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The volatility of cash flow and cash availability in the capital structure of Brazilian industrial companies

Volatilidade do fluxo de caixa e da disponibilidade de caixa na estrutura de capital de empresas industriais brasileiras

Volatilidad del flujo de caja y de la disponibilidad de caja en la estructura de capital de las empresas industriales brasileñas

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Abstract
This study aims to verify the effect of cash flow volatility and cash availability volatility on the capital structure of Brazilian industrial companies. Descriptive, documentary, and quantitative research were developed. The sample included 77 Brazilian industrial companies listed in Brasil, Bolsa, Balcão (B3), with data from 2014 to 2018, which generated a total of 385 observations. The economic and financial information was extracted from the Economática® database. The results show that companies with greater Cash Flow Volatility (CFV) and greater Cash Availability Volatility (CAV) have higher indebtedness levels, which are also more extensive in the short term. Furthermore, as a methodological difference, it was observed that when the Cash Flow Volatility derives from a positive trend, according to the growth of flows generated in recent periods, creditors tend to observe this favorably and provide more resources to companies under these conditions, including a longer-term for payment.
Keywords: Cash flow volatility; Cash availability volatility; Capital structure

Resumo
Este estudo tem por objetivo verificar o efeito da volatilidade do fluxo de caixa e da volatilidade da disponibilidade de caixa na estrutura de capital de empresas industriais brasileiras. Desenvolveu-se pesquisa descritiva, documental e quantitativa. A amostra abrangeu 77 empresas industriais brasileiras listadas na Brasil, Bolsa, Balcão (B3), com dados de 2014 a 2018 e que geraram, ao todo, 385 observações. As informações econômico-financeiras foram extraídas da base Economática®. Os resultados apontam que empresas com maior Volatilidade do Fluxo de Caixa (VFC) e maior Volatilidade da Disponibilidade de Caixa (VDC) apresentam patamares de endividamento superiores, sendo estas também mais extensivas no curto prazo. Ademais, como diferencial metodológico, observou-se que quando a Volatilidade do Fluxo de Caixa deriva de tendência positiva, conforme crescimento dos fluxos gerados nos últimos períodos, credores tendem a observar isto de forma favorável e ceder mais recursos a empresas nestas condições, inclusive com maior prazo para pagamento.
Palavras-chave: Volatilidade do fluxo de caixa; Volatilidade da disponibilidade de caixa; Estrutura de capital

Resumen
Este estudio tiene como objetivo verificar el efecto de la volatilidad del flujo de caja y la volatilidad de la disponibilidad de caja en la estructura de capital de las empresas industriales brasileñas. Se desarrolló una investigación descriptiva, documental y cuantitativa. La muestra incluyó 77 empresas industriales brasileñas listadas en *Brasil, Bolsa, Balcão (B3)*, con datos de 2014 a 2018 y que generaron, en total, 385 observaciones. La información económico-financiera se extrajo de la base Economática®. Los resultados muestran que las empresas con mayor Volatilidad del Flujo de Caja (VFC) y mayor Volatilidad de la Disponibilidad de Caja (VDC) tienen mayores niveles de endeudamiento, siendo también más extensos en el corto plazo. Además, como diferencial metodológico, se observó que cuando la VFC se deriva de una tendencia positiva, como los flujos generados en los últimos períodos han crecido, los acreedores tienden a observar esto de manera favorable y a conceder aún más recursos a las empresas en estas condiciones, y también con un plazo más largo para el pago.
Palabras clave: Volatilidad del flujo de caja; Volatilidad de la disponibilidad de caja; Estructura de capital

1 Introduction

Capital structure is defined as how an organization is financed, which comprises the relationship between debt and equity (Muritala, 2012). This theme has been one of the central questions in finance research since seminal works of the late 1950s and early 1960s, with special attention to Modigliani and Miller (1958) and Modigliani and Miller (1963). The way a company is financed is fundamental for countless stakeholders, such as managers and shareholders, as the incorrect combination of funding sources tends to severely affect the performance and survival of companies (Muritala, 2012). Faced with this scenario, over time, theories were developed in order to understand how organizations structure their funding sources, with the ideal level of debt being the central aspect of the discussion.

According to Cai, Fairchild, and Guney (2008), in addition to the indebtedness level, another important aspect is debt maturity. The choice of short-term and long-term debt entails several relevant consequences. The company's liability structure must be aligned with its asset structure, in order to avoid possible corporate liquidations. In addition, companies may signal their profits by choosing a specific debt maturity mix, as this tends to affect the cost of corporate financing.

In this sense, numerous researchers in finance have been directed to understand which factors affect the way organizations capture their resources. Despite the advances in this theme, given the diversified results, several points remain inconclusive. In a contemporary view, Memon, Chen, Tauni, and Ali (2018) mention that one of the factors that affect financial managers' decisions regarding capital structure policy is cash flow volatility. However, even with growing interest in this phenomenon, Keefe and Yaghoubi (2016) and Memon *et al*. (2018) emphasize that the empirical literature is inconclusive.

In the theoretical field, the influence of cash flow volatility on the debt level is understood as negative, once volatility increases, the chances of an organization facing financial difficulties also increase, and, as a result, the value decreases tax advantages of debt. Therefore, companies that face high cash flow volatility reduce their leverage levels so that they may minimize the cost of debt (Memon *et al*., 2018). About debt maturity, for Dangl and Zechner (2016), the high volatility of the cash flow reduces the debt term (Dangl and Zechner, 2016) and, thus, it is expected that companies with high (low) volatility of cash flow use debt with short (long) maturities (Memon *et al*., 2018).

Finally, it should be noted that in addition to the cash flow volatility, it will also be sought to test the cash availability volatility, to ascertain whether the destination of the generated cash flows, when allocated in cash and its equivalents also influence how organizations raise funds. Therefore, given the scenario described, the following research problem emerges: what is the effect of cash flow volatility and cash availability volatility on the capital structure of Brazilian industrial companies? To answer the outlined question, this research aims to verify the effect of cash flow volatility and cash availability volatility on the capital structure of Brazilian industrial companies.

The study is justified by numerous perspectives. According to Serrasqueiro and Caetano (2015), although countless researches have been developed over time, there is no consensus on the best way for the organizations to structure their funding sources (Serrasqueiro & Caetano, 2015) and which factors influence such choices. In a similar perspective, Tripathy and Asija (2017) mention that capital structure remains one of the most controversial topics in the financial literature. Theories such as trade-off theory, pecking-order theory, and market timing theory seek to conditionally explain the choice of corporate capital, however, research has not yet presented a unified theory, leaving the subject open for future studies.

