RCC Revista Contemporânea de Contabilidade

Asymmetric cost behavior in competitor analysis: study through public information

Comportamento assimétrico de custos na análise de concorrentes: estudo por meio de informações públicas

Comportamiento asimétrico de costos en el análisis de la competencia: estudio a través de la información pública

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Abstract
The study aimed to identify how information about the asymmetric behavior of costs can be used to analyze the costs of competitors in the apparel segment. Anderson, Banker and Janakiraman (2003) model was used to identify the cost behavior of the five companies analyzed in the period from 2010 to 2019 and, later, a regression model with panel data was carried out to investigate the influence of the asymmetric behavior of costs on the performance of companies. The results showed that companies with asymmetric behavior (anti-sticky) presented a lower performance (measured by gross margin and EBITDA) in relation to those with symmetrical behavior of costs, even with lower participation of costs and fixed expenses in the cost structure. This result contributes by highlighting the importance of monitoring information on asymmetric behavior of costs in the analysis of competitors' costs, especially in relation to the cost structure, since they can influence the expected result.
Keywords: Competitor Cost Analysis; Asymmetric Cost Behavior; *Sticky/anti-sticky Costs*

Resumo
O estudo teve o objetivo de identificar como as informações sobre o comportamento assimétrico dos custos podem ser usadas para a análise de custos de concorrentes no segmento de vestuário. Foi utilizado o modelo de Anderson, Banker e Janakiraman (2003) para identificação do comportamento de custos das cinco empresas analisadas no período de 2010 a 2019 e, posteriormente, foi realizado um modelo de regressão com dados em painel para investigar a influência do comportamento assimétrico dos custos sobre o desempenho das empresas. Os resultados apontaram que empresas com comportamento assimétrico (*anti-sticky*) apresentaram desempenho (medido pela margem bruta e pelo EBITDA) menor em relação às com comportamento simétrico de custos, mesmo apresentando menor participação de custos e despesas fixas na estrutura de custos. Esse resultado contribui ao evidenciar a importância de que informações sobre comportamento assimétrico dos custos sejam acompanhadas na análise de custos de concorrentes, especialmente em relação à estrutura de custos, visto que podem influenciar o resultado esperado.
Palavras-chave: Análise de Custos de Concorrentes; Comportamento Assimétrico dos Custos; *Sticky/anti-sticky Costs*

Resumen
El estudio tuvo como objetivo identificar cómo la información sobre el comportamiento asimétrico de los costos se puede utilizar para analizar los costos de los competidores en el segmento de prendas de vestir. Se utilizó el modelo de Anderson, Banker y Janakiraman (2003) para identificar el comportamiento de costos de las cinco empresas analizadas en el periodo de 2010 a 2019y, posteriormente, se realizó un modelo de regresión con datos de panel para investigar la influencia del comportamiento asimétrico de los costos en el desempeño de las empresas. Los resultados mostraron que las empresas con comportamiento asimétrico (anti-sticky) presentaron un menor desempeño (medido por margen bruto y EBITDA) en relación a aquellas con comportamiento simétrico de costos, aún con menor participación de costos y gastos fijos en la estructura de costos. Este resultado contribuye a resaltar la importancia de monitorear la información sobre el comportamiento asimétrico de los costos en el análisis de los costos de los competidores, especialmente en relación con la estructura de costos, ya que pueden influir en el resultado esperado.
Palabras-clave: Análisis de Costos de la Competencia; Comportamiento de Costos Asimétricos; *Sticky/anti-sticky Costs*

1 Introduction

Competitor cost analysis is one of the artifacts of Strategic Cost Management which, according to Heinen and Hoffjan (2005), may be defined as the analysis of accounting information related to competitors. Given that, some research in the area of competitor cost analysis has explored the use of publicly available information, particularly in published financial statements, such as the studies by Brock (1984), Jones (1988), Moon and Bates (1993), Hesford (2008), Casella (2008), Benjamin, Souza, and Costa (2015), and Baiochi, Severgnini, Batista, Abbas, and Marques (2019).

In 1988, Jones compared Caterpillar's structure to its competitors via public information, obtaining a 20% reduction in company costs and expenses (Jones, 1988). Considering the relevance of competitor monitoring, Moon and Bates (1993) proposed a conceptual framework for evaluating financial reports called CORE (Context, Overview, Ratios, Evaluation) and exemplified its use by evaluating the reports of a large North American supermarket chain from the perspective of its main competitor. Similarly to Moon and Bates (1993), Hesford (2008) also considered the importance of competitor monitoring when investigating competitive intelligence personnel in industries.

