable	*Formula*
TD: Total Debt	= (Short-Term Debt + Long-Term Debt) / Total Asset
STD: Short-Term Debt	= Short-Term Debt / Total Asset
LTD: Long-Term Debt	= Long-Term Debt / Total Asset

Total Debt: it indicates the percentage of short-term and long-term debt in relation to the company's assets; the higher this percentage, the higher the company's leverage level. When the TD index is high, it shows that there is great dependence on debt.

Short-Term Debt: it indicates the percentage of short-term debt in relation to the company's assets.

Long-Term Debt: it indicates the percentage of long-term debt in relation to the company's assets.

The three variables of indebtedness were chosen to evaluate whether there are specific drivers, according to the type of indebtedness. The financial literature has more research evaluating the long-term debt. Short-term indebtedness is little discussed in the literature.

Independent variables

The definition of independent variables was performed through an adaptation of empirical studies (Booth et al., 2001; Brito; Corrar; Batistella., 2007, Nakamura et al., 2007; Bastos; Nakamura, 2009; Frank; Goyal, 2003; Espinola, 2013).

Table 2
Independent variables and formulas

Independent Variable	*Formula*
Operating margin	= Operating Incomes / Total Revenue
Size	= ln Total Revenue
Tangibility	= Permanent Asset / Total Asset
ROE: Return On Equity	= Net Profit / Equity
Growth	= Total Revenue (t) / Total Revenue (t-1)
Tobin's Q ratio	= (Total Market Value + Total Debt) / Total Asset
Altman Z-score	= 1.2X1 + 1.4X2 + 3.3X3 + 0.6X4 + 1.0X5

Note: EBIT corresponds to Earnings Before Interest and Taxes. X1 corresponds to working capital / total assets. X2 corresponds to retained earnings / total assets. X3 corresponds to earnings before interest and taxes / total assets. X4 corresponds to market value of equity / book value of total liabilities. X5 corresponds to sales / total assets

http://dx.doi.org/10.22201/fca.24488410e.2018.1152

Operating margin: it indicates the percentage between the operating incomes and revenues. According to the Pecking Order Theory, presented by Brealey and Myers (2006), companies that show profits tend to use equity instead of debt. Therefore, their relation is inversely related to the level of indebtedness.

Size: expressed by the log of the revenues. By theory, larger firms tend to have low default risk, lowering the cost of borrowing. It has a direct effect on indebtedness.

Tangibility: it indicates the percentage of fixed assets in relation to total assets. Companies with more physical structures have greater tangibility.

ROE: it reflects the percentage of return on equity. Theories show that there is a discordance of analysis. According to Jensen and Meckling (1976), because of Agency problems, managers seek to retain the company's excess profits to make investments. Researchers show that companies committed to debt tend to have agency problems. Thus, according to the trade-off model, the most profitable companies should be the most leveraged. However, according to the Pecking Order Theory, described by Myers (1984), excess of profit generates high indexes of reinvestment, which eliminates the necessity of searching for third-party capital. Therefore, the ratio is inverse to the level of leverage.

Growth: it indicates the percentage of growth of revenue over time. According to the Pecking Order Theory: the higher the revenue growth, the lower the need for debt.

Tobin's Q ratio: this ratio was developed by Tobin (1969) and shows the relation between the market value, given by the expectation of future earnings, and the company's book value. According to theories, companies with high indebtedness tend to add more market value.

Altman Z-score: The Z-score was developed by Altman (1968). It is an indicator of credit risk. It is used to forecast bankruptcies of companies. It is calculated from multiple income and corporate balance values to measure the financial health of a company.