As for cash flow volatility, recent international studies such as Keefe and Yaghoubi (2016) and Memon *et al*. (2018) have been developed seeking to understand how this factor affects the capital structure of companies, connoting to be current in corporate finance. In Brazil, the study of the theme is even more recent, providing opportunities in few works, such as by Martins and Vasconcelos (2020). Therefore, it seeks to advance in two main aspects concerning the studies mentioned, namely: 1) to understand how the volatility of cash availability, as this is a measure of the destination of the generated cash, affects how

organizations capture their resources; and, 2) understand how the trend, whether increasing or decreasing, in cash flow volatility and cash availability volatility contributes to explaining the observed phenomenon.

Finally, the research is also justified by the study scenario. According to Benachenhou (2013), the so-called emerging countries, including Brazil, characterize a new economic and social geography, which no longer allows them to be neglected (Benachenhou, 2013). However, despite this notorious scenario, research on the capital structure theme was concentrated, for a long time, in developed countries. This statement is supported by Memon *et al*. (2018), which specifically about the cash flow volatility in the debt structure, mention that the institutional differences of emerging countries compared to developed ones need additional understanding, opening up research possibilities.

2 Theoretical Reference

2.1 Capital Structure

The corporate capital structure is characterized by funding sources that allow the organization to operate, invest and grow in the face of different economic scenarios (Yaghoubi, 2017). The capital structure theme contemplates, together with the investment policy and dividends, the most important subjects of finance, which resulted, over time, in an extensive number of researches. Still, despite the breadth of existing studies, Tripathy and Asija (2017) mention that capital structure remains one of the most controversial topics in the financial literature. The question of academics and professionals involves discovering the ideal composition between debt and corporate equity that will keep the company competitive (Tripathy & Ajisa, 2017).

According to Muritala (2012), the existence (or not) of the ideal capital structure is one of the most complex issues at the heart of the theme (Muritala, 2012), which has led, over time, to the development of numerous theories, which go through different concepts. Among such theories, emphasis is given to three of them, namely: the trade-off theory (Modigliani & Miller, 1958; Modigliani and Miller, 1963); the pecking-order theory (Myers, 1984); and, the market timing theory (Baker & Wurgler, 2002).

Despite, the trade-off theory establishes that the debt must be weighted by costs and benefits, the most common being bankruptcy and tax advantage, respectively; the pecking-order theory operates by understanding the hierarchy in the use of financing sources, according to the criterion of informational asymmetry, in which it should start with self-financing, passing through loans from third parties and ending, ultimately, with the issuance of capital; and, finally, the market timing theory considers that the corporate capital structure is constituted by windows of opportunity that range over time, in which the most attractive capital source is used, when necessary, which may range accordingly with the requested moment in the market.

In this vast field, Chong and Kim (2018) highlight that empirical studies that test capital structure theories have shown successes and failures, given the enormous heterogeneity observed in the financing structure of organizations globally, not allowing conclusions. However, the general assumption in many of these studies is that the corporate leverage (as a measure of capital structure) is stable over time (Chong & Kim, 2018), ensuring possibilities for advances in knowledge on the subject.

Two essential aspects that are discussed in this research come from the level and maturity of corporate debt. From a historical perspective, Leland and Toft (1996) mention that the choice of companies' capital structure, seeking to maximize the market value, is linked to the amount (level) and maturity (maturity) of the debt. From a contemporary perspective, Keefe and Yaghoubi (2016) and Memon *et al*. (2018) operate their research in identifying the factors that explain the level of leverage and the use of debts of different maturities in companies, pointing out that these aspects are still current in the interest of finance researchers.

Specifically about the level of indebtedness, the main theoretical current existing and disseminated for a few decades is that debt generates some benefits, such as the tax advantage, but also brings costs associated with excessively high leverage, as is the case with bankruptcy costs (Dangl & Zechner, 2016). Given this, according to a survey carried out by Yaghoubi (2017), several researchers have argued that companies have an optimal level of capital structure and try to remain in this ideal zone, adjusting to the target when necessary (Yaghoubi, 2017). This makes the indebtedness level fundamental for organizations, in which the value-maximizing capital structure of each company varies according to the internal and external corporate environment (Mouton & Smith, 2016).

As for debt maturity, Arslan and Karan (2006) highlight that over time, research on the corporate capital structure moved from the choice between debt and equity to a focus on understanding the characteristics of debt, especially regarding its maturity. Usually, using accounting principles, debt is measured as short-term and long-term, with twelve months being the divisor factor (Yaghoubi, 2017). As for its consequences, Arslan and Karan (2006) argue that short-term debt has three main risks, especially in emerging markets, being the risk of interest, refinancing and corporate liquidity (Arslan & Karan, 2006), which makes its correct dimension essential for the survival of organizations.

Based on this interim, the cash flow volatility and the cash availability volatility as explanatory factors

of the debt level and debt maturity are discussed below, formulating, at the same time, the research hypotheses that will be tested in Brazilian industrial companies.

2.2 Cash Flow Volatility

Volatility measures, as a rule, are operationalized by the standard deviation of the variable under study, in line with what was observed in Veirman and Levin (2018). Cash flow volatility, specifically, is a measure of business risk that measures the probability that a company will face financial difficulties, and is generally defined as the standard deviation of operating cash flow in a given period (Memon *et al*., 2018). According to previous literature, cash flow volatility has been an important determinant of debt level and maturity, and, according to Memon et al. (2018), several theoretical explanations lead to believe that volatility affects the leverage structure of corporations.

Based on models from the 1970s, Keefe and Yaghoubi (2016) argue that there is a positive relationship between cash flow volatility and debt cost. This fact makes the higher cash flow volatility provide an increase in the equity value and a decrease in indebtedness via third parties, as the marginal debt cost is increased (Keefe & Yaghoubi, 2016), causing the benefits of indebtedness to cease at lower levels. Therefore, organizations with high cash flow volatility operate with lower indebtedness levels, intending to reduce their exposure to the higher cost of debt and the consequent risk of bankruptcy.

Memon *et al*. (2018) argue that the high cash flow variability and the higher cost linked to financial difficulties are clear characteristics of companies with a higher degree of insolvency risk. This aspect can be explained by the trade-off theory in which high-risk companies opt for relatively smaller debt. In other words, as volatility increases, it maximizes the chances of organizations getting into financial difficulties and, as a result, decreases the present value of debt tax advantages. Empirical evidence has mostly pointed out that the influence of cash flow volatility on the debt level is negative, as observed in the recent study by Martins and Vasconcelos (2020). Therefore, the following research hypothesis is elaborated:

H_1 – The cash flow volatility has a negative effect on the debt level of Brazilian industrial companies.