With a practical approach advocated by Brock (1984), Casella (2008), and Benjamin et al. (2015) had similar objectives. They explored the possibility of estimating the cost structure of companies that operate in the paper and pulp segment (Casella, 2008), food and beverage, and vehicles and parts (Benjamin et al., 2015). Among the results found by these researches, it stands out the possibility of using statistical techniques to estimate the companies' cost structure based on publicly available information in the case of publicly traded companies.

The study of Baiochi et al. (2019) expanded the literature in the area by exploring the main predictors of the Cost of Goods Sold (COGS) through the analysis of competitors' costs, also used by Casella (2008) and verified the influence of capital structure and fixed assets on COGS in companies of the sugar and alcohol sector. Both the study of Baiochi et al. (2019) and that of Casella (2008) found the possibility of analyzing the cost structure of companies through financial and accounting statements and that this information can be used for the cost analysis of competitors.

However, cost structure analysis alone may not reveal information that can influence results/returns, such as asymmetric cost behavior (sticky/anty-sticky cost). To understand the sticky cost, it is necessary to compare it with the traditional understanding of cost behavior. In traditional accounting models, costs change in proportion to the volume of activities. This view assumes a symmetrical change in costs in relation to changes in the volume of activities, regardless of whether there is an increase or decrease in the quantity produced (Benston, 1966; Anderson, Banker, & Janakiraman, 2003).

Contesting the traditional view, the seminal work of Anderson et al. (2003) presented empirical evidence that the behavior of costs, called sticky costs, can be asymmetric, increasing in a more significant proportion when activity rises than decreasing when activity decreases by an equivalent proportion. Alternatively, the adjustment in cost in response to a decrease in the level of activity would exceed the response to an equivalent increase in the level of activity, being called anti-sticky (Weiss, 2010).

The asymmetric behavior of costs, which, according to Malik (2012), has been proven by several studies, such as those by Anderson et al. (2003), Weidenmier and Subramaniam (2003), Calleja, Steliaros and Thomas (2006), Balakrishnan and Gruca (2008), Banker, Byzalov, and Plehn-Dujowich (2014), Fazoli, Reis and Borgert (2018), affects firms' returns, as it leads to a smaller cost adjustment when the activity level decreases, which consequently generates lower cost savings and a greater reduction in profits (Weiss, 2010; Warganegara & Tamara, 2014; Chung, Hur, & Liu, 2019). Weiss (2010) found that asymmetric cost behavior influences market analysts' profit forecasts and that investors appear to consider this behavior when forming their beliefs about the value of firms. Given this, one can observe the importance of this information for both the company itself and its competitors by indicating the efficiency in adjusting costs in times of reduced

demand and the effects on profitability/return, especially in publicly traded companies, by affecting the interest of analysts and investors.

Thus, there is a research gap in ascertaining how asymmetric cost behavior can be used in the cost analysis of competitors. As such, the study aims to identify how information about asymmetric cost behavior can be used to analyze competitors in the apparel segment. In a complementary manner, the study sought to investigate the relationship between asymmetric cost behavior and the investigated companies' performance to strengthen the arguments that these are essential aspects when analyzing the costs of competitors.

Considering that the literature in the area points out that the main difficulty for the practice of competitors' cost analysis in companies is the collection and analysis of competitors' cost information (Brock, 1984; Baiochi et al., 2019), the study contributes to the managerial practice by discussing the possibility of expanding the ways of analyzing competitors' costs, being that, in the case of publicly traded companies, the necessary information is publicly available. The research also contributes to the knowledge about asymmetric cost behavior by addressing a specific segment, the apparel segment, thus having the potential to find specificities of cost behavior and performance in this segment.

For instance, the presence of seasonality in the analyzed segment and an anti-sticky behavior were verified in three companies. One of the results pointed out that companies that presented anti-sticky behavior had a lower average performance compared to companies with symmetrical cost behavior, even though they presented a lower proportion of fixed costs and expenses in their cost structure, which was not expected. Considering the research of Weiss (2010) and Warganegara and Tamara (2014), these results indicate that asymmetric cost behavior negatively impacts firms' performance, regardless of being anti-sticky or sticky. According to the evidence found, one implication of this result is that asymmetric cost behavior may be a moderating variable between cost structure and performance.

Another result found points out which companies exhibit asymmetric/symmetric behavior, which can affect both cost management internally (decision on capacity level and performance) and externally (analysts' forecast of returns and interest in these companies by both analysts and investors (Weiss, 2010)).