Hypotheses for normality periods

H_1: The relationship between operating margin and debt is negative;

H_2: The relationship between size and debt is positive;

H_3: The relationship between tangibility and debt is negative;

H_4: The relationship between ROE and debt is negative;

H_5: The relationship between Altman Z-score and debt is negative;

H_6: The relationship between expected growth (Tobin's Q ratio) and debt is positive;

H_7: The relationship between growth and debt is negative;

Data processing and statistical tests

In the study it was used a regression analysis with panel data, unbalanced. To this end, it was tested the hypothesis of two regression models, Fixed and Random, through the Hausman specification test, proposed by Hausman (1978). It was used Eviews 7 software for test and regression statistics. It has been widely used by many researchers in the area (Nakamura *et al*., 2007, Brito, Corrar; Batistella, 2007; Bastos; Nakamura, 2009; Frank; Goyal, 2003; Almeida *et al*., 2004; Espinola, 2013).

http://dx.doi.org/10.22201/fca.24488410e.2018.1152

Regression model:

$$Debt_{i,t} = \alpha + \beta_1 OM_i + \beta_2 SIZ_i + \beta_3 TANG_i + \beta_4 ROE_i + \beta_5 GROW_i + \beta_6 Q\text{-}TOB_I + \beta_7 Alt\text{-}Z_i + \mu$$

where:
- *Debt* represents the debt dependent variables (or the debt/asset ratio).
- α is the line intercept.
- β are angular coefficients.
- μ capture errors in the model estimation
- *i* represents the company
- *t* represents the period (time).

Validation of the regression model

The validation of the regression model was made by testing for the absence of multicollinearity and independence of residuals. Multicollinearity is the phenomenon of correlation between variables. Their evidence occurs when the R^2 of the regression is high and the variables are not significant. To this end, we analyzed the correlation matrix between the variables and the significance of the parameters. Residual dependence occurs when the regression's errors are autocorrelated. To this end, the serial autocorrelation test proposed by Durbin and Watson (1971) was used.

Table 3
Pearson Correlation Matrix (normality period)

	Operating Margin	*Size*	*Tangibility*	*ROE*	*Growth*	*Tobin's Q*	*Altman Z*
Operating Margin	1.000						
Size	0.186	1.000					
Tangibility	-0.063	0.160	1.000				
ROE	0.314	0.148	-0.061	1.000			
Growth	-0.047	-0.053	-0.038	0.005	1.000		
Tobin's Q	0.012	0.036	0.027	0.043	0.000	1.000	
Altman Z	0.057	0.100	-0.041	0.164	-0.018	0.037	1.000

Results and discussion

The correlation matrix was performed (Table 3 and Table 4) between the independent variables in order to determine multicollinearity (if it is established, there is a problem of almost exact linear relationship between these variables, reducing the quality of the regression). However, there is a correlation between ROE and Operating Margin variables. The variables have the same input (net profit) in the calculation. However, as the correlation was lower than 0.5, as recommended by Gujarati and Porter (2008) the effect of multicollinearity cannot be disregarded.

http://dx.doi.org/10.22201/fca.24488410e.2018.1152

Table 4
Pearson Correlation Matrix (crisis period)

	Operating margin	*Size*	*Tangibility*	*ROE*	*Growth*	*Tobin's Q*	*Altman Z*
Operating margin	1.000						
Size	0.192	1.000					
Tangibility	0.103	0.152	1.000				
ROE	0.256	0.134	0.112	1.000			
Growth	-0.060	-0.208	-0.109	-0.007	1.000		
Tobin's Q	0.135	0.173	0.068	0.125	-0.083	1.000	
Altman Z	0.236	0.088	-0.120	0.341	0.093	0.262	1.000

The low values of the correlations between the dependent variables suggest that there is no multicollinearity effect on the data. Thus, it is not necessary to test multicollinearity using the Farrar and Glauber (1967) test.

It was also performed the Durbin-Watson test (Table 5), which is based on the assumption that the errors in the regression model are generated from the previous observation, i.e., it correlates the errors of the current regression model with the previous one. Results close to 2 indicate independence of the residuals, validating the proposed regression model (Brito, 2007).

Table 5
Durbin-Watson Test

		Normality Period	*Crisis Period*
Durbin-Watson	Short-Term Debt	2.07	1.83
	Long-Term Debt	1.97	1.90
	Total Debt	2.04	2.06

Note: The asymptotic limits for the t statistics at the 1% and 5% levels. Considering the level of significance at 1%, the numbers of DW statistic are 1.603 (DL) and 1.746 (DU).