The cash flow volatility is mainly represented by measures that capture the standard deviation of the operating cash flow generated over a period of time (Yaghoubi, 2017), and such existing variability may result from the decrease or increase in the cash flow generated. This trend factor is important, as according to Ferreira and Vilela (2004), cash availability and cash flows earned (as availabilities generators), when appropriate, act as drivers of benefits to corporations, being, among them, the reduction of the probability of financial difficulties and the minimization of the costs of raising external resources (Ferreira & Vilela, 2004). Therefore, it is to be expected that cash flow volatility, when it presents a positive trend, is not as sensitive to the lower level of corporate indebtedness compared to the volatility with a negative trend, suggesting the following research hypothesis:

H_2 – The rising cash flow trend mitigates the negative effect of cash flow volatility on the debt level of Brazilian industrial companies.

As for the influence of cash flow volatility on debt maturity, Keefe and Yaghoubi (2016) suggest, based on previous research that the cost of indebtedness tends to grow as the debt maturity term increases. This prerogative may be considered natural, since the longer the term for payment of a debt, the greater tends to be the associated risk, providing an increase in the interest rate. Companies with high cash flow volatility, as they are already exposed to higher interest rates through this feature, will tend to make more extensive use of short-term financing sources, in order to better counterbalance the costs and benefits of debt.

From an empirical perspective, several studies seek to understand the issues related to debt maturity, its determinants, and its consequences for companies. Indeed, Miltersen and Toroso (2008) argue that the existing trade-off to reach the optimal debt maturity must consider the benefits of maturity flexibility and the costs of issuing long-term debt. The results prove the importance of balancing the two factors (flexibility and costs) and also point out that the greater the volatility of the processes that generate results in companies (and which also participate in cash flow generation), the lower the maturity of the debt. Based on the theoretical and empirical precepts discussed, there is the following research hypothesis:

H_3 – Cash flow volatility has a negative effect on the debt maturity of Brazilian industrial companies.

It is known that the increased risk in cash flow generation reduces the average optimal maturity of the debt (Miltersen & Toroso, 2008). Additionally, the (positive) cash flow growth rate has the opposite effect (Dangl & Zechner, 2016), that is, if the cash flow presents a positive trend, even if volatile, the optimal debt maturity tends to be maximized. According to Dangl and Zechner (2016), this phenomenon occurs because the commitment to reduce indebtedness in response to decreasing cash flows is less valuable for companies

that present expected cash flow growth rates. Thus, there are subsidies for the elaboration of the research hypothesis that follows:

H_4 – The upward trend in cash flow mitigates the negative effect of cash flow volatility on the debt maturity of Brazilian industrial companies.

2.3 Cash Availability Volatility

The generation of resources through cash flows can be seen as a substitute for money kept as financial slack, with companies with more volatile cash flows being more likely to suffer shortages of cash (cash and cash equivalents) due to deterioration unexpected of these flows arising from corporate operations (Ferreira & Vilela, 2004). In fact, Dang, Kim and Shin (2012) mention that companies with high volatility in earnings and, therefore, probably also in cash flows, tend to have limited access to the financial market to make adjustments to the capital structure. (Dang *et al*., 2012), especially for the loans contraction, since their yields fluctuate to meet the debt obligations. According to the above arguments, unstable cash flows are expected to negatively affect the availability of cash, which in this period will suffer from high volatility linked to the decline in available resources. Therefore, the perspectives discussed lead to the elaboration of the following hypothesis:

H_5 – The cash availability volatility has a negative effect on the debt level of Brazilian industrial companies.

In a discussion about capital structure theories, which are mainly linked to the search for the best way to raise funds for corporations, Bhardwaj (2018) mentions that when managers of an organization accumulate a relevant amount of financial slack, there is a greater tendency to become immune to market discipline (Bhardwaj, 2018). This financial slack, which is linked to high cash availabilities, may provide a given company the potential for investments or, even if the organization chooses to remain with excess cash, it provides an easier possibility to seek resources from third parties, as creditors consider the availabilities as the potential for the payments of the debt in installments.

Therefore, as much as the cash availability volatility tends to hinder access to third-party capital (Dang *et al*., 2012) when this is derived from excess and growing financial resources in the organization, access to loans and financing tends to be facilitated. Based on this, the following research hypothesis is presented:

H_6 – The increasing trend in cash availability mitigates the negative effect of the cash availability volatility on the debt level of Brazilian industrial companies.

Bates, Kahle, and Stulz (2009) verified that the cash availability of North American industrial companies has, over time, increased, intending to take precautions in the current highly competitive and globalized market. This fact is mainly since companies' cash flows have become riskier (volatile) (Bates *et al*., 2009), suggesting a relationship between cash generation (flows) and its maintenance in cash (availability).

That said, and also knowing that the empirical evidence from Keefe and Yaghoubi (2016) indicates that an increase in the standard deviation of the cash flows volatility, which will later turn into cash, implies a reduction of approximately 24% in the index long-term debt (maturity) for US organizations; and also by Memon *et al*. (2018) who verified, in the Chinese scenario, that the volatility of aspects related to cash, besides resulting in lower levels of leverage for companies, provides a 26.62% reduction in the probability of issuing debentures and other long-term debt, the following research hypothesis is elaborated:

H_7 – The cash availability volatility has a negative effect on the debt maturity of Brazilian industrial companies.

Based on what has been discussed so far, it is possible to state that the increase in volatility increases the probability of situational occurrence in which a company is no longer able to take advantage of the tax advantages on debt (Memon *et al*., 2018), reducing their optimal level of third-party capital and, consequently, causing such riskier organizations (greater volatility) to promote, in a smaller proportion, the use of third-party resources (Memon *et al*., 2018) and long-term debt. However, knowing that such volatility may occur due to increasing or decreasing availability over time and also that according to Bhardwaj (2018) the consolidated market assumptions can be mitigated when the movement of cash is for the abundance of resources (movement increasing), there is the composition of the following research hypothesis:

H_8 – The increasing trend in cash availability mitigates the negative effect of the cash availability volatility on the debt maturity of Brazilian industrial companies.

3 Methodological Procedures

This study, which aims to verify the effect of cash flow volatility and cash availability volatility on the capital structure of Brazilian industrial companies, is classified as descriptive, as it observes variables without manipulating them. In addition, the research is configured as a documentary, once the information used to calculate the variables was obtained through the Economática® database. Finally, regarding the approach to the problem, this is defined as quantitative, because the influence of variables is verified through the operationalization of statistical techniques.

The research population covered all Brazilian industrial companies listed in Brasil, Bolsa, Balcão – B3. The sample was composed of organizations that had data to operationalize the variables in all periods studied, covering the 5-year time gap - 2014 to 2018 - (information from 2010 to 2013 were also used, however, only to calculate the variables cash flow volatility and cash availability volatility). It should be noted that 2010 coincides with the year of adoption of international accounting standards in Brazil, making the accounting information used in this research consistent throughout the analysis period.

Furthermore, companies whose variables were considered outliers were excluded because they were more than three standard deviations away from the average, which could bias the findings. Besides, additionally, the 1% *winsorization* of the data was applied in both tails of the distribution, that is, the extremes were defined as 1% and 99% to replace the possible outliers that could remain. With these precepts, the research sample consisted of 77 companies, totaling 385 observations.