2 Theoretical Foundation

2.1 Competitors' cost analysis

For Brock (1984), corporate business strategy can be defined as a set of actions that ensure competitive advantage. Given this context, analyzing competitors' costs has become important for effective strategic management planning. However, still according to the author, the use of this artifact may be challenging to implement, given that the most relevant and necessary data for the analysis are not disclosed, not even by public companies, and these are usually related to products of the sales line, technologies used in production, or operational costs, amongst other internal aspects of the competitor's production process.

According to Heinen and Hoffjan (2005), the term *competitor accounting* was developed in the accounting literature with a competitive focus in the context of strategic management. The analysis of this information can provide a more detailed view of competitors' costs and financial situation, determine the company's competitive position, and predict competitors' strategic competitive behavior. Still, according to the authors, knowledge of competitors' costs helps the company to improve its planning, justifying specific suggestions and the feasibility of cost reduction programs.

According to their objectives, the research developed in the area of competitors' cost analysis can, in general, be classified into two groups: (a) those that verified the use and the perception of the usefulness of the practices of Competitor-Focused Accounting (CFA) in companies, and (b) those that identified possibilities of competitor cost analysis based on public information.

The first group is the research of Guilding (1999), Anderson and Guilding (2006), and Friedrich, Fontoura, Souza, and Wittimann (2016). In his paper, Guilding (1999) attempted to synthesize the CFA practices found in the literature. His study aimed to evaluate CFA adoption rates, assess practitioners' perceptions of the extent to which CFA may be helpful to their firm, and develop and test propositions related to contingent factors that may affect CFA adoption rates and perceptions of its usefulness. During his research, the author developed a list of the most commonly used CFA practices: competitor cost evaluation, competitive position monitoring, competitor evaluation based on financial statements, strategic costing, and strategic pricing. Three contingent factors significantly influenced the use and perceived usefulness of CFA practices: firm size, competitive strategy, and strategic mission.

Furthermore, Anderson and Guilding's (2006) study expanded the literature by exploring the application of competitor analysis from an accounting perspective in a hotel complex, assessing to what extent CFA is formalized. The research results indicated that this activity occurs informally; however, hotels should have a formalized CFA system for decision-making. The study by Friedrich et al. (2016) aimed to identify the knowledge and use of cost analysis practices of competitors in companies of the metal-mechanic sector in Rio Grande do Sul, Brazil. Similarly to the study by Guilding (1999), the most widely used is monitoring the strategic position among the competitor cost analysis practices investigated in the study.

As for the second group, examples of research that sought to identify the possibility of analyzing competitors' costs based on public information include Moon and Bates (1993), Casella (2008), Benjamin et al. (2015), and Baiochi et al. (2019). According to Moon and Bates (1993), strategic managerial accounting plays a vital role in providing information about the primary sources of a firm's competitive advantage, and the external focus of analysis should consider recent financial results published by competitors. The authors also presented a new framework for interpreting and analyzing financial statements in the context of organizations' strategies, the CORE, which comprises four stages: context, overview, ratios, and evaluation. However, according to Costa (2011), the CORE innovation was restricted to proposing a support structure for analysis utilizing financial statements, but not regarding the analysis of competitors' costs.

Casella's (2008) study utilized accounting and financial statements as a tool to analyze competitor costs among four companies in the pulp and paper segment in Brazil. Results indicated that it was possible to understand the structure of labor, fixed assets, depreciation, and the companies' main indexes, also enabling the comparison of the competitors' position in as much as stock turnover, operational cycle, degree of operational leverage, sales and administrative expenses and cost structures of the analyzed companies.

Through the statistical technique of panel data, Benjamin et al. (2015) analyzed the financial information published by companies in food and beverages, vehicles, and parts segments. The authors highlighted that the statistical technique proved to be an important tool for estimating the cost structure as from the analysis of publicly available information, allowing managers, through the results obtained, to make analyses between the cost structure and the organizational performance, being then able to allocate resources more efficiently. Finally, the study by Baiochi et al. (2019) investigated the main predictors of COGS based on the competitor cost analysis technique and verified the influence of capital structure and fixed assets on COGS in companies in the sugar and ethanol sector.

The present research is part of this second group of studies presented and expands the literature in the area by exploring the possibility of using information about asymmetric cost behavior in the cost analysis of competitors. Analyzing asymmetric cost behavior can generate complementary information about the company and its competitors. Along with other information about competitors, such as cost structure and performance indicators, cost behavior can measure flexibility and efficiency in cost adjustment. Research results from Warganegara and Tamara (2014) and Chung et al. (2019) indicated a negative relationship between asymmetric cost behavior and firm performance, suggesting that this may be a relevant variable when analyzing the firm relative to competitors. The following topic summarizes key research findings on asymmetric cost behavior.