Durbin-Watson statistic for all models indicated the acceptance of null hypotheses for 1% levels. It indicates that regression residuals are independent. There is no serial autocorrelation of residuals. DW statistic numbers are between 1.746 and 2.397 (4-DL).

Descriptive statistics

Table 6 shows the mean and standard deviation of the debt variables (dependent variables), which were calculated at book value, and Table 7 shows independent variables: operating margin, size, tangibility, ROE, growth, Tobin's Q, and Altman Z.

Debt indicators show changes during the analyzed periods. It can be observed that in times of crisis the means are higher. It shows that debt was higher in this period. The standard deviation does not influence the analysis, since the sample was diverse and composed of companies from various industries and sizes.

Table 6
Descriptive statistics of dependent variables

Dependent Variable	Normality Period		Crisis Period	
	Mean	Standard Deviation	Mean	Standard Deviation
Short-Term Debt	0.091	0.077	0.103	0.096
Long-Term Debt	0.203	0.131	0.226	0.169
Total Debt	0.294	0.157	0.329	0.193

In the descriptive statistics of the independent variables, it may be observed that all have changed in the compared periods. The operating margin shows a substantial change. It shows negative percentage in times of global crisis and in Brazilian economic recession. Considering the other indicators, several show lower mean in the crisis period; thus it may be considered that these indicators were affected by government and situational macro environment.

Table 7
Descriptive statistics of independent variables

Independent Variable	Normality Period		Crisis Period	
	Mean	Standard Deviation	Mean	Standard Deviation
Operating margin	0.112	0.412	0.111	0.202
Size	21.516	1.600	21.651	1.644
Tangiblity	0.412	0.334	0.470	0.342
ROE	0.105	0.253	0.042	0.390
Growth	0.269	1.376	0.627	5.064
Tobin's Q	1.750	7.816	1.106	0.550
Altman Z	2.002	1.980	2.059	2.006

Estimated coefficients

Table 8 shows the results of the Hausman specification test statistics.

Table 8
Hausman Test

Dependent Variable	Normality Period			Crisis Period		
	Chi-Sq. Statistic	Prob.	Effect Indicated	Chi-Sq. Statistic	Prob.	Effect Indicated
Short-Term Debt	4.832	0.681	Random	10.584	0.158	Random
Long-Term Debt	16.197	0.023	Fixed	13.947	0.052	Random
Total Debt	13.981	0.052	Random	18.103	0.012	Fixed

http://dx.doi.org/10.22201/fca.24488410e.2018.1152

The results of Long-Term Debt in normality period and Total Debt in crisis period reject the null hypothesis. It shows that there are correlations between the regressors and error term. It indicates to estimate of models in the fixed form. The other models, however, accept the null hypothesis, indicating for an estimate of random models.

Tables 9, 10, and 11 consider the estimated coefficients of the proposed regression model of dependent variables (short-term debt, long-term debt, and total debt). In the Short-Term Debt model, the variables that have significance effects are those with p-value lower than 10%. Analyzing the normality period, operating margin, size, ROE, growth, and Altman Z were the variables that influenced the dependent variable. In the long-term debt it was noticed that operating margin, tangibility, ROE, growth, and Tobin's Q were not significant. Finally, analyzing the total debt, operating margin, growth, and Tobin's Q did not influence the regression model.

The behavior of indicators in crisis period was similar to the normality period. Both indicators were statistically significant. Independent variables with p-values greater than 10% are not statistically significant. In both periods the variables that most influenced the independent variables and had more differentiation between the periods were operating margin, growth, and Tobin's Q.

When the variable becomes statistically insignificant in a period, this variable is discarded, as it is not possible to consider it in comparison.

In the long-term debt (for the normality period), size is determinant of capital structure; However, in crisis period, Tobins's Q also becomes a determinant of long-term debt, confirming the findings of Brito, Corrar, and Batistella (2007).