About the analysis of the data, operated on an annualized basis, the descriptive statistics of the variables under study was initially elaborated, being these dependent on capital structure - debt level and maturity -, the volatility independent - on the cash flow and availability – and the other control variables – profitability, size, liquidity, sales growth, sector fixed effect and year fixed effect. Based on these, therefore, the multiple regression models were operationalized. For a better understanding, Figure 1 is presented below, which contains the variables related to the study, in addition to their description, equation, and authors that support the way they are dimensioned for their empirical application.

Through the variables presented in Figure 1, the regression models were developed, with a total of eight models, constituted as follows: (1) and (2) with the debt level-dependent variables and the cash flow volatility independent variables (hypotheses *H1* and *H2*); (3) and (4) with the debt maturity dependent variables and the cash flow volatility independent variables (hypotheses *H3* and *H4*); (5) and (6) with the debt level-dependent variables and the cash availability volatility independent variables (hypotheses *H5* and *H6*); and, (7) and (8) with the debt maturity dependent variables and with the cash availability volatility independent variables (hypotheses *H7* and *H8*). It should also be noted that all the models also have control variables. For better understanding, below are the equations.

$$TD = \beta_0 + \beta_1 CFV + \beta_2 D\_CFV + \beta_3 PROF + \beta_4 SIZE + \beta_5 LIQ + \beta_6 SG + \Sigma SectorFixedEffect + \Sigma FixedYearEffect + \varepsilon \quad (1)$$

$$OD = \beta_0 + \beta_1 CFV + \beta_2 D\_CFV + \beta_3 PROF + \beta_4 SIZE + \beta_5 LIQ + \beta_6 SG + \Sigma SectorFixedEffect + \Sigma FixedYearEffect + \varepsilon \quad (2)$$

$$LTD = \beta_0 + \beta_1 CFV + \beta_2 D\_CFV + \beta_3 PROF + \beta_4 SIZE + \beta_5 LIQ + \beta_6 SG + \Sigma SectorFixedEffect + \Sigma FixedYearEffect + \varepsilon \quad (3)$$

$$LTOD = \beta_0 + \beta_1 CFV + \beta_2 D\_CFV + \beta_3 PROF + \beta_4 SIZE + \beta_5 LIQ + \beta_6 SG + \Sigma SectorFixedEffect + \Sigma FixedYearEffect + \varepsilon \quad (4)$$

$$TD = \beta_0 + \beta_1 CAV + \beta_2 D\_CAV + \beta_3 PROF + \beta_4 SIZ + \beta_5 LIQ + \beta_6 SG + \Sigma SectorFixedEffect + \Sigma FixedYearEffect + \varepsilon \quad (5)$$

$$OD = \beta_0 + \beta_1 CAV + \beta_2 D\_CAV + \beta_3 PROF + \beta_4 SIZE + \beta_5 LIQ + \beta_6 SG + \Sigma SectorFixedEffect + \Sigma FixedYearEffect + \varepsilon \quad (6)$$

$$LTD = \beta_0 + \beta_1 CAV + \beta_2 D\_CAV + \beta_3 PROF + \beta_4 SIZE + \beta_5 LIQ + \beta_6 SG + \Sigma SectorFixedEffect + \Sigma FixedYearEffect + \varepsilon \quad (7)$$

$$LTOD = \beta_0 + \beta_1 CAV + \beta_2 D\_CAV + \beta_3 PROF + \beta_4 SIZE + \beta_5 LIQ + \beta_6 SG + \Sigma SectorFixedEffect + \Sigma FixedYearEffect + \varepsilon \quad (8)$$

After observing the research models, it is noteworthy, finally, that for tabulating the variables an electronic spreadsheet was used. Subsequently, in order to verify the effect of cash flow volatility and cash availability volatility on the capital structure of Brazilian industrial companies, therefore linked to the research aim, the statistical method of multiple linear regressions was used with the aid of the specialized software IBM STATA (Data Analysis and Statistical Software) version 12. Finally, it is essential to highlight that the assumptions for the operationalization of the regression models were made - normality, multicollinearity, autocorrelation, and heteroscedasticity - also in the IBM STATA version 12, these being presented, more comprehensively, in the following data analysis section.

Variable	Description	Equation	Authors
Dependent Variables - Debt Level			
Total Debt (TD)	Total Debts to Total Assets Ratio	$\frac{Current\ Liabilities\ + Non-Current\ Liabilities}{Total\ Assets}$	Keefe and Yaghoubi (2016); Memon *et al.* (2018)
Onerous Debt (OD)	Onerous Debts to Total Assets Ratio	$\frac{Short-Term\ and\ Long-Term\ Loans\ and\ Financing\ + Debentures}{Total\ Assets}$	Keefe and Yaghoubi (2016)
Dependent Variables - Debt Maturity			
Long-Term Debt (LTD)	Long-Term Debt to Total Debt Ratio	$\frac{Non-Current\ Liabilities}{Current\ Liabilities\ + Non-Current\ Liabilities}$	Cai *et al.* (2008)
Long-Term Onerous Debt (LTOD)	Long-Term Onerous Debts to Onerous Debts Ratio	$\frac{Long-Term\ Loans\ and\ Financing\ + Long-Term\ Debentures}{Short-Term\ and\ Long-Term\ Loans\ and\ Financing\ + Short\ Term\ and\ Long-Term\ Debentures}$	Proposed by the Authors
Independent Variables			
Cash Flow Volatility (CFV)	Standard deviation between Operating Cash Flow and Net Assets ratio for the last 5 fiscal years	Standard deviation of the last 5 years of the following ratio: $\frac{Operating\ Cash\ Flow}{Net\ Assets}$	Memon *et al.* (2018)
Trend Dummy of Cash Flow Volatility (D_CFV)	Dummy variable, which receives a value of 1 if the trend (slope) of the Operating Cash Flow and the Net Assets of the last 5 years is increasing; and, 0 otherwise	Trend (inclination) of the last 5 exercises of the following ratio: $\frac{Operating\ Cash\ Flow}{Net\ Assets}$	Proposed by the Authors
Cash Availability Volatility (CAV)	Standard deviation between the Cash and its Equivalents and Net the Assets ratio for the last 5 years	Standard deviation of the last 5 years of the following ratio: $\frac{Cash\ and\ Cash\ Equivalentsa}{Net\ Assets}$	Proposed by the Authors
Trend Dummy of Cash Availability Volatility (D_CAV)	Dummy variable, which receives a value of 1 if the trend (slope) between Cash and its Equivalents and Net Assets in the last 5 years is increasing; 0 otherwise	Trend (inclination) of the last 5 exercises of the following ratio: $\frac{Cash\ and\ Cash\ Equivalentsa}{Net\ Assets}$	Proposed by the Authors
Control Variables - Firm-Specific			
Profitability (PROF)	EBIT and Total Assets Ratio	$\frac{Earnings\ Before\ Interest\ and\ Taxes\ (EBIT)}{Total\ Assets}$	Mouton and Smith (2016); Memon *et al.* (2018)
Size (SIZE)	Natural Logarithm of Total Assets	Total Asset LN	Keefe and Yaghoubi (2016); Tripathy and Asija (2017)
Liquidity (LIQ)	Current Assets and Current Liabilities Ratio.	$\frac{Current\ assets}{current\ Liabilities}$	Cai *et al.* (2008); Tripathy and Asija (2017)
Sales Growth (SG)	Variation of Sales from the previous period to the current one Ratio.	$\frac{Sales\ t-Sales\ t-1}{Sales\ t-1}$	Mouton and Smith (2016)
Control Variables - Fixed Effects			
Sector Fixed Effect	Bovespa economic sector classification, considering: 1) Industrial goods; 2) Cyclical consumption; 3) Non-cyclical consumption; 4) Basic materials; and, 5) Other industrial sectors.	Not applicable	Adaptado de Keefe and Yaghoubi (2016); Veirman and Levin (2018)
Fixed Year Effect	Study period, having: 1) 2014; 2) 2015; 3) 2016; 4) 2017; and, 5) 2018	Not applicable	Keefe and Yaghoubi (2016); Veirman and Levin (2018)