2.2 Asymmetric cost behavior

In the traditional accounting model, costs are described as fixed or variable (sometimes as semi-variable) according to their relationship with the volume of production (Benston, 1966; Anderson et al., 2003); that is, costs vary proportionally to the variation in the volume of activities, regardless of the direction of this oscillation (Noreen, 1991). Benston (1966) states that a flaw of this model is the assumption of linearity between costs and production volume. According to the author, however, this linearity may be found, but it should not be assumed a priori.

Considering challenges to the traditional cost behavior model, Anderson et al. (2003) conducted a research where they identified that administrative, general, and sales expenses of North American companies presented an asymmetrical behavior. More specifically, the researchers reported that the proportion of an increase in costs associated with an increase in volume was more significant than the proportion of a decrease in costs associated with an equivalent decrease in volume. The results pointed out that for every 1% increase in revenue, expenses increased, on average, by 0.55%; when revenue decreased by 1%, expenses decreased, on average, by only 0.35%. This behavior was called sticky costs by these authors.

According to Anderson et al. (2003), this asymmetric behavior is related to the fact that when managers go through periods of reduced sales, they choose to wait to obtain more information or evidence that allows them to assess the permanence of the reduction in demand before making decisions to cut costs. The postponement in decision-making leads to a delay in the companies' cost reduction, and thus unused resources are kept during the interval between the reduction in sales and the adjustment decision. Among the factors for this postponed decision-making is the fact that equipment acquisition or labor costs may be higher in periods of macroeconomic growth. Hence, managers choose to keep these resources even if they are not used to their total capacity.

Similar to Anderson et al. (2003), Cannon (2014) assigned asymmetric cost behavior to the manager. In investigating the United States air transportation industry, the author identified three deliberate situations by managers that can give rise to sticky costs. First, managers may maintain idle capacity as demand falls but increase it later when demand picks up again. A second factor is an asymmetric adjustment in selling prices, lowering prices in periods when demand falls to stimulate sales and keeping prices low even after demand picks up again. At last, the third type of asymmetry can occur when managers add more costs by increasing capacity as demand grows than decreasing it as demand for products falls.

Balakrishnan, Petersen, and Soderstrom (2004) identified that, in some cases, the asymmetric behavior of costs could be inverse, presenting a more significant reduction when revenue decreases than an increase when revenue grows in an equivalent proportion. The explanation for this phenomenon is due to the level of capacity utilization. More specifically, the authors explain that if a company has idle capacity, managers are likely to use this slack to absorb increased demand; if there is a demand reduction, the company with excess capacity is more likely to cut costs further. Given this, the adjustment in cost in response to a decrease in activity level would exceed the response to an equivalent increase in activity level. This behavior was termed anti-sticky by Weiss (2010).

Malik (2012) divided the research on sticky costs into three categories. The first group of research studies provided additional evidence on the phenomenon of asymmetric cost behavior in different contexts, replicating the model of Anderson et al. (2003). Examples of research in this group are Medeiros, Costa, and Silva (2005), who, by replicating Anderson's model (2003), investigated and confirmed the existence of sticky costs in Brazilian companies, and Cannon (2014), who investigated the asymmetric behavior of costs in companies in the air transport sector in the United States. Thus, various national and international studies have confirmed the sticky cost phenomenon in companies from various segments, and research in this first category is no longer needed. The first studies, classified by Malik in the first category, proved the phenomenon by concluding that the view that costs vary only with production volume can no longer be considered unique, and the approach of Anderson et al. (2003) and of Noreen and Soderstrom (1994, 1997), who were the first scholars to cite cost asymmetry occurs in companies.

The second group comprises studies that examined determinants of asymmetric cost behavior (Malik, 2012), such as that of Balakrishnan et al. (2004), which investigated the influence of capacity utilization on sticky costs; Grejo, Abbas, Camacho, and Junqueira (2019), who analyzed the influence of fixed assets on asymmetric cost behavior, concluding a more significant asymmetry in firms that have higher representativeness of fixed assets and, therefore, more representative is fixed cost relative to variable cost; finally, Richartz, Borgert, and Lunkes (2014) investigated the relationship between spending on labor and fixed costs with the level of cost asymmetry in Brazilian companies.

Still, in the second group, Reis and Borgert (2019) presented 50 international studies that identified determinants of asymmetric cost behavior, such as macroeconomic environment, managers' deliberate decision delay, cost structure, free cash flow, the intensity of assets and liabilities, magnitude of revenue variations, managers' optimism and pessimism, agency problems, market regulation, and company size. Therefore, also in this category, advances can be seen in the studies. However, according to these authors, since these studies occurred in different contexts and were tested individually, the authors investigated the interaction of factors that jointly explain the asymmetric behavior of costs.