Table 9
Estimated coefficients (Short-term Debt)

	Normality Period			Crisis Period		
	Coeff.	t-stat	p-value	Coeff.	t-stat	p-value
Const	0.239	6.366	0.000	0.342	3.722	0.000
Operating margin	-0.016	-2.297	0.022	-0.034	-0.960	0.339
Size	-0.006	-3.169	0.002	-0.012	-2.695	0.008
Tangibility	-0.012	-1.410	0.159	-0.015	-0.746	0.457
ROE	-0.058	-5.006	0.000	0.035	1.856	0.065
Growth	0.003	1.660	0.097	-0.002	-1.379	0.170
Tobin's Q	0.000	-0.509	0.611	0.044	3.396	0.001
Altman Z	-0.007	-5.326	0.000	-0.012	-3.272	0.001
R-squared	0.140			0.146		
Adjusted R-squared	0.131			0.112		
F-statistic	16.228			4.234		
Prob (F-statistic)	0.000			0.000		
Effects Specification	Random			Random		

http://dx.doi.org/10.22201/fca.24488410e.2018.1152

Table 10
Estimated coefficients (Long-term Debt)

	Normality Period			Crisis Period		
	Coeff.	t-stat	p-value	Coeff.	t-stat	p-value
Const	-0.202	-2.888	0.004	-0.297	-1.998	0.047
Operating margin	-0.013	-1.015	0.310	-0.046	-0.816	0.416
Size	0.021	6.329	0.000	0.019	2.797	0.006
Tangibility	-0.016	-1.065	0.287	0.034	1.073	0.285
ROE	-0.007	-0.293	0.769	0.013	0.424	0.672
Growth	0.002	0.560	0.575	0.000	-0.197	0.844
Tobin's Q	0.000	-0.179	0.858	0.128	6.186	0.000
Altman Z	-0.019	-7.815	0.000	-0.026	-4.274	0.000
R-squared	0.291			0.254		
Adjusted R-squared	0.146			0.224		
F-statistic	2.002			8.429		
Prob (F-statistic)	0.000			0.000		
Effects Specification	Fixed			Random		

Table 11
Estimated coefficients (Total Debt)

	Normality Period			Crisis Period		
	Coeff.	t-stat	p-value	Coeff.	t-stat	p-value
Const	-0.022	-0.289	0.773	-0.189	-0.733	0.466
Operating margin	-0.021	-1.509	0.132	0.088	0.997	0.322
Size	0.018	5.135	0.000	0.018	1.519	0.134
Tangibility	-0.035	-2.132	0.033	0.028	0.604	0.548
ROE	-0.091	-3.938	0.000	-0.313	-3.051	0.003
Growth	0.004	0.959	0.338	-0.029	-1.179	0.243
Tobin's Q	0.000	-0.500	0.617	0.199	5.553	0.000
Altman Z	-0.025	-8.930	0.000	-0.038	-4.385	0.000
R-squared	0.156			0.857		
Adjusted R-squared	0.147			0.604		
F-statistic	18.402			3.396		
Prob (F-statistic)	0.000			0.000		
Effects Specification	Random			Fixed		

http://dx.doi.org/10.22201/fca.24488410e.2018.1152

Hypotheses analysis

Through the analysis of the regression coefficients, it was possible to determine the relationship between the dependent variables and each of the explanatory factors (independent variables). Negative sign (-) shows a negative relationship, positive sign (+) shows a positive relationship and SI (statistically insignificant) means that there was no significance. Table 12 shows three columns of data: the first shows the expected relationship according to the hypotheses mentioned in the Methodology, the second shows the observed relationship in the normality period, and, finally, the third shows the observed relationship in the crisis period.

Table 12
Expected Relationships x Observed Relationships

Variable	Expected Relationship	Observed Relationship in the normality periods (2007, 2009–2014)			Observed Relationship in the crisis periods (2008 and 2015)		
	Debt	Short-term Debt	Long-term Debt	Total Debt	Short-term Debt	Long-term Debt	Total Debt
Operating margin	-	-	SI	SI	SI	SI	SI
Size	+	-	+	+	-	+	SI
Tangibility	-	SI	SI	-	SI	SI	SI
ROE	-	-	SI	-	+	SI	-
Growth	-	+	SI	SI	SI	SI	SI
Tobin's Q	+	SI	SI	SI	+	+	+
Altman Z	-	-	-	-	-	-	-