Figure 1: Dependent, Independent, and Control Variables

Notes: 1) Net assets = total assets (-) cash and cash equivalents; 2) the slope (trend) dummy variables are derived from the "slope of the linear regression line for the estimated data points"; 3) the variables designated as "proposed by the authors" refer exclusively to the methodological configuration adopted in this research. Its use in other settings is known from previous literature, especially in the area of finance; and, 4) According to Veirman and Levin (2018), by controlling, by fixed effects, a range of factors, more reliable volatility estimates are produced. Therefore, "Fixed Sector Effect" and "Fixed Year Effect" are operationalized, in this research, to produce more robust models.

Source: Survey data.

4 Data Analysis

4.1 Descriptive Statistics

Before entering the regression models that seek to properly meet the research aim, it is essential to understand the general characteristics of the sample. For this purpose, Table 1 is presented, which contains the mean, standard deviation, minimum, and maximum of the numerical variables under study, as well as a proportional reference of the categorical variables.

Table 1
Descriptive Statistics of Numerical and Categorical Variables

Variables	Numerical Variables			
	Mean	**Standard deviation**	**Minimum**	**Maximum**
TD	0.6675	0.2792	0.1320	1.7400
OD	0.3467	0.1778	0.0341	0.8431
LTD	0.4764	0.2015	0.0463	0.8555
LTOD	0.5612	0.2635	0.0000	0.9707
CFV	0.0416	0.0282	0.0064	0.1528
CAV	0.0372	0.0345	0.0006	0.1846
PROF	0.0499	0.0825	-0.4054	0.2908
SIZE	15.0355	1.9749	11.1514	20.6181
LIQ	1.6750	1.0882	0.0718	9.0528
SG	0.0407	0.1671	-0.4839	0.5995
Variables	**Categorical Variables**			
	Trend (slope) Descending		**Trend (slope) Ascending**	
D_CFV	229 (59.5%)		156 (40.5%)	
D_CAV	185 (48.1%)		200 (51.9%)	
Total	385 observações (100,00%)			

Caption: TD = Total Debt; OD = Onerous Debt; LTD = Long-Term Debt; LTOD = Long-Term Onerous Debt; CFV = Cash Flow Volatility; CAV = Cash Availability Volatility; PROF = Profitability; SIZE = Size; LIQ = Liquidity; SG = Sales Growth; D_CFV = Cash trend dummy (slope) of Flow Volatility; D_CAV = Trend dummy (slope) of Cash Availability Volatility.
Source: Research data.

Based on data presented in Table 1, it's clear that, on average, approximately two-thirds of the capital used by Brazilian industrial organizations comes from third parties. This number is enhanced, since some companies, due to their negative equity (unsecured liabilities), have a total debt ratio greater than 1. Even so, it is possible to infer that the proportion of use of third-party capital by Brazilian companies is what maximizes the importance of understanding the determinants of debt structure. Besides, onerous debt corresponds to a little more than half of the total debt, pointing out that loans and financing, and debentures are sources that are used intensively by organizations in their search for third-party resources.

Understood to the general facets of the level of debt, it is observed, next, regarding its maturity, that 47.6% of corporate debts are in long-term, that is, they have a maturity period of more than one year, rising to 56 .1% when considering only onerous debt. Naturally, there is a relevant percentage growth in long-term onerous debts compared to general debts of the same period, since, usually, onerous debts subsidize purchases of fixed assets that will generate results over extended periods, being, therefore, conditioned there are also longer payment times, while general debts include items such as suppliers, salaries, taxes, etc. which are, by nature, mostly short-term.

4.2 Regression Models

Through the regressions that follow, the effect of the volatility independent variables - cash flow and cash availability -, their trends (slope) and also the control variables - profitability, size, liquidity, and growth can be observed of sales – in the variables dependent on the capital structure, which establish the level and maturity of the debt. Such relations are linked, in stages, to hypotheses 1 to 8, and their beginning is presented in Table 2, which follows for further description.

In table 2 is presented the cash flow volatility and its trend in the debt level ratio (hypotheses 1 and 2), with the statistical models in question being significant at the 1% level, which allows for inferences. The independent and control variables, through R^2, showed an explained power of 48.14% for total debt and 19.49% for onerous debt. The number of observations in these and all the models that follow is 385, derived from the 77 Brazilian industrial companies studied over 5 years. It is also noteworthy that all models have year and sector fixed effect control, aiming to consider possible changes in the behavior of the variables according to the aforementioned characteristics.

Table 2
Effect of Cash Flow Volatility on Capital Structure - Debt Level

Variables	Total Debt (TD)			Onerous Debt (OD)		
	Coef.	t-test	Sig.	Coef.	t-test	Sig.
CFV	2.9179	5.91	0.000*	0.5450	1.45	0.147
D_CFV	0.0149	0.72	0.471	0.0327	1.76	0.080***
PROF	-0.7428	-3.81	0.000*	-0.4427	-2.94	0.003*
SIZE	-0.0011	-0.17	0.862	0.0185	3.81	0.000*
LIQ	-0.1037	-7.12	0.000*	-0.3004	-4.20	0.000*
SG	0.0225	0.29	0.770	0.1391	2.66	0.008*
CONS	0.7741	6.85	0.000*	0.1135	1.39	0.167
R^2	0.4814			0.1949		
Sig. Model	0.0000			0.0000		
No Obs.	385			385		
Sector FE	Yes			Yes		
Year FE	Yes			Yes		
Jarque-Bera	0.0001			0.1099		
VIF	≤ 1.70			≤ 1.70		
Durbin-Watson	2.0987			1.8500		
White Test	0.0000			0.0002		
White Matrix (RR)	Yes			Yes		

Legend: CFV = Cash Flow Volatility; D_CFV = trend dummy (slope) Cash Flow Volatility ; PROF = Profitability; SIZE = Size; LIQ = Liquidity; SG = Sales Growth; FE = Fixed Effect; VIF = Variance Inflation Factor; RR = Robust Regression.
Note: Significance at the *1% level; **5%; ***10%.
Source: Research data.