Malik's (2012) third category includes research that investigated the consequences of sticky costs on, for example, forecasting results (Banker & Chen, 2006; Weiss, 2010) and result management (Silva, Zonatto, Dal Magro & Klann, 2018). Recently, a study by Ibrahim, Ali, and Aboelkheir (2022) analyzed articles published in 36 journals over the past 27 years (1994-2020) and highlighted that there are still unexplored determinants that require further research, including culture, idle capacity management, business risks, auditor type, lobbying intensity, and CEO demographic characteristics. Regarding the consequences of cost asymmetry, research examining its implications at the macroeconomic level and for accounting techniques such as cost/volume/profit analysis, pricing decisions, and cost estimation has also been suggested by the authors. Hence, the present research falls into this third group of research by investigating the possible implications that assessing asymmetric cost behavior may have on the cost analysis of competitors. The research also contributes evidence on the effect of sticky costs on the performance of firms in the apparel segment.

3 Methodological Procedures

The data necessary for the research were collected from the balance sheets and quarterly income statements of companies in the fabrics, apparel, and footwear segment of the cyclical consumption sector (subgroup: trade), according to the Brasil, Bolsa, e Balcão ([B]^3) classification, that had complete information from the period 2010 to 2019 available in the Economatica™ database. For fluidity in the text, the segment studied is henceforth referred to as apparel. The option to study companies in one segment was done because it is understood that it is the classification that best groups companies that compete more directly. Competition between companies is a recurring factor in the choice of samples in works on the cost analysis of competitors (Casella, 2008; Costa & Rocha, 2014; Baiochi et al., 2019). The choice for this segment was because, among the segments in [B]3, apparel presented the most considerable number of firms with available data in the study period. The competitiveness of the sectors in which these companies operate and the low level of market regulation were also factors considered in the choice.

The choice of quarterly information was made to obtain a more significant amount of data and the potential to capture the seasonality of the level of activity of the companies. The information was collected from the companies' unconsolidated financial statements and updated by the Extended National Consumer Price Index (IPCA) to minimize the effects of inflation in the analyses (Richartz et al., 2014).

From a total of eight companies in the apparel segment, the companies selected for the research were Grazziotin, Guararapes, Lojas Renner, Lojas Marisa, and Cia Hering. These companies were selected for the similarity and competitiveness of the markets in which they operate and for the data availability in the period investigated, from the first trimester of 2010 to the third one of 2019. The companies Arezzo and Le Lis Blanc were not considered in the research because they focus on footwear and high purchasing power market, respectively, differentiating them from the others. C&A Modas did not present complete data for the period studied. The information from the first trimester of 2010 was used only as a basis for calculating variations (variation of the first trimester of 2010 in relation to the second trimester of 2010), which is necessary to identify the asymmetric behavior of costs. Thus, 190 observations (5 companies in 38 trimesters) were performed, and the data were analyzed with the statistical software Stata 13™.

3.1 Cost and expense structure estimation

In a first stage of the research, an estimation was sought regarding the structure of costs and expenses of the companies investigated. An adaptation of the regression model used by Souza (2011) was used. Unlike this author, in this research, the regression model was estimated for each company individually; therefore, panel data were not used. For this reason, there was also no need to use the logarithmic functional form since this is typically used to solve the problems of heterogeneity among companies within the same model. Estimating the cost structure of individual firms with non-logarithmic data was also used by Casella (2008) and Baiochi et al. (2019). The model used was as follows:

$$TCE = \beta_0 + \beta_1 REV + \beta_2 FIX + \mu \quad (1)$$

Where:
TCE = Total Cost and Expenses (Cost of Goods Sold + Administrative Expenses + Sales Expenses);
REV = Net Sales Revenue;
FIX = Fixed Asset;
β_0, β_1, β_2 = Model-estimated parameters;
μ = Regression error term.

The coefficient β_1 estimates the firms' variable costs and expenses in this model. The model assumes that net sales revenue (REV) influences variable cost, and therefore, the higher the β_1 value, the higher the relationship between revenue and TCE. Then, the coefficient β_1 indicates the impact of variable costs in a balanced manner (Baiochi et al., 2019). The fixed assets (FIX) variable is used in the model to estimate the share of fixed costs and expenses in TCE (Souza, 2011). Through the equation $\beta_2 \times FIX_t + \beta_0$, it is possible to estimate the value of fixed costs and expenses (FCE) of a period. Therefore, the model considers both the angular coefficient β_2 (when significant) and the constant to calculate the proxy of total fixed costs and expenses. Thus, it is possible to obtain the proportion of FCE in relation to TCE, as was performed in the analyses of this research. According to Souza (2011, p. 50), the fixed assets variable is included in the model "because it represents a proxy of fixed costs and expenses, as it is related to the company's structure and does not vary according to volume, within a certain range."

