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Effect of Financial Restriction on Sticky Costs: Empirical Evidence from Brazil

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ABSTRACT

This research aimed to investigate the impact of financial constraint on asymmetric cost behavior in companies listed on B3 (Brazil). For that, a descriptive, documentary and quantitative study were developed with the use of multiple linear regression, totaling a sample of 834 observations. The results show that companies with and without financial restrictions present an asymmetrical behavior of costs, ie, the increase in total costs in the face of an increase in sales revenue is higher when compared to the reduction of costs due to a proportional reduction in the recipe. However, the findings have shown that financially constrained firms better adjust total costs to the company's situation and decreases in revenue. In other words, it can be seen that these companies make more drastic cuts in total expenses due to the reduction of sales revenue, however, increasing the asymmetry of costs. On the other hand, when the economy returns, it loses due to the low investment capacity for growth, because they are experiencing difficulties in obtaining resources. It is concluded that the behavior of costs is adapted to the conditions of companies that are financially constrained. The evidence found in the study contributes to creditors and regulators, who can support new financing policies and risk monitoring for companies with financial constraints, since they aim to adopt the asymmetry in costs due to a fall in revenue, which reveals that they seek exit from the financial situation, with a view to improving the company's overall capacity.

PALAVRAS-CHAVE

Restrição Financeira, Comportamento dos custos, Empresas brasileiras.

RESUMO

Esta pesquisa objetivou investigar o impacto da restrição financeira no comportamento assimétrico dos custos de empresas listadas na B3 (Brasil). Para tanto, foi desenvolvido um estudo descritivo, documental e quantitativo com a utilização de regressão linear múltipla, totalizando uma amostra de 834 observações. Os resultados mostram que as empresas com e sem restrições financeiras apresentam um comportamento assimétrico dos custos, ou seja, o aumento dos custos totais diante de um aumento da receita de vendas é superior quando comparado com a redução dos custos devido a uma redução proporcional na receita. No entanto, os resultados revelaram que as empresas com restrições financeiras adaptam melhor os custos totais diante da situação da empresa e diminuições na receita. Em outras palavras, pode-se constatar que essas empresas realizam cortes mais drásticos nos gastos totais em decorrência da redução da receita de vendas, todavia, aumentando a assimetria dos custos. Por outro lado, quando da retomada da economia acabam perdendo pela baixa capacidade de investimento para crescimento, por estarem passando por dificuldades para a obtenção de recursos. Conclui-se que o comportamento dos custos é adaptado às condições das empresas com restrições financeiras. As evidências encontradas no estudo contribuem para credores e reguladores, que podem subsidiar novas políticas de financiamento e monitoramento de risco para empresas com restrição financeira, uma vez que visam adaptar a assimetria ocorrida nos custos em função de uma queda na receita, o que revela que procuram saídas diante da situação financeira, com vistas a melhorar a capacidade global da empresa.

1 Introduction

The behavior of costs refers to the way costs respond to the change in activity and decision (Ibrahim & Ezat, 2017). Understanding cost behavior is critical for managers and accountants in order to provide and use information to make effective decisions (Maher et al., 2008). Especially when companies are in periods of financial constraint, when companies have difficulty obtaining financial resources from external sources and the cost of raising funds increases (Paulson & Townsend, 2004; Kaplan & Zingales, 1997). The companies face financial constraints due to imperfect capital market (Ro et al., 2017).

When there is asymmetry in costs, these increase more with increases in activities, than the decrease in response to an equivalent decrease in activities. Thus, in this behavior, costs increase more when sales revenues increase than they fall when sticky costs (Anderson et al., 2003). Asymmetric cost behavior contradicts the traditional model, which assumes that costs behave symmetrically for increases and decreases in activity (Noreen & Soderstrom, 1997), ie, there is symmetry in cost behavior (anti-sticky). The theory of sticky costs highlights that cost rigidity is a consequence of deliberate resource utilization decisions by managers (Chen et al., 2013).

In this sense, it is pointed out that companies with greater financial constraints will seek better alignment of cost behavior, therefore, financial constraints may have an impact on the cost behavior of companies. Evidence from the Campello et al. (2010) study indicated that financially constrained firms plan deeper spending cuts and seek credit lines from banks because of fears of future credit restraint and sell more assets to finance its operations. Thus, analysts should be able to measure the degree of financial constraints faced by firms by analyzing the flow of investments (Almeida & Campello, 2001).

The literature on the subject has grown and studies have been developed relating financial constraints with qualitative and quantitative measures of accounting reports (Kaplan & Zingales, 1997), investment in research and development (Bond et al., 2003), entrepreneurship (Paulson & Townsend, 2004), policies of cash reserves (Costa et al., 2008), survival and growth of enterprises (Musso & Schiavo, 2008), financial crisis (Campello et al., 2010), mergers and acquisitions (Chen et al., 2009), investment (Crisóstomo et al., 2014), the sensitivity of the investment cash flow (Riaz et al., 2016), volatility of cash flow (Palkar, 2017), financing costs and inventories (Hoberg et al., 2017).

Despite the development of these studies, however, "reflexes of financial constraints on accounting numbers is still a scarce issue in the literature that seeks interactions between accounting and finance" (Demonier et al., 2015, p. 1265). Therefore, there is a gap for the realization of this research, because no evidence was found of studies that aimed to investigate the relationship between financial constraints and cost behavior. Thus, in order to understand this relationship, it is necessary to understand the behavior of costs in these environments.