The result shows that the determinants of the capital structures are different between the normality period and the crisis period. Some variables did not reject the hypotheses mentioned in the Methodology. Following the premises of the Pecking Order Theory, the Operating margin variable, which measures the operating profit margin, should be negative. Brealey and Myers (2006) point out that, according to the Pecking Order Theory, companies with higher operating margin tend to finance themselves (reinvestment) rather than through third-party capital. Table 12 shows that in Brazil this assumption is true, since the coefficient is negative. The greater the company's operating margin, the lower the debt. However, in the normality period, the regression model showed a negative relationship: thus the hypothesis was not rejected. In fact, the model showed that there is a proportional relationship between the operating margin and debt indicators, but it was observed only in normality periods for a short-term debt. In other models statistics were not significant.

The Size variable also adhered well to the assumptions of theories. The great size of a company makes it easier to obtain financing, making the company more leveraged. These results are also in agreement with studies of Ozkan (2001) and Gaud et al. (2005). However, in the models with Short-Term Debt variable this hypothesis is rejected. The same occurred with the Tangibility variable. Less tangible companies tend to have higher level of leverage.

However, the tangibility parameter can assume positive or negative values, as presented by Titman & Wessels (1988).

In relation to Tobin's Q, which demonstrates the expected investment opportunity, it is observed that the positive values of Tobin's Q corroborate the Pecking Order Theory, which states that the investment opportunity ratio should be positive in relation to the leverage level.

Although the Growth variable was not significant in crisis periods, the positive value in the normality period does not corroborate the Pecking Order Theory. The higher the revenue growth, the lower will be the dependence on debts. Therefore, this leads to a reduction in the leverage level.

The ROE variable also confirms the Pecking Order Theory, which states that more profitable companies are less indebted. This theory argues that companies should not seek external financing, without first exhausting their own resources. Therefore, higher operating margin tends to decrease leverage.

Similar to the ROE variable, the Altman Z variable is also in agreement with the theory. High scores reduce the level of credit risk and leverage. Therefore, if companies have more debts, they will have worse scores of credit risk.

It may be observed that the relationship of some dependent variables (short-term debt, long-term debt, and total debt) with the independent variables in the analyzed periods was different. Thus, the negative macroeconomic influences affect the determinants of the capital structures. Espinola (2013) used a sample of US companies and confirmed that in times of financial crisis determinants also changed, and operating margin, size, and tangibility had more significance than the others.

The initial hypotheses of variables (operating margin and ROE) were not rejected. Regarding the operating margin variable, Myers (1984), Donaldson (1961), and Brealey and Myers (2006) suggest that firms prefer raising capital, firstly from retained earnings, secondly from debt, and thirdly from issuing new equity. This relationship occurs because of the transaction costs involved in issuing equity, according to Myers and Majluf (1984). However, in periods of economic expansion in Brazil, companies tend to use both equity and short-term debts. During this period, the Brazilian Development Bank (BNDES) provides credit at low costs.

Conclusions

This paper analyzed the determinants of the capital structures of Brazilian companies. In addition, the study compared different economic periods (normality and crisis) in order to determine whether there was variation in indebtedness related to the independent variables. The results of the tests indicated a change in the ratio of some independent variables.

One of the contributions of this research is demonstrating that through statistical tests it is possible to observe changes in the capital structure determinants in different economic periods. In addition, it is emphasized that the factors chosen for the research show only some variables that influence corporate debt. The variables that explain the debt in the crisis period were size, ROE, Tobin's Q, and Altman Z. According to Espinola (2013), size was also a very significant variable in determining the capital structure.

Many of the hypotheses mentioned in the Methodology were not rejected by determining correlation with capital structure theories. The hypotheses were more substantiated in the Pecking Order Theory, Static Trade-off Theory, and Agency Theory.

The aims of research were achieved: through the proposed regression model, we found capital structure determinants of Brazilian publicly-held companies. The general hypothesis built in the introduction was not rejected because there was a change in the relationship of the capital structure determinants when comparing the normality period (2007, 2009–2014) with the crisis period (2008 and 2015).