About the assumptions of the models, the normality (Jarque-Bera test) was violated when the dependent variable, total debt was used. In this specific case, the data were relaxed through the central limit theorem, which, according to Couto, Oliveira, Torres, and Morais (2015), will be applied when the sample size is at least 30 cases, according to the condition of this study. Furthermore, Freund & Simon (2000) assert that the assumptions of the central limit theorem are widely accepted in the statistical literature, guaranteeing the adopted procedure. Furthermore, the VIF (variance inflation factor) of the variables was equal to or less than 1.70, far from the maximum acceptable limit of 5, therefore, there are no problems of multicollinearity in the models.

The residual autocorrelation test (Durbin-Watson) was, in both models, between the acceptable of 1 and 3 and, still, very close to 2, which is ideal, thus meeting the specificities of the regressions. Finally, in both models, heteroscedasticity problems were detected through White's test. To overcome this condition, a robust regression was performed, which, according to Fávero, Belfiore, Silva, and Chan (2009), inserts the White matrix, adjusting the standard errors through the model's heteroscedasticity.

As for the results, it appears that the cash flow volatility (CFV) has a positive relationship with the debt level of companies, however, the findings are significant only for the independent variable of total debt. These results show, therefore, that companies with greater variability of cash flow generated over time use resources from third parties (debt) more intensively. The trend (slope), dimensioned by the variable D_CFV in turn, points out that increasing cash flows facilitate access to onerous debt (10% significance).

About the control dimensions, emphasis is given to profitability and liquidity, both negatively related to the level of debt, both with total debt and with onerous debt. Having seen the results of cash flow volatility at the debt level, below, in Table 3, we have the findings of cash flow volatility at debt maturity.

The models linked to Table 3 were also significant at the 1% level, which allows for inferences. The explanatory power (R^2) is 35.96% and 49.40% for long-term debt (LTD) and long-term onerous debt (LTOD), respectively. Both were relaxed using the central limit theorem (normality), do not contain multicollinearity (VIF) and autocorrelation (Durbin-Watson) problems, and robust regression was applied to correct the heteroscedasticity of the models.

The results point that the cash flow volatility is negatively related to the debts accounted for in non-current, however, it is only significant concerning the long-term onerous debt. Even so, companies with high variation in cash generation have more restricted access to debts with maturities longer than one year compared to organizations with more stable cash flows over time. In addition, the cash flow trend, measured by the variable D_CFV, indicates that when companies are achieving better cash performance in recent periods, they obtain resources from third parties with longer terms.

Table 3
Effect of Cash Flow Volatility on Capital Structure - Debt Maturity

Variables	Long-Term Debt (LTD)			Long-Term Onerous Debt (LTOD)		
	Coef.	t-test	Sig.	Coef.	t-test	Sig.
CFV	-0.3548	-1.06	0.289	-0.9944	-2.55	0.011**
D_CFV	0.0596	3.33	0.001*	0.0385	1.91	0.056***
PROF	-0.6571	-5.64	0.000*	-0.3633	-2.39	0.017**
SIZE	0.0297	5.88	0.000*	0.0566	10.33	0.000*
LIQ	0.0396	2.51	0.013**	0.0592	3.37	0.001*
SG	0.0382	0.66	0.510	0.0572	0.80	0.426
CONS	0.0397	0.44	0.658	-0.2622	-2.76	0.006*
R^2		0.3596			0,4940	
Sig. Model		0.0000			0,0000	
No Obs.		385			385	
Sector FE		Yes			Yes	
Year FE		Yes			Yes	
Jarque-Bera		0.0001			0.0000	
VIF		≤ 1.70			≤ 1.70	
Durbin-Watson		2.1233			1.9937	
White Test		0.0000			0.0000	
White Matrix (RR)		Yes			Yes	

Legend: CFV = Cash Flow Volatility; D_CFV = trend dummy (slope) of Cash Flow Volatility; PROF = Profitability; SIZE = Size; LIQ = Liquidity; SG = Sales Growth; FE = Fixed Effect; VIF = Variance Inflation Factor; RR = Robust Regression.
Note: Significance at the *1% level; **5%; ***10%.
Source: Research data.

Finally, it is reported that the control variables profitability (negative), size (positive), and liquidity (positive) were also shown to determine the debt maturity of the Brazilian industrial companies analyzed here. In addition, Table 4 presents the volatility findings of available cash (CAV) at the level of debt, with this focus on a more detailed analysis later.

Table 4
Effect of Cash Availability Volatility on the Capital Structure - Debt Level

Variables	Total debt (TD)			Onerous Debt (OD)		
	Coef.	t-test	Sig.	Coef.	t-test	Sig.
CAV	0.3288	0.96	0.338	1.3254	4.74	0.000*
D_CAV	0.0175	0.74	0.460	0.0264	1.55	0.121
PROF	-0.7927	-3.93	0.000*	-0.3951	-3.01	0.003*
SIZE	-0.0167	-2.96	0.003*	0.0091	2.02	0.044**
LIQ	-0.1257	-7.70	0.000*	-0.0366	-5.39	0.000*
SG	0.0121	0.16	0.871	0.1183	2.26	0.025**
CONS	1.1467	11.96	0.000*	0.2030	3.03	0.003*
R^2		0.4191			0.2425	
Sig. Model		0.0000			0.0000	
No Obs.		385			385	
Sector FE		Yes			Yes	
Year FE		Yes			Yes	
Jarque-Bera		0.0000			0.0615	
VIF		≤ 1.86			≤ 1.86	
Durbin-Watson		2.0619			1.8775	
White Test		0.0000			0.0057	
White Matrix (RR)		Yes			Yes	

Legend: CAV = Cash Availability Volatility; D_CAV = Trend dummy (slope) of the Cash Availability Volatility; PROF = Profitability; SIZE = Size; LIQ = Liquidity; SG = Sales Growth; FE = Fixed Effect; VIF = Variance Inflation Factor; RR = Robust Regression.
Note: Significance at the *1% level; **5%; ***10%.
Source: Research data.