The starting point in the fixed cost structure is that many, but not all, arise a result of deliberate resource commitment decisions made by managers (Cohen et al., 2017). Given the context of the financial constraint, there is a need for companies to understand the impact of this on cost behavior, as well as the necessary adaptation to costs when companies are subject to financial constraints, since studies on this subject need to be given more attention, especially in the case of the Brazilian economy, which is in the process of expansion in the world scenario (Richartz & Borgert, 2014) and mainly because the Brazilian environment, being a developing country, presents an imperfect capital market making companies depend, almost exclusively, on banks to raise funds (Paulson & Townsend, 2004; Ro et al., 2017).

There is evidence in the literature that suggests that costs do not always react in a linear fashion, as advocated by the traditional model, Anderson et al. (2003), who called cost behavior asymmetric. However, the empirical results showed the existence of asymmetry of the costs (Silva et al., 2019; Pamplona et al., 2016; Ibrahim, 2015; Banker et al., 2014; Balakrishnan et al., 2014; Marques et al., 2014; Richartz & Borgert, 2014; Caylor & Lopez, 2013; Porporato & Werbin, 2012; He et al., 2010; Calleja et al., 2006; Medeiros et al., 2005; Subramaniam & Weidenmier, 2003; Anderson et al., 2003; 2007). In addition, there is evidence in the literature that points to internal factors that may exert an influence on cost behavior, such as companies that are financially constrained. The results of the study by Crisóstomo et al. (2014) show that Brazilian companies facing

financial constraints depend on internally generated funds. Thus, companies that are going through financial difficulties can adapt the behavior of the costs in front of their financial situation.

Considering that the relationship proposed in this study is incipient, this fact motivates the investigation of the effects of financial constraints on companies' practices regarding costs in relation to increases and decreases in revenue. Thus, the present study seeks to answer the following research question: Do companies listed in B3 with financial constraints adjust the behavior of costs? The objective is to investigate whether companies listed in B3 with financial constraints adjust the behavior of costs.

It is justified the analysis of the Brazilian environment, since according to Aldrighi and Bisinha (2010), it gains importance to the discussion about the financial restrictions that Brazilian companies face, due to their own characteristics as the institutional environment in which they operate and with fragile legal protection to the investors. In addition, the role of financial constraints in the choice of investments made by companies is an important topic of financial research, since financially constrained companies do not opt for the optimal level of investment since they will have to invest in lower levels (Costa et al., 2008). For Farre-Mensa et al. (2016) financial constraints are fundamental for empirical research in the areas of finance and economics.

In addition, the literature on financial constraints focuses mainly on developed countries, while developing countries, with increasing importance in the international economy, have received little attention, such as Brazil. Although the existence of research that has analyzed the financial constraints, the research is limited on this topic in the developing markets, is an important motivation for the development of this study with a focus in Brazil (Crisóstomo et al., 2014). According to Riaz et al. (2016) in developed financial markets, firms are less likely to suffer severe financial constraints, as developing markets suffer more from this financial problem. Therefore, it has been interesting to analyze data from Brazil, since we believe that the evidence will contribute to the literature, drawing attention to the aspects of the behavior of costs in the face of financial constraints faced by Brazilian companies.

The relationship between financial constraint and sticky costs is justified by managers need to know how costs behave in order to make informed decisions about products and to plan and evaluate performance (Venieris et al., 2015; Lanen et al., 2011) especially when they meet and financial constraint and is required of managers better organizational decision-making (Cohen et al., 2017). With regard to investors, they depend on published financial statements based on available information on the determinants of cost behavior. From the point of view of financial analysts, predicting cost behavior is an essential part of earnings forecasting (Xu & Sim, 2017; Weiss, 2010).

This research, when investigating the impact of financial constraint on asymmetric cost behavior in companies listed on B3 (Brazil), contributes to the expansion of the literature on this subject and also helps the investors, creditors, and regulators understand the trends that have financial restrictions adopted in view of the occurrence of asymmetry in costs.

The study provides empirical evidence on the relationship between sticky costs, for companies with financial constraints. Understanding fixed cost behavior has direct benefits for managers to make decisions about cost control and external stakeholders (for example, financial analysts) who evaluate the company's performance (Xu & Sim, 2017). The findings enrich the existing knowledge of the real effects of financial constraints and introduce insights into the relationship between financial constraints and corporate behavior.

2 Review of Literature and Research Hypotheses

2.1 Behavior of Costs

One of the first studies that defined and examined cost rigidity was that of Anderson et al. (2003). Anderson et al. (2003) demonstrated that costs increase more when activity increases than fall as activity declines. In the economic theory of cost stickiness, costs are sticky because of economic forces that act to slow the downward adjustment more than the upward adjustment. The forces include permanent sales decline, macroeconomic growth, and asset and employee intensities (Anderson et al., 2003).

The results showed that the firms' costs presented an asymmetric behavior, called sticky

costs. This theory has been proven in the studies developed by Pamplona et al. (2016), Ibrahim (2015), Balakrishnan et al. (2014), Banker et al. (2014), Marques et al. (2014), Richartz and Borgert (2014), Caylor and Lopez (2013), Porporato and Werbin (2012), He et al. (2010), Calleja et al. (2006). In the Brazilian scenario, Medeiros et al. (2005), tested four hypotheses related to asymmetry in cost behavior, which was partially accepted, however, also showed asymmetry in cost behavior.