Finally, this research field is large and diverse. Therefore, there is opportunity to develop new capital structure theories or delve into the existing theories, adapting them to increase the value of companies based on the choice of optimal debt point. In addition, this research is restricted to Brazilian companies. We also suggest testing the hypotheses presented here in companies of Latin American countries. Thus, it will be possible to determine whether the capital structure theories are also divergent from the American reality.

References

Almeida, H., Campello, M. and Weisbach, M. S. (2004), The Cash Flow Sensitivity of Cash. *The Journal of Finance*, 59 (4), 1777–1804. https://doi.org/10.1111/j.1540-6261.2004.00679.x

Alti, A. (2006), How Persistent Is the Impact of Market Timing on Capital Structure?. *The Journal of Finance,* 61 (4), 1681–1710. https://doi.org/10.1111/j.1540-6261.2006.00886.x

Altman, E. I. (1968). Financial Ratios, Discriminant Analysis and the Prediction of Corporate Bankruptcy. *Journal of Finance,* 23(4), 589-609 https://doi.org/10.2307/2978933

Baker, M. and Wurgler, J. (2002), Market Timing and Capital Structure. *The Journal of Finance*, 57 (1), 1–32. https://doi.org/10.1111/1540-6261.00414

Bastos, D. D, and Nakamura, W. T. (2009). Determinantes da estrutura de capital das companhias abertas no Brasil, México e Chile no período 2001-2006. *Revista Contabilidade & Finanças*, 20 (50), 75-94. https://doi.org/10.1590/s1519-70772009000200006

Berger, D. and Turtle, H. (2011), Emerging Market Crises and US Equity Market Returns. *Global Finance Journal***.** 22: 32–41. https://doi.org/10.1016/j.gfj.2011.05.003

Brealey, R. and Myers, S. (2006) Principles of corporate finance. (8. ed.) Nova York: McGraw-Hill.

Brito, G. A. S, Corrar, L. J., and Batistella, F. D. (2007). Fatores determinantes da estrutura de capital das maiores empresas que atuam no Brasil. *Revista Contabilidade & Finanças,* 18 (43), 9-19. https://doi.org/10.1590/s1519-70772007000100002

Donaldson, G. (1961) Corporate Debt Capacity: A Study of Corporate Debt Policy and the Determination of Corporate Debt Capacity. Boston: Divison of Research, Harvard School of Business Administration.

Durbin, J. and Watson, G. S. (1971). "Testing for serial correlation in least squares regression.III". *Biometrika*. 58 (1): 1–19. https://doi.org/10.2307/2334313

Durand, D. (1952) Cost of debt and equity funds for business: trends and problems of measurement. In: *Conference On Research On Business Finance,* 1952, New York: Universities National Bureau, 1952. (Available in: https://www.nber.org/chapters/c4790.pdf)

Espinola, L. F. P. (2013) Determinantes da estrutura de capital na crise financeira global. Master Dissertation. Universidade de São Paulo. (Available in: http://www.teses.usp.br/teses/disponiveis/12/12139/tde-18092013-162654/publico/LuisFernandoPerezEspinolaVC.pdf)

Fama, R., Barros, L.A.B.C.; Silveira, A.M. A (2001) A estrutura de capital é relevante? Novas evidências a partir de dados norte-americanos e latino-americanos. *Caderno de Pesquisa em Administração*, 8 (2) 1-84. (Available in: http://www.regeusp.com.br/arquivos/v08-2art06.pdf)

Farrar, D. E. and Glauber, R. R. (1967). Multicollinearity in Regression Analysis: The Problem Revisited. *Review of Economics and Statistics*. 49 (1): 92–107. https://doi.org/10.2307/1937887

Frank, M. and Goyal, V. (2003) Testing the pecking order theory of capital structure. *Journal of Financial Economics*. 67 (2), 217-24. https://doi.org/10.1016/s0304-405x(02)00252-0

Frank, M. Z. and Goyal, V. K. (2009), Capital Structure Decisions: Which Factors Are Reliably Important?. *Financial Management*, 38: 1–37. https://doi.org/10.1111/j.1755-053x.2009.01026.x

Gaud, P.; Jani, E.; Hoesli, M.; Bender, A. (2005) The capital structure of swiss companies: an empirical analysis using dynamic panel data. *European Financial Management*. 11, (1), 51-69. https://doi.org/10.1111/j.1354-7798.2005.00275.x

Grinblatt, M. and Titman, S. (2005) *Mercados financeiros e estratégia corporativa*. (2 Ed), Porto Alegre: Bookman.