The models applied in Table 4 have as dependent variables the total debt and the onerous debt, which are explained (R^2) by the independent variables in 41.91% and 24.25%, respectively. Both models are significant at 1%, ensuring their applicability. Besides, establishing the assumptions, there is the relaxed normality according to the central limit theorem, the VIF pointing out that there are no multicollinearity problems, the Durbin-Watson that there are no autocorrelation problems, and robust regressions were operationalized to correct heteroscedasticity problems.

Given the results, the cash availability volatility has a positive effect on the debt level of the analyzed companies. However, it is worth noting that the mentioned result is significant only when the dependent variable is onerous debt. Thus, it may be seen that both the greater cash flow volatility (Table 2) and the

greater cash availability volatility make companies seek to finance themselves more extensively via third parties. On the other hand, although positive, the trend coefficients for the cash availability volatility (D_CAV) are not significant, and this variable is therefore not a determinant of the debt level in Brazilian industrial companies.

As for the control, profitability, and liquidity variables, they are confirmed as negatively related to debt levels – total and onerous. In addition, the size of the company was significant in both, but negatively to the total debt and positively to the onerous debt. This factor establishes that smaller companies enjoy greater access to third-party resources, but such resources are more related to operational aspects - suppliers, etc., since, in the headings of loans and financing and debentures, the larger organizations have higher levels of debt. Finally, Table 5 presents the results of the cash availability volatility at the maturity of companies' debt.

Table 5
Effect of Cash Availability Volatility on Capital Structure - Debt Maturity

Variáveis	Long-Term Debt (LTD)			Long-Term Onerous Debt (LTOD)		
	Coef.	t-test	Sig.	Coef.	t-test	Sig.
CAV	-0.4992	-1.86	0.063***	0.0208	0.07	0.941
D_CAV	0.0164	0.92	0.357	0.00004	0.00	0.998
PROF	-0.5318	-4.87	0.000*	-0.2621	-1.77	0.077***
SIZE	0.0336	7.47	0.000*	0.0612	12.68	0.000*
LIQ	0.0401	2.55	0.011**	0.0650	3.66	0.000*
SG	0.0560	0.96	0.339	0.0656	0.90	0.368
CONS	0.0045	0.07	0.947	-0.3722	-4.94	0.000*
R^2		0.3479			0.4817	
Sig. Model		0.0000			0.0000	
No Obs.		385			385	
Sector FE		Yes			Yes	
Year FE		Yes			Yes	
Jarque-Bera		0.0000			0.0000	
VIF		≤ 1.86			≤ 1.86	
Durbin-Watson		1.9756			1.9759	
White Test		0.0000			0.0000	
White Matrix (RR)		Yes			Yes	

Legend: CAV = Cash Availability Volatility; D_CAV = Trend dummy (slope) of the Cash Availability Volatility; PROF = Profitability; SIZE = Size; LIQ = Liquidity; SG = Sales Growth; FE = Fixed Effect; VIF = Variance Inflation Factor; RR = Robust Regression. Note: Significance at the *1% level; **5%; ***10%.
Source: Research data.

Table 5 demonstrates that the explanatory power (R^2) of the models was 34.79% and 48.17%, the first as a function of the dependent variable long-term debt (LTD) and the second to long-term onerous debt (LTOD). Besides, the two models are significant at the 1% level, with the normality relaxed by the central limit theorem, not presenting, according to VIF and Durbin-Watson, respectively, multicollinearity and autocorrelation problems, and also having the heterogeneity adjusted by the application of robust regression that inserts the White matrix.

The cash availability volatility variable, when significant, is negatively related to the debt maturity (specifically to long-term debt). Therefore, as in the case of cash flow volatility (Table 3), the cash availability volatility is also considered to minimize long-term debt obtained by Brazilian industrial companies. In contrast, the trend in cash availability, despite being positive, is not significant with the debt maturity measures and, therefore, is not a determinant of the debt accounted for in non-current liabilities. Finally, given the control variables, profitability (negatively), size (positively), and liquidity (positively) influence debt maturity.

4.3 Results Discussion

The empirical results of this research provide the discussion of numerous theoretical aspects, from their adherence to different positions. In this sense, the cash flow volatility presented a positive relationship with both the debt level variables, being significant with the total debt, which goes against the existing theoretical precepts. According to Keefe and Yaghoubi (2016) and Memon et al. (2018), the high variability of the cash flow causes the cost of debt to rise according to the associated risk. Thus, with increased chances of financial embarrassment or insolvency, companies with greater cash flow volatility should be opposed to debt. Empirically, Martins and Vasconcelos (2020) observed a negative relationship between cash flow volatility and the capital structure of Brazilian publicly-held companies, classifying this result as adhering to the trade-off theory.

However, in contrast to the previous empirical finding, the results of this study suggest that Brazilian industrial companies with more volatile cash flows use third-party capital on a larger scale. Although different from what is recommended in the previous literature consulted, such evidence may be understood as an

alternative form of fundraising that derives from the internal insufficiency, in some periods, that companies with high cash flow volatility have to finance. Therefore, such risky organizations, aiming to continue their projects, make more extensive use of third-party capital, even though this may mean an increase in the cost of capital as mentioned by Keefe and Yaghoubi (2016) and Memon et al. (2018). However, despite being explained, the results do not support research hypothesis 1 that cash flow volatility has a negative effect on the debt level of Brazilian industrial companies, rejecting it

Furthermore, regarding the trend of cash flow volatility at the debt level, it was observed that this acts positively in both measures used but is significant (at 10%) only in onerous debt. However, the volatility of the cash flow can be due to disbelieving or increasing variations. For Ferreira and Vilela (2004), both cash and abundant cash flows act as minimizers of the cost of capital and financial difficulties for companies (Ferreira & Vilela, 2004) and, thus, it is expected that the growth of both over time tends to facilitate fundraising via third parties. In this perspective, the results found here are consistent with what is recommended in the previous literature consulted.

In turn, the effect of cash flow volatility on debt maturity presented negative coefficients in both dependent variables, being significant (at 5%) with long-term onerous debt. This finding indicates that companies with more unstable cash flows have less access to long-term third-party resources. The trade-off capital structure theory argues that there is an optimal level of debt that, according to Miltersen and Toroso (2008), should consider, among other factors, the benefits of flexible debt maturity and its issuance costs trailers. Besides, Keefe and Yaghoubi (2016) corroborate that the cost of debt tends to rise according to the longer term of maturity of contracts signed with third parties.

Based on the above, it is natural to assume that companies with high cash flow volatility, to offset the cost of debt, admittedly higher for them, seek debt with a shorter term, in addition to naturally having greater difficulty in extending terms, once they offer a higher degree of risk than lenders. Based on these factors, the findings of this research are consistent with previous literature cited, allowing not to reject hypothesis 3 that cash flow volatility has a negative effect on the debt maturity of Brazilian industrial companies.