Calleja et al. (2006) point out that companies that have a property structure comprising fixed assets could expect a high level of cost asymmetry. The results suggest that the asymmetric behavior of costs occurs when the revenue presents small decreases. In addition, costs tend to be less asymmetric when cost analysis is carried out over long periods of time, and even when firms have higher revenue variances, ie, higher than 10%, because changes in this level require changes in the costs. Banker et al. (2008) provide evidence that cost variations tend to be asymmetric, due to managers' decisions tied to their optimism. Weiss (2010) identified that asymmetric behavior of costs influences the priorities of analysts and investors because they use this information to observe the value of the company.

The results of the research developed by Chen et al. (2012) suggest that, in addition to economic factors, the agency (corporate governance) factors also motivate managers' decisions to adjust costs and, thus, help explain the cost behavior. The findings of Caylor and Lopez (2013) revealed that the normal behavior of costs occurs from a decrease of sales and expenses since the expenses did not diminish as much as the decrease in the sales.

For Richartz and Borgert (2014), when performed a general analysis with all companies, the theory of sticky costs was partially applicable, seen that for levels of variation of revenues of up to 10% there was an asymmetry in costs. The evidence found by Balakrishnan et al. (2014) allowed us to conclude that the data observed in the short term tend to present asymmetry in costs. On the other hand, when observed the behavior of costs over longer periods, the asymmetry presented a reduction.

Medeiros and Costa (2004) present evidence on cost rigidity by analyzing a sample of 198 Brazilian companies in the period 1986-2003. Its results demonstrate that the behavior of costs increases 0.59% for a 1% increase in sales and decreases 0.32% for a 1% reduction in sales. He et al. (2010) examine the cost behavior for a sample of 1,802 Japanese companies in the period 1975-2000 and find evidence of cost rigidity in Japan. Their results indicate that the cost behavior is persistent and increases by 0.59%, but decreases by 0.45% for a corresponding 1% change in sales.

Marques et al. (2014) suggest that the behavior of costs is asymmetrical in relation to the increase in sales revenue. However, asymmetry declined when considered for more than one year. The research by Banker et al. (2014), indicates that managers are more likely to increase production capacity when, in the two previous periods (or more), increases in demand occur, that is, the occurrence of asymmetry in costs. Thus, they are also more likely to decrease resource allocation if, in two periods (or more), revenue decreases, and thus there is the asymmetric behavior of costs (Banker et al., 2014). In this sense, when the cost behavior analysis is performed year-on-year, cost variations tend to be asymmetric.

The research carried out by Pamplona et al. (2016) revealed that the behavior of costs in the largest publicly traded companies in Brazil, Chile and Mexico are asymmetric, since the increase in costs through the increase in sales revenue is higher when compared to the reduction in costs due to of a proportional reduction in revenue. From these results, the total costs of Brazilian companies are less rigid since they presented asymmetric behavior. Finally, Subramaniam and Weidenmier (2003) point out that the behavior of costs can differentiate between companies since each presents different characteristics and characteristics.

To do so, in the face of the evidence found in the literature of an asymmetric behavior of costs, the first hypothesis of the research was elaborated:

H_1: *The behavior of costs of Brazilian companies is asymmetric and the increase in costs through the increase in net sales revenue is higher when compared to the reduction of costs due to a proportional reduction in net sales revenue.*

2.2 Financial Restriction and Costing Behavior

The financial constraints present a macroeconomic dimension since the fluctuations in

the companies' cash flow and liquidity are correlated with the movements of the economy throughout the business cycle (Oliveira, 2019). A company is financially constrained if the cost or availability of external funds prevents it from making an investment it would have chosen to make when internal resources were available (Kaplan & Zingales, 1997), and also when it does not have sufficient resources to make investments (Korajczyk & Levy, 2003). For Paulson and Townsen (2004) the financial constraint will make supply and demand for credit related to the characteristics of the borrower, the lender and the financial market. In the absence of financial constraints, entrepreneurs would be able to compensate for the shortfall between their own funds and the maximum level of investment profitability through loans (Aldrich & Bisnis, 2010).

Danielson and Scott (2004) provide evidence that companies facing financial constraints are dependent on the use of credit to finance their operations. Thus, financial constraints have a significant impact on business activity (Paulson & Townsend, 2004). If a company faces financial constraints, its access to credit markets is more limited and its funds are more expensive. To the extent that increased debt reduces shareholder returns, the capital of financially constrained firms should be less valued (Kieschnick et al., 2013). In this way, a company needs to manage its internal costs when it is in financial restriction.

Evidence in the literature suggests that companies with financial restrictions use the internal resources to maintain their activities, and this is a reality observed other contexts, such as the United States (Whited & Wu, 2006), United Kingdom (Bond et al., 2003), Germany (Audretsch & Elston, 2002), Czech Republic (Lyz & Svejnar, 2002) and Pakistan (Riaz et al., 2016). Almeida et al. (2004) argue that firms with constraints tend to accumulate the largest values in resource accounts for use in upgrade processes.

The costs are asymmetrical if they increase more when the activity rises than they decrease in the same proportion of activity to an equivalent amount (Balakrishnan et al., 2014; Banker et al. 2013; Weiss, 2010; Medeiros et al., 2005; Subramaniam & Weidenmier, 2003; Noreen & Soderstrom, 1997). According to Subramaniam and Weidenmier (2003), selling, general and administrative expenses do not present an asymmetric behavior of costs for small variations in revenue, which means linearity of costs in relation to revenue.

Balakrishnan et al. (2014) emphasize that the idle capacity of companies can influence the behavior of costs. Calleja et al. (2006) found evidence that companies with higher levels of debt in their balance sheets, on average, do not present asymmetric costs. This fact can be explained as these companies need to meet the interest payments, and may be subject to greater oversight by creditors, making the managers guarantee a flexible cost structure, which is sensitive to changes in their terms of negotiation. Musso and Schiavo (2008) argue that the existence of financial constraints occurs due to the occurrence of any asymmetric information in costs, that is, the financial constraints are related to the asymmetric cost behavior.