3.2 Identification of asymmetric cost behavior

The empirical model to identify the asymmetric behavior of costs was that of Anderson et al. (2003). According to the authors, the model allows measuring the response of selling, general, and administrative expenses to changes in sales revenue and discriminating the periods in which revenue increases from the periods in which it decreases. Following the example of Richartz et al. (2014), the dependent variable used in the model was the TCE, composed of the sum of the cost of goods sold, sales expenses, and administrative expenses. The REV variable is used as a proxy for the level of activity of firms (Anderson et al., 2003). The model considers the percentage change in REV and TCE for a given period t relative to period t-1. The reduction dummy variable takes value 1 when revenue decreases and 0 when revenue increases from period t-1 to t. The model used to identify the cost behavior was the following:

$$Log\left(\frac{TCE_t}{TCE_{t-1}}\right) = \beta_0 + \beta_1\left(\frac{REV_t}{REV_{t-1}}\right) + \beta_2\, Reduction\ Dummy + \mu \quad (2)$$

According to Anderson et al. (2003), the coefficient β_1 measures the percent change in TCE associated with 1% growth in revenue. The reduction dummy variable captures the difference in the effects of the revenue variable on TCE between periods of increasing and decreasing activity levels. As such, the sum of the coefficients $\beta_1 + \beta_2$ measures the percentage change in TCE associated with a 1% reduction in revenue. If the behavior of the TCEs is asymmetric, the percentage of variation of the TCEs associated with decreasing revenue will be smaller than the percentage of variation of the TCEs associated with increasing

revenue.

Model 2 was used in a data panel format to identify the asymmetric behavior of the average costs of the companies and with data from the companies individually to identify the specificities of the cost behavior in each of them. The Hausman test was used to define the best model with panel data; the Wooldridge test was used to verify the autocorrelation problem. Finally, the regression with the robust standard error was performed in order to minimize the heteroscedasticity problem.

3.3 Relationship between cost structure, sticky costs, and performance

In order to reinforce the argument that information about the asymmetric behavior of costs and the cost structure is relevant for the analysis of competitors, we also analyzed the relationship between the cost structure (share of fixed costs and expenses concerning total costs and expenses - FCE/TCE), the sticky/anti-sticky costs, and the performance of the companies studied. This analysis was undertaken to verify whether cost information, such as the cost structure of the companies, can be somehow affected by the asymmetric behavior of costs, which can help in the analysis of competitors' costs.

For such, the following regression model with panel data was used:

$$\text{Performance}_{i,t} = \beta_0 + \beta_1 \text{FCE/TCE}_{i,t} + \beta_2 \text{Sticky}_i + \beta_3 \text{Log.Asset}_{i,t} + \mu \quad (3)$$

The dependent variables used to measure performance were Return on Assets % (ROA), Return on Invested Capital % (Average ROIC), Net Margin % (NM %), and the logarithm of EBITDA (Log.EBITDA) (Earnings Before Interest, Taxes, Depreciation, and Amortization), all captured from the Economatica™ platform. Thus, four regressions were performed, one for each performance indicator. These indicators are frequently used in research (Sousa, 2011; Chung et al., 2019) in various industries and companies and are widely accepted as indicators of company performance. The operational definitions of the performance variables used are presented in Table 1.

Table 1
Definitions of Dependent Variables

Variable	Definition
Return on Assets % (ROA)	$\left(\frac{Net\ Earnings + Minority\ Shareholding}{Total\ Asset}\right) \times 100$
Return on Invested Capital % (Average ROIC)	$\left(\frac{1 - Income\ Tax}{100}\right) \times \frac{EBIT}{Invested\ Capital} \times 100$
Net Margin % (NM %)	$\left(\frac{Net\ Earnings + Minority\ Shareholding}{Net\ Operating\ Revenue}\right) \times 100$
EBITDA (Earnings Before Interest, Taxes, Depreciation, and Amortization)	$Earnings\ Before\ Interest\ and\ Taxes\ (EBIT) + Depreciation, Depletion, and\ Amortization$

Source: Economatica™

The possible explanatory variables were defined as (a) the proportion of fixed costs and expenses over total costs and expenses (FCE/TCE), as estimated in model 1; (b) the level of sticky/anti-sticky costs according to the individual estimates in model 2, as presented in the last row of Table 4; and (c) the logarithm of Assets (Log.Assets), as a control variable referring to firm size. The sticky variable differs from firm to firm but is constant over time.