Next, it was observed that the trend of cash flow volatility acts positively both in long-term debt (at 1% significance) and long-term onerous debt (at 10% significance). According to Dangl and Zechner (2016), cash flow volatility decreases the optimal debt maturity, however, the growth rate of said flow has the opposite effect. Thus, the findings of this research that companies with increasing cash flows, even if more volatile due to this, increase the search for and contracting of debt with a longer maturity agrees with the literature. Therefore, hypothesis 4 that the upward trend in cash flow mitigates the negative effect of cash flow volatility on debt maturity of Brazilian industrial companies is not rejected.

The cash flows generated are, at first, destined as available cash. Such availability, upon generation and subsequent decision-making by managers, may suffer greater or lesser variability, affecting the level and maturity of companies' debt. In this sense, it was observed that the volatility of cash availability is positively related to total debt and onerous debt, being significant (at 1%) with the latter. However, according to Dang et al. (2012), companies with inconsistent performance tend to have volatile cash flows and cash, which limits access to the financial market. Therefore, the results of this research diverge from the theory consulted, rejecting hypothesis 5 that the cash availability volatility has a negative effect on the debt level of Brazilian industrial companies.

Furthermore, the trend in cash availability has a positive effect on both debt level measures, but neither of them is significant. As cash availabilities can be seen as potential for installment payments, Bhardwaj (2018) argues that the high volume of financial slack tends to make companies immune to market discipline (Bhardwaj, 2018), especially when there are limitations to access the third-party capital. Therefore, increasing cash availabilities are understood as enhancing access to external resources, which is in line with what was found in this study. However, due to its lack of significance, hypothesis 6 that the increasing trend in cash availability mitigates the negative effect of cash availability volatility on the debt level of Brazilian industrial companies is rejected.

As for the cash availability volatility in impacting debt maturity, when significant (at 10%), this variable negatively affects long-term debt. According to Memon et al. (2018), in the emerging scenario in China, factors linked to cash volatility provide, in addition to lower levels of leverage for companies, a reduction of approximately 27% in the probability of issuing long-term debt, including debentures. The significant results for the Brazilian scenario are in line with the theoretical and empirical precepts of Memon et al. (2018), not rejecting hypothesis 7 that the cash availability volatility has a negative effect on the debt maturity of Brazilian industrial companies.

Finally, the trend of cash flow volatility has a positive coefficient for both debt maturity dependent variables, however, they are not significant. According to theory, Bhardwaj (2018) argues that market patterns are minimized when the cash slope moves towards the abundance of resources (Bhardwaj, 2018). Therefore, if the availability of cash is ranging due to its growth, access to third-party capital, including long-term ones, tends to be facilitated. Thus, the positive cash availability volatility and debt maturity ratio, observed for the Brazilian scenario is in line with the previous literature, however, even so, research hypothesis 8 that the increasing trend of availability is rejected. The negative effect of cash availability volatility on the debt maturity of Brazilian industrial companies is due to the lack of statistical significance.

5 Final Considerations

This study aimed to verify the effect of cash flow volatility and cash availability volatility on the capital structure of Brazilian industrial companies. The results reveal that both cash flow volatility (CFV) and cash availability volatility (CAV) influence the level and maturity of companies' debt, the first being positively and the second negatively. This fact suggests that, in the Brazilian context, companies with greater cash variability – that is, those that are riskier, make more extensive use of third-party resources and such resources are predominantly short-term.

Besides, the trend cash flow volatility variable (D_CFV) indicates that when the high variation of the flows comes from an increasing trend of cash generation, companies are more likely to contract debts with third parties, as well as to contract such debts over a longer period. On the other hand, the cash availability volatility (D_CAV), despite also presenting positive coefficients, as it is not statistically significant, is not a determinant of the level and maturity of the debt of the Brazilian industrial companies studied.

5.1 Contributions to Knowledge Advancement

The empirical findings indicate that both cash flow volatility and cash availability volatility positively affect the debt level of Brazilian industrial companies, differing from previous precepts regarding the phenomenon in question, as well as from empirical evidence by Martins and Vasconcelos (2020) in Brazil. Therefore, in possession of these results, it is possible to debate new contributions, as well as provide referrals for future research, especially in the Brazilian study scenario.

Precisely, it is legitimate that the volatility of aspects related to cash - flow and availability - may be thrusters of corporate debt, because when, during some periods, the internal generation of resources becomes insufficient to cover corporate demands, third-party capital becomes the main available source of resources and, therefore, used by corporate managers, even though this may mean an increase in the risk of financial difficulties. In this way, it contributes so that new understandings are developed, based on third-party debt as an alternative source of fundraising by companies in unstable cash situations.

Furthermore, it was observed that the volatility of cash flow and cash availability make it difficult to obtain long-term funds from third parties. As much as this is in line with what is recommended in the previous literature regarding exclusively the volatility of the aspects related to cash to the debt maturity when analyzed together with the cash volatility and the debt level, they bring to light a situation even more difficult for Brazilian companies that have highly variable cash flows.

This is because, differently from the theoretical order, which mentions such companies as less indebted (levels) and with more short-term debt (maturity), in the Brazilian scenario such organizations are designed as more indebted and also with mostly short-term debt, which provides the worst possible condition for a debtor. This raises the need for reflections on how harmful the volatility of cash flow and cash availability to companies is. Despite this, the findings shown here point to the volatility of aspects related to cash with an even greater potential to asphyxiate company finances than what was previously agreed in the literature in the area.

Finally, the trend of cash flow volatility, which is ignored in previous research, was shown to be important, when it presents an increasing inclination, for companies to raise more resources through third parties and with maturities longer than a year (long-term). Therefore, this study brings the reflection that the volatility direction must be evaluated together with the cash flow variability level. All contributions are of interest to numerous parties, with special attention to managers, intending to qualify the management of the financial resources of the companies they manage.

5.2 Limitations and Recommendations for Future Research

As much as the study results bring new perspectives on the phenomenon observed, they must be interpreted with caution, given the existing limitations inherent to the research of this type. Such limitations permeate, above all, other potential ways of dimensioning the variables of interest, even more so that some of the measures used were applied in a seminal manner under the methodology adopted here and, therefore, they need new insights to consolidate. Therefore, it is not of interest to consummate the understanding of the subject, but rather to establish new and more robust parameters for future research.

In this sense, by adopting this methodology, researchers may explore such variables to understand the phenomenon in other contexts, thus advancing both the applicability of the measures and the observance of potential differences that may exist between the countless and diversified world economies. In addition, other methodological approaches may be applied in the Brazilian scenario, as the effect of cash flow volatility on the corporate capital structure was shown to be different in this research compared to the study by Martins and Vasconcelos (2020), pointing out that the stratification of samples, the application of more complete statistical models, among other factors, can bring new knowledge, broadening and enriching the debate on the subject.

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