The evidence found in the Brazilian context (Crisóstomo et al., 2014, Bassetto & Kalatzis, 2011) on financial constraints support the hypothesis that Brazilian companies facing financial constraints seek to adjust costs in the face of changes in revenues. Market imperfections affect firms' investment policy, so firms face financial constraints on investment (Riaz et al., 2016). Consequently, the financial situation is expected to affect the adaptation of cost behavior in Brazilian companies.

For Ibrahim and Ezat (2017) the deliberate decision and the managers' hesitation to reduce insufficient resources are the main reasons for the stick costs. Some managers are hesitant to cut resources when demand decreases, which implies that companies bear the costs of unused resources that they are not supposed to bear. In this sense, Venieris et al. (2015) highlight that during a decline in sales, managers' increase the slack of resources held by companies, which significantly affects the behavior of costs.

The economic theory of cost stickiness implies that cost stickiness arises from managerial optimal resource allocation decision rules (Chen et al., 2013). Ro et al. (2015) demonstrate that companies with financial constraints have low financial development, which causes the company to enter a crisis. Thus, company managers in financial constraints are subject to making decisions about allocating costs so that the company's performance.

The financial constraint corresponds to

companies with financial problems which reflects in higher costs, the economic theory of fixed costs predicts that companies with financial problems present greater rigidity in costs (that is, a greater degree of asymmetry in the responses of costs to increases versus decreases in sales). Thus, we formulate the following hypothesis on financial constraints and behavior of costs of Brazilian companies:

H₂: *Companies listed on B3 with financial constraints adapt the asymmetry in cost behavior.*

3 Method and Research Procedures

In order to investigate whether the companies listed in B3 financially constrained adjust the cost behavior, descriptive, documentary and quantitative research were carried out. The research is documentary because the data source originated from the financial statements released by companies listed on B3. Thus, even though the data source was due to the specific information derived from economatica, it stopped with such information through the financial statements released by the companies during the study period.

The study population comprised the companies listed in B3 (Brazil). It is noteworthy that in the definition of the sample, companies in the financial sector were excluded in order not to distort the results due to the economic and operational characteristics that differ from other companies. Holdings and holding companies were also excluded because we will not have the same cut in costs due to a decline in sales revenues. These companies receive financial transfers depending on the economic group and their costs are linked only to the financial management of the business and, for this reason, cost cuts end up being less impacted. Companies with incomplete information on sales revenues, expenses, costs and the calculation of the financial constraint were also excluded from the sample.

In the end, companies with negative cash flow were excluded due to the financial constraint model. In this sense, the sample was composed of 834 observations between the period of 2006 and 2015. The model of asymmetric cost behavior is greatly affected by the institutional environment and, therefore, the choice of the studied period occurred due to the moment of economic and political stability. experienced by Brazil. Table 1 shows the variables used in the research.

Table 1. Variables used in the research

Variable		Definition	Collect	Authors
Cost behavior	Total Costs	Cost of Goods Sold (CGS) + Sales, General and Administrative Expenses	Economática®	Subramaniam & Weidenmier (2003); Balakrishnan et al. (2014); Medeiros et al. (2005); Calleja et al. (2006); Anderson et al. (2007); Weiss (2010); Chen et al. (2012); Banker et al. (2013); Caylor & Lopes (2013); Banker et al. (2014); Richartz & Borgert (2014); Richartz et al. (2014); Marques et al. (2014).
	Liquid revenue of sales	Gross Revenue - Sales taxes, returns, trade discounts and rebates.		Subramaniam & Weidenmier (2003); Balakrishnan et al. (2014); Medeiros et al. (2005); Calleja et al. (2006); Anderson et al. (2007); Weiss (2010); Chen et al. (2012); Banker et al. (2013); Caylor & Lopes (2013); Banker et al. (2014); Richartz & Borgert (2014); Richartz et al. (2014); Marques et al. (2014).

Source: Research data.

It is noteworthy that the data source came from the economatica software. In order to define whether the companies have financial restrictions, three criteria were used according to the study of Demonier et al. (2015): balance of cash and cash equivalents, investments in fixed assets and dividends distribution. For the classification of financially constrained companies, the criteria presented in Table 2 were followed.

Table 2. Criteria for identifying companies with financial restrictions

Criterion		Description	Grounding
Financial Restrictions	Positive change in the availability balance	(Cash and cash equivalents + short - term investment)$_{it}$ - (Cash and cash equivalents +	According to Almeida et al. (2004), companies that demonstrate a high degree of financial constraints tend to keep higher amounts in cash, to

		short-term investment)$_{it-1}$	use in unforeseen cases and thus not to take external resources, since it would be more expensive.
	Negative or zero variation of investment in fixed assets	(Fixed Assets + Depreciation)$_{it}$ - (Fixed Assets + Depreciation)$_{it - 1}$	For Cleary (1999), the company that presents financial constraint seeks not to make investments with its own resources, so that in case it needs, it will not be forced to bear high capital costs.
	Negative or nil variation of dividend distribution	((Distribution of dividends + IE)$_{it}$/LL$_{it}$)- ((dividend distribution + JSCP)$_{it-1}$/LLit-1)	Fazzari et al. (1988) point out that companies with financial constraints tend to maintain a higher profit value in order to cover possible contingencies because they present the cost of equity less than the cost of external capital.