Gujarati, D. N. and Porter, D. C. (2008) *Basic Econometrics*. (5 ed.). New York: McGraw-Hill Companies.

Hovakimiam, A (2006). Are Observed Capital Structures Determined by Equity Market Timing?. *Journal of Financial and Quantitative Analysis*, 41, 221-243. https://doi.org/10.1017/s0022109000002489

Jensen, M. and Meckling, W. (1976) Theory of the firm: managerial behavior, agency costs and ownership structure. *Journal of Financial Economics*. 3, 305-360. https://doi.org/10.1016/0304-405x(76)90026-x

Leary M. and Roberts, M. (2010) The Pecking Order, Debt Capacity and Information Asymmetry. *Journal of Financial Economics*. 95 (3), 332-355. https://doi.org/10.1016/j.jfineco.2009.10.009

Mendes, E. A., Basso, L. F.C., & Kayo, E. K. (2009). Estrutura de capital e janelas de oportunidade: testes no mercado brasileiro. *RAM. Revista de Administração Mackenzie*, 10 (6), 78-100. https://doi.org/10.1590/s1678-69712009000600006

Mitchell, W. (1941) Business Cycles and Their Causes. Los Angeles: University of California Press, Berkeley at Los Angeles, CA.

Modigliani, F. and Miller, M.H. (1958) The Cost of Capital, Corporation Finance and the Theory of Investment. *The American Economic Review*. 48 (3), 261-297. (Available in: https://www.jstor.org/stable/1809766)

Myers, S. (1984) The Capital Structure Puzzle. *The Journal of Finance*. 39, 574-592. https://doi.org/10.1111/j.1540-6261.1984.tb03646.x

Myers, S. and Majluf, N. (1984) Corporate financing and investment decisions when firms have information that investors do not have. *Journal of Financial Economics*. 13, 187-221. https://doi.org/10.1016/0304-405x(84)90023-0

Ozkan, A. (2001) Determinants of capital structure and adjustments to long run target: evidence from UK company panel data. *Journal of Business Finance and Accounting*. 175 – 199. https://doi.org/10.1111/1468-5957.00370

Nakamura, W. T, Martin, D. M. L, Forte, D., Carvalho Filho, A. F. de, Costa, A. C. F. da, & Amaral, A. C. do. (2007). Determinantes de estrutura de capital no mercado brasileiro: análise de regressão com painel de dados no período 1999-2003. *Revista Contabilidade & Finanças*, 18 (44), 72-85. https://doi.org/10.1590/s1519-70772007000200007

Ross, S.; Westerfield, R.; Jaffe, J. (2002) *Administração financeira*. (2 Ed.) São Paulo: Atlas.

Santos, C.M, Pimenta Júnior, T. & Cicconi, E.G. (2009) Determinantes da escolha da estrutura de capital das empresas brasileiras de capital aberto: um survey. *Revista de Administração*. 44 (1), 70-81. (Available in: http://www.spell.org.br/documentos/download/6825)

Shyam-Sunder, L.; Myers, S. (1999) Testing Static Trade-off Against Pecking Order Models of Capital Structure. *Journal of Financial Economics*. 51, 219-244. https://doi.org/10.1016/S0304-405X(98)00051-8

Thakor, A. (2012) Incentives to innovate and financials crises. *Journal of Financial Economics*. 103, 130-148. https://doi.org/10.1016/j.jfineco.2011.03.026

Titman, S. and Wessels, R. (1988) The determinants of Capital Structure Choice. *The Journal of Finance*, 43 (1), 1-19. https://doi.org/10.1111/j.1540-6261.1988.tb02585.x

Tobin, J. (1969) A general equilibrium approach to monetary theory. *Journal of Money, Credit and Banking*, 1, 15-29. https://doi.org/10.2307/1991374