4 Analysis and Discussion of the Results

For the analyses, the companies' information was examined by observing the behavior of the two main variables, of both regression models, about the investigated period, revenues, and the proportion of costs and expenses in the cost structure. The information about the evolution of the Net Sales Revenue variable is presented in Figure 1. Moreover, the figure presents the seasonality of the investigated companies' activity levels, evidenced primarily by the information about the two largest companies (by the net sales revenue criterion). It can be seen that the companies have a higher sales volume in the fourth trimester of each year, possibly due to year-end sales, usually followed by a drop in the first trimester of the following year.

Seasonality can be relevant when observing the connection between competitors' cost analysis and cost behavior. It occurs because it is expected that the company that best adapts its installed capacity and, consequently, its costs to the level of demand of each period will outperform its competitors. In a competitive market such as the apparel one and with seasonality, the monitoring of the cost behavior of the company itself and its competitors can be relevant managerial information.

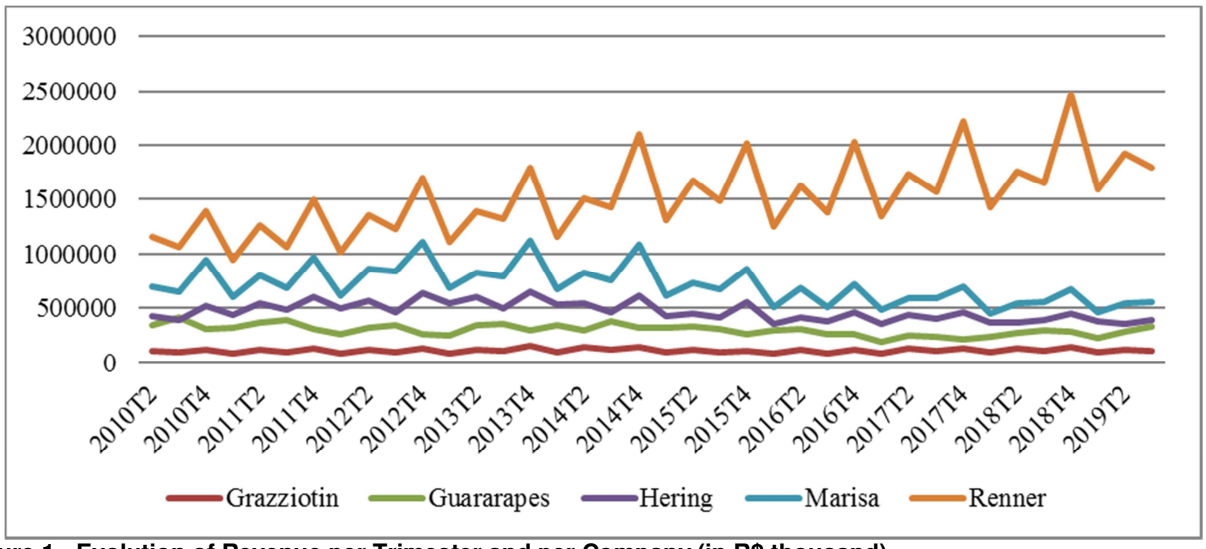

Figure 1 - Evolution of Revenue per Trimester and per Company (in R$ thousand)
Source: Research data

Figure 1 also shows a growth trend in Renner's Net Sales Revenue. It is also observed that this company maintained its sales level during a period of economic crisis (2014 to 2016), while other companies, such as Marisa and Hering, demonstrated a downward trend in sales during this period.