Note: IE = Interest on Equity; LL = Net Income.
Source: Adapted from Demonier et al. (2015).

According to Table 2, companies with financial constraints show positive variations in the availability balance (Almeida et al., 2004; Demonier et al., 2015), negative or zero investment changes in fixed assets (Cleary, 1999; Demonier et al., 2015) and negative or null variations in the distribution of dividends (Fazzari et al., 1988; Demonier et al., 2015).

For the analysis of the data, descriptive statistics were initially performed and the results are then presented through the application of multiple linear regression, with the aid of SPSS® statistical software. To detect the effects of financial constraints, a dummy variable was developed, which assumed the value of 1 for companies with financial restrictions (according to the criteria shown in Table 2) and 0 for companies classified without financial restrictions.

Regarding the behavior of costs, the empirical model of analysis that verifies the reaction of costs through the variation of sales revenue is shown as follows:

$$\log\left[\frac{\text{Total Costs i,t}}{\text{Total Costs i,t}-1}\right] = \beta_0 + \beta_1 log\left[\frac{\text{Revenue i,t}}{\text{Revenue i,t}-1}\right] + \varepsilon_{i,t}$$

Equation (1)

Subsequently, to analyze the relationship of companies with financial constraints and cost behavior, the following analysis model was used:

$$\log\left[\frac{\text{Total Costs i,t}}{\text{Total Costs i,t}-1}\right] = \beta_0 + \beta_1 log\left[\frac{\text{Revenue i,t}}{\text{Revenue i,t}-1}\right] + \beta_2 Financial\ Restriction + \varepsilon$$

Equation (2)

For the analysis of cost behavior, there are two main variables: net sales revenue and total costs. The total costs are the sum of the Cost of Goods Sold (CGS) and the selling, general and administrative expenses (SG&A). The model is adapted from the studies of Anderson et al. (2003), Subramaniam & Weidenmier (2003) and Richartz et al. (2014).

Regarding the models, the equations presented consider the change in the index for the dependent variable "total costs" and the independent variable "net sales revenue", considering as the numerator of period t and denominator t-1. Thus, it is possible to verify the positive and negative changes in revenue in period t in relation to period t-1. The asymmetric cost variation should demonstrate β1 increase > β1 reduction. The analysis of the results is presented below.

It is said that the assumptions of multiple linear regression were met, and the data showed normality by the Kolmogorov-Smirnov test, in which all variables had a significance greater than 0.05. In addition, normality would be previously met by the number of observations contained in the model, in which the central limit theorem indicates acceptance of normality in models with more than 100 observations. Multicollinearity was also achieved because the models presented a VIF statistic of a maximum of 1.40. The autocorrelation of residues will be achieved by the durbin-watson test approaching 2.00 in all models. Finally, homoscedasticity was met by the pesarán-pesarán test in which the models showed an equal dispersion in the residues.

4 Presentation and Analysis of Results

This session presents the description and analysis of the results. The results of the analysis of the behavior of the costs and inclusion of the financial constraint of the companies in the model, with the purpose of identifying the impact of the financial constraint on the behavior of the costs, are evidenced. Table 3 shows the descriptive statistics of the variables used in the study.

Table 3. Descriptive statistics of variables

Variable	Companies	Obs.	Mean	SD	Median	Maximum	Minimum
Cost	Restricted	66	0.0451	0.2539	0.0544	0.7579	-0.8267
	Unrestricted	765	0.1032	0.2197	0.0936	1.1257	-0.7360
Revenue	Restricted	66	0.0336	0.2378	0.0527	0.5777	-0.9933
	Unrestricted	765	0.0964	0.2356	0.0918	1.1521	-1.0554

Note: Obs: observation; SD: Standard Deviation.
Source: Research data.

In Table 3, comparing companies with financial restrictions and companies without financial restrictions, it is possible to verify that the cost and the average income of companies with financial restrictions were lower than the values presented by companies without financial restrictions. This result may be an indication that the less profitable companies deal with greater financial constraints due to the lack of perspective that the market can have on this, that is, the market prices the financial difficulties (Demonier et al., 2015).

Table 4 shows the asymmetric behavior of costs together with the financial constraint variable.

Table 4. Asymmetric behavior of costs in the increase and decrease of the Revenue

Panel A - Sample with increase in Sales Revenue		
Explanatory Variables	**Dependent Variable**	
	Model 1 CTC Coef./Sig.	**Model 2 CTC Coef./Sig.**
(Constant)	0.025*	0.172*
Inc.Rev.	0.815*	
Inc.Rev.* Restriction.		0.397*
Sig. Model	0.000*	0.000*
Durbin-Watson	1.927	1.970
R squared	0.622	0.012
N. of observations	601	601
Panel B - Sample with decrease in Sales Revenue		
Explanatory Variables	**Dependent Variable**	
	CTC Coef./Sig.	**CTC Coef./Sig.**
(Constant)	0.019*	-0.088*
Dec.Rev.	0.805*	
Dec.Rev.* Restriction.		0.803*
Sig. Model	0.000*	0.000*
Durbin-Watson	1.968	1.875
R squared	0.659	0.234
N. of observation	233	233

* Significance at the level of 5%.
CTC - change in total costs; Inc. Rev. - increase in sales revenue; Inc. Rev.* Restriction - increase in sales revenue moderated by the dummy of financially constrained companies; Dec. Rev. - decrease in sales revenue; Dec. Rev. * Restriction - decrease in sales revenue moderated by the dummy of financially constrained companies.
Source: Research data.

The Panel A of Table 4 demonstrates the results of three multiple linear regression models, the first one related to the asymmetric behavior of costs according to the increase/decrease in sales revenue. In addition, the second model shows the behavior of costs explained by the increase/decrease in sales revenue with variable financial restriction effect. Finally, the third model complements the analysis of the effect of variable financial restriction on the association between cost behavior and variation (increase/decrease) in sales revenue.

The results indicate, from model 1, that for every 1% increase in sales revenue the total cost tends to increase by 0.815% and, on the other hand, with every 1% decrease in sales revenue the total cost reduces by 0.805 %. In general, it can be inferred that there is asymmetry in the behavior of costs since the increase in revenue is reflected in a dramatic increase in costs and, on the other hand, the companies are able to adapt in costs by reducing it when the decrease in revenue of sales. In addition, it is noted that in general, in the companies analyzed the costs are considered less rigid.

From this result we can accept the H_1 study, hypothesis of the study since we found asymmetry in the cost behavior. The findings of this study converge with the results of previous studies carried out from this theoretical perspective. Thus corroborating with the sticky costs theory and the research developed by Anderson et al. (2003; 2007), Subramaniam and Weidenmier (2003),

Medeiros et al. (2005), Calleja et al. (2006), He et al. (2010), Porporato and Werbin (2012), Caylor and Lopez (2013), Marques et al. (2014), Balakrishnan et al. (2014), Banker et al. (2014), Ibrahim (2015) and Pamplona et al. (2016).

This fact can be explained by the arguments of Balakrishnan et al. (2014) because they point out that certain companies that perform at maximum capacity at a given moment are impacted by the volume of activities. In companies with idle capacity that can use this gap to meet the needs of increased demand do not require investments.

However, in the analysis of model 2 that reflects the effect of the financial constraint on the relationship between increase/decrease in sales revenue and cost behavior. The findings indicated that for every 1% increase in sales revenue, associated with financially constrained companies, the total cost increased by 0.397%. At the time of the decrease in sales revenue by 1%, the total cost also has a reduction of 0.803%. These results reveal that when the variable of companies with financial constraints was included, the asymmetric behavior of costs presented symmetry, that is, companies with financial constraints aim to adapt the behavior of costs in the face of reductions in revenues, which allows us to accept the hypothesis H_2.

In view of these results, it can be concluded that financially constrained companies show an improvement in cost adaptation due to the increase and/or reduction in revenues, where the increase in revenue makes companies more efficient in the face of low-cost growth. On the other hand, when there is a reduction in revenues, companies with financial constraints can adapt costs almost to the same extent as companies without financial constraints. It is suggested that financially constrained companies take care of costs when there is an increase in revenues, a factor that can be explained by the need to increase cash for future investments and to honor their commitments. These findings confirm the arguments of Crisóstomo et al. (2014) because the authors consider that the companies considered a priori more prone to face financial constraints suffer more strongly the effects of market imperfections, being an exit to these companies the adjustment of the costs, as evidenced in this research.

Table 5 shows the summary of the existence of asymmetric cost behavior by comparing coefficients of variation of increase and decrease of revenue.

Table 5. Asymmetric cost behavior

Model 1	Model 2
No effect of Financial Restriction	**With effect of Financial Restriction**
Revenue increases by 1% and total cost increases by 0.815%	Revenue associated with Financial Restriction increases by 1% and cost increases by 0.397%.
Revenue decreases by 1% and total cost decreases by 0.805%	Revenue associated with Financial Restriction decreases by 1% and cost decreases by 0.803%.
Asymmetry 0.01%	**Symmetry -0.406%**

Source: Research data.

According to the results of Table 5, it can be seen that in the model that does not consider the effect of the financial constraint, the evidence shows that the behavior of costs is asymmetrical at 0.01%, that is, companies can adapt their costs of compatible with the increase or decrease in sales revenues. On the other hand, with the effect of the financial constraint, the findings suggest a symmetrical behavior of costs (-0.406%). This result indicates that financially constrained firms adapt costs more adequately to the increase and reduction of revenues when compared to companies that are not financially constrained.

Next, the research sample was separated into two clusters, the first being composed of companies that did not contain financial constraints and the second by companies with financial constraints.

In this sense, Table 6 shows the behavior of costs by the segregation of the sample of increase of sales revenue in companies with and without financial restriction.

Table 6. Asymmetry of costs in the clusters of the financial constraint due to the increase in sales revenue

Explanatory Variables	**Cluster 1 No Financial Restriction**	**Cluster 2 With Financial Restriction**	**Adjustment of Costs as a result of the increase in revenue**
	CTC	**CTC**	**Cluster 1 – Cluster 2**
(Constant)	0.026*	-0.003	
Inc.Rev.	0.806*	1.079*	-0.273
Sig. Model	0.000*	0.000*	
Durbin-Watson	1.947	2.123	
R squared	0.619	0.717	
N. of	557	44	

observation			

Source: Research data.

In the group of companies with financial constraints, the findings determine that with each 1% increase in sales the total cost increases by 1.079%, however, among the group of companies without financial restriction, it is concluded that every 1% increase in sales revenue the total cost increases by 0.806%. It can be concluded that the group of companies without financial constraints shows an improvement in the adjustment of costs in view of the increase in revenues. The result can be explained by the need for larger investments by financially constrained companies when they grow their sales.

This result can be explained by the view of Crisóstomo et al. (2014) because the authors emphasize that capital market imperfections affect the investment of companies in Brazil and these effects are even stronger for financially restricted companies. Thus, according to Riaz et al. (2016), managers are motivated to increase the resources under their control because of a direct link between compensation and sales growth.

Table 7 shows the asymmetric behavior of costs by segregation of the sample of a decrease in sales revenue in companies with and without financial restriction.

Table 7. Asymmetry of costs in the clusters of the financial constraint by the decrease in sales revenue

Explanatory Variables	**Cluster 1 No Financial Restriction**	**Cluster 2 With Financial Restriction**	**Adjustment of Costs due to Decrease in Revenues**
	CTC	**CTC**	**Cluster 1 – Cluster 2**
(Constant)	0.014	0.020	
Dec.Rev.	0.735*	1.006*	-0.271
Sig. Model	0.000*	0.000*	
Durbin-Watson	1.787	1.902	
R squared	0.594	0.870	
N. of observation	208	25	

Source: Research data.

The results in Table 7 show that with every 1% decrease in sales revenue the cost reduces by 0.735%, which reveals that the costs are quite asymmetrical among the group of companies without financial restriction. On the other hand, in the group of companies with financial constraints, the findings indicate that with every 1% decrease in sales revenue the cost reduces by 1.006%. This result suggests that financially constrained firms tend to improve costs adaptation, ie they can reduce costs by a greater proportion than the drop in sales revenues itself. The findings of the Brazilian studies on the subject of financial constraints (Crisóstomo et al., 2014; Bassetto & Kalatzis, 2011) support these results found in this research.

Finally, Table 8 shows the summary of the asymmetric cost behavior by the effect of the samples segregated by the financial constraint clusters.

Table 8. Summary of asymmetric cost behavior by the effect of samples segregated by financial constraint clusters

Cluster 1 – without financial restriction	**Cluster 2 – with financial constraint**
Revenue increases by 1% and total cost increases by 0.806%	Revenue increases by 1% and total cost increases by 1.079%
Revenue decreases by 1% and total cost decreases by 0.735%	Revenue decreases by 1% and total cost decreases by 1.006%
Asymmetry 0.071%	**Asymmetry 0.073%**

Source: Research data.

It is verified by grouping the asymmetric behavior of costs in function of the increase and decrease of revenues, that this was close between the companies without and with financial restriction. In spite of this, it should be noted that the best cost adjustment occurred in companies with a financial constraint due to the decrease in revenue, where costs can achieve an excellent adaptation. This finding was also found by Musso and Schiavo (2008) because the findings of this research revealed that the existence of financial constraints occurs due to the existence of asymmetric information in costs, that is, companies with financial constraints present adaptation in the asymmetric behavior of costs.

This finding reveals that the view of the traditional model of cost behavior does not really reflect the reality of Brazilian companies with and without financial constraints, since in this model it is assumed that costs change proportionally through changes in activity volume, regardless of whether these changes occur due to a reduction or increase in activity level. Moreover, this result contradicts the arguments of Calleja et al. (2006), since they consider that costs tend to be less asymmetric during long time horizons and when

companies have higher revenues. However, in this study 10 years were analyzed and in this period both companies with and without financial restrictions presented costs with asymmetric behavior.

In view of these results, it is pointed out that Brazilian companies offer a fertile field of study on financial constraints, since the findings of this research, the difficulty of obtaining capital at affordable interest rates by financial institutions and, on the other hand, which in a way reduces the characteristic of investment in the capital market by these companies. According to Crisóstomo et al. (2014), Brazil still has characteristics that generate higher external financing costs, since capital markets are still much less developed compared to the more advanced economies. Thus, cost adaptation becomes relevant in a financially constrained environment, where firms may choose to make more severe cuts in the face of reduced sales revenues because they are already in financial distress. On the other hand, in economic resumption, these companies may lose out because of the low investment capacity for growth at times of economic recovery.

Thus, although the changes achieved in Brazil represent advances in the capital market and economic stabilization, the low degree of shareholder and creditor protection, as well as high interest rates, may limit the access of Brazilian companies to external resources (Crisóstomo et al., 2014), which causes companies to adapt the behavior of costs, in view of the fluctuations in revenues. The evidence on financial constraints in Brazil (Crisóstomo et al., 2014; Bassetto & Kalatzis, 2011) and those found in the present study make it possible to support the H_2 hypothesis of the study. That Brazilian companies facing financial constraints seek to adjust costs in the face of changes in revenues, since market imperfections affect the investment policy of companies, so that companies face financial constraints (Riaz et al., 2016).

In addition, the institutional structure and capital market developments were not sufficient to reduce the high-interest rates in Brazil compared to European, North American or even undeveloped countries (Marques & Fochezatto, 2007). To get an idea, Marques and Fochezatto (2007) survey present data on interest rates for the year 2005 in different underdeveloped countries. Brazil has the highest interest rates (19.24%), followed by Russia and Venezuela, with 13 and 12.7%, respectively. The other countries analyzed showed interest rates below 8%, reaching a minimum of 2.2% in China. Despite the fact that the data are from the year 2005, it is pointed out that up to now Brazil faces high-interest rates that often prevent companies from developing, and thus, these have financial restrictions, which also end up harming the behavior of costs, since companies need to adapt to them in order to continue competing in the market.

In general, these assertions could be verified in this research, since the results confirmed in all the models analyzed, for example, that companies with greater financial constraint consequently lead to a better alignment in the behavior of costs. Therefore, companies with lower availability of resources tend to make better adaptations of costs in response to changes in sales revenue.

Given the above results, it can be inferred that, given the importance of corporate investment for economic growth, at the political level, new institutional conditions should be created to improve the role of financial markets in financing business investment (Crisóstomo et al., 2014). Finally, the discussions and final considerations of the study are presented.

5 Discussion and Final Considerations

This research investigated the impact of financial constraint on asymmetric cost behavior in companies listed on B3 (Brazil), from a sample composed of 834 observations. Regarding the behavior of the costs, the findings revealed for the analyzed sample, that the costs presented asymmetric behavior in general since the increase of the total costs by the 1% increment in the revenue was superior when compared to the reduction of the total costs through a decrease of 1% of revenue. This result indicates that the behavior of the costs of the companies, in general is asymmetric and the increase of the costs through the increase of the revenue is superior when compared to the reduction of the costs due to a proportional decrease of the revenue.

In turn, the results indicated that companies with financial restrictions showed signs of adaptation in the behavior of costs since the results indicated symmetry when compared with companies without the effect of financial restriction. In this case, there are indications that companies in conditions of financial constraints

avoid increasing costs when sales revenue decreases, which allows a symmetry in the behavior of costs when the situation of resource constraints to the progress of activities. This practice can be motivated in the companies because of these aiming at a commitment with the interested parties when a decrease in the financial conditions of the companies, that is, when they are going through financial difficulties.

On the other hand, when segregating samples in companies with and without financial restrictions due to the increase and decrease in revenues, the results indicated an asymmetry in the behavior of costs for both groups. However, the best adaptation of costs occurred in companies with financial constraints from the analysis of the decrease in revenue, since the costs managed to achieve an excellent adaptation to this scenario when compared to companies without financial constraint. It is indicated by this result that companies with financial constraints can obtain a better adaptation in the behavior of costs when there is a decrease in sales revenue. In view of this result, it can be seen that Brazilian companies with and without financial constraint are supported by the theory of sticky cost since asymmetry was observed in the behavior of costs in the analyzed companies.

Moreover, this research suggests that the asymmetric adaptation in cost behavior in financially constrained firms is related to the fact that, if managers increased costs in the face of the sign of a bad financial condition for the market could reduce a reduction in sales revenue, access to credit as well as resources. Thus, this adjustment of costs in the face of a fall in revenues encourages these companies to reduce their total costs, in order to retain more cash for the development of their activities, even with the occurrence of financial restrictions.

In addition, another explanation for the adjustment of the total costs of financially constrained companies is that the reduction of cash/funds contributes to the increase of uncertainties about the return of capital lent by creditors, suppliers, and investors once that the profits are compromised, which would contribute to the increase of financial restrictions in subsequent periods. In this way, cost adjustment is a way out for companies that are experiencing financial constraints when there is a decrease in sales revenue.

Thus, the results found in this research confirm the hypothesis that companies with financial restrictions adapt the behavior of costs to financial reality since they can make cuts in expenses, both sales, general and administrative, in the face of a reduction in revenue of sales. In other words, companies with greater financial constraints lead to better alignment of costs, thus, companies with lower availability of resources tend to make better cost adjustments when changes in revenue occur. This behavior of companies can occur so that creditors, investors, and shareholders are not harmed by the company's situation.

In practical terms, companies with financial restrictions are characterized by the presence of low financial slack, which may explain the greater efficiency in adapting costs. It is likely that these companies are more active in the search for the protection of their resources, which are already scarce, in order to maintain competitiveness in future contingencies. In this sense, creditors and regulators to support new financing policies and to monitor corporate risks through financial statements (Demonier et al., 2015) can use this evidence.

In addition, companies facing financial constraints have limited access to credit markets and a high cost of capital (Kieschnick et al., 2013), which are factors that can explain the better adaptation of the cost cut in the face of a reduction in revenue. Thus, it is concluded that the financial slack (of companies without resource restriction) causes inertia in adapting the costs necessary to face unfavorable environments for companies.

In theoretical terms, it is proven that costs are less rigid in environments where the decision to use financial resources is not deliberate (Chen et al., 2013), a fact that occurs with companies with financial restrictions. The results corroborate Campello et al. (2010) and Crisóstomo et al. (2014), who state that there are deeper cuts in spending on companies with financial constraints due to the difficulty that they already face to normally manage their operations.

The results are useful in providing evidence that companies located in a developing country are able to better adapt their costs in the event of lost revenue. And this may be due to the difficulty of companies to raise funds from third parties at a low cost of capital, making financial constraint an intensifying factor in cutting costs. It is noteworthy that in developed countries companies are able to

raise funds in greater volume through the stock market and, with this, financial constraint would not become such a worrying factor to make drastic cuts in the moment that a strong loss of revenue occurs. These findings confirm the evidence of financial restrictions being present in companies with environments that have difficulty obtaining financial resources and with imperfect capital markets, which occurs in Brazil (Paulson & Townsend, 2004; Ro et al., 2017).

Finally, the results of this research contribute to accounting users, such as investors, creditors, government and suppliers, among others, by showing the possibility of identifying signs of financial constraints of a company from the analysis of its financial statements, and that these companies with financial. That way, constraints aim at adapting the asymmetry in cost behavior in the face of a reduction in sales revenue in order to improve the company's financial situation.

The limitation of this study is the methodology used to identify companies with financial constraints, since another way of identifying these companies may present different results. It is recommended, for future work, that the research sample is enlarged or modified since a new sample will allow the use of this study for the purpose of comparability of the results. In addition, it is suggested for future work the separate analysis of the total costs in view of an increase/decrease in sales revenue and the impacts of the financial constraint in this segregated analysis, since the total costs were analyzed together with the proposed theme.

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