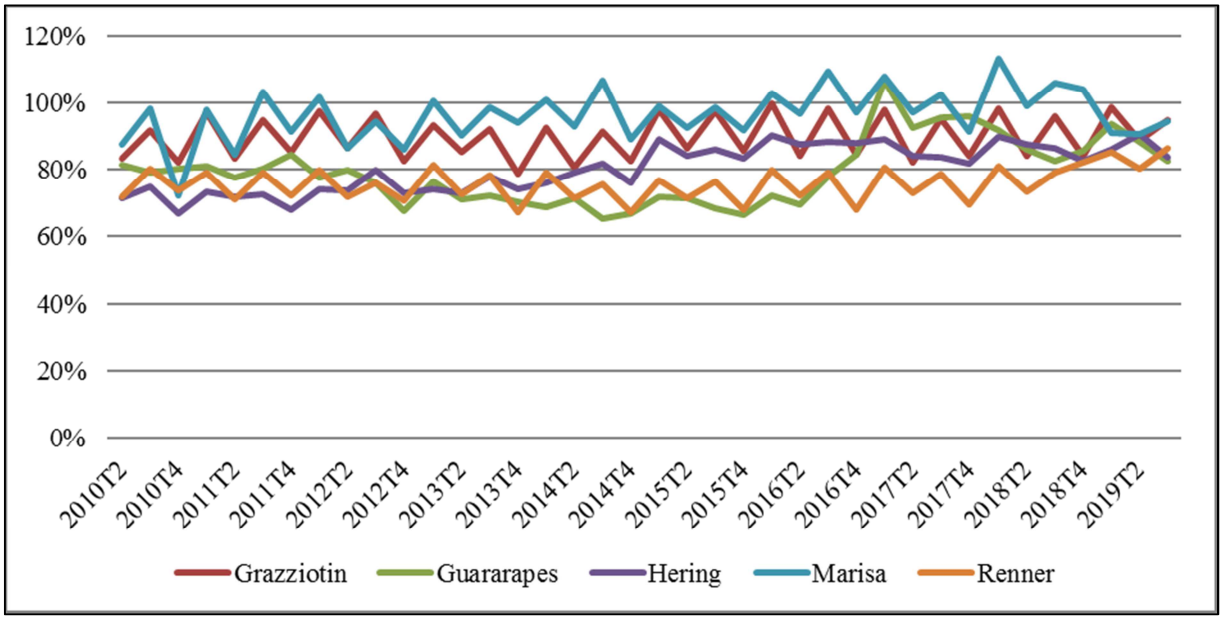

Figure 2 - Proportion of TCE to Revenue
Source: Research data

Figure 2 shows the behavior of the TCE in relation to revenue. The behavior of the TCE variable followed an evolution pattern close to that of revenue, and because of this, it was decided to analyze the proportion of TCE to revenue. The TCE to revenue ratio presented an average of 84% in the analyzed period. The companies Grazziotin and Marisa presented a TCE/Revenue ratio above the average, which was higher than 100% for Marisa in some periods. In a similar analysis, but considering only the average of several companies, Richartz et al. (2014) observed an increasing trend in the TCE/Revenue ratio from 2002 to 2012. As expected, the TCE/Revenue ratio was generally higher during falling sales, probably due to firms' fixed costs. This finding is reinforced by the information presented in Figure 3.

The estimation of the structure of cost and expenses of the sample companies, on an individual basis, was done through a regression model based on the study by Souza (2011). It was decided to use regression with robust standard error due to the heteroscedasticity problem found in some companies' data (Fávero, Belfiore, Takamatsu, & Suzart, 2014). Some exclusions of outliers had to be made to meet the assumption of normality of the regression residuals. Two observations were excluded from the Hering company (T1 and T4 2010), one observation was excluded from the Marisa company (T4 2010), and one observation from Renner (T4 2018). The results of the regressions are presented in Table 2.

With the regression results, it was possible to define equations to estimate each company's fixed and

variable costs in each period studied. For companies where the fixed asset variable was not statistically significant, the equation defined did not consider the β_2 value. As an example, the equations defined for Grazziotin and Hering were, respectively, the following:

$$TCE_{Grazziotin} = 44{,}943.30 + (-\ 0.0529656 \times \text{Fixed Asset}) + (0.5671556 \times \text{Revenue})$$

$$TCE_{Hering} = 108{,}667.90 + (0.5158333 \times \text{Revenue})$$

Table 2
Regression Results for Cost and Expense Structure Estimation

Company	Obs. No.	R^2	Revenue (β_1)	Fixed Asset (β_2)	Constant (β_0)
Grazziotin	39	0.9326	0.5671556***	-0.0529656**	44,943.30***
Guararapes	39	0.7206	0.4566936***	-0.0692407***	143,337.90***
Hering	37	0.8405	0.5158333***	Non Significant	108,667.90***
Marisa	38	0.9349	0.7925763***	Non Significant	138,349.70***
Renner	38	0.9791	0.4977492***	0.1146318***	208,468.80***

*, **, *** statistically significant at 10%, 5% and 1% significance, respectively.
Source: Research data

The part of the equation 44,943.30 + (-0.0529656 x Fixed Asset), referring to Grazziotin, represents the estimated FCE. For companies where the fixed assets variable was not statistically significant, FCE is represented by the constant (β_0). It is worth mentioning that the data collected from the Economatica™ platform are in thousands of *reais* and were corrected by the IPCA index. With the equations defined, the value of FCE and variable costs and expenses was estimated (coefficient β_1 multiplied by the period's revenue), and, given this, the proportion of FCE to TCE was calculated. The results of these calculations are presented in Figure 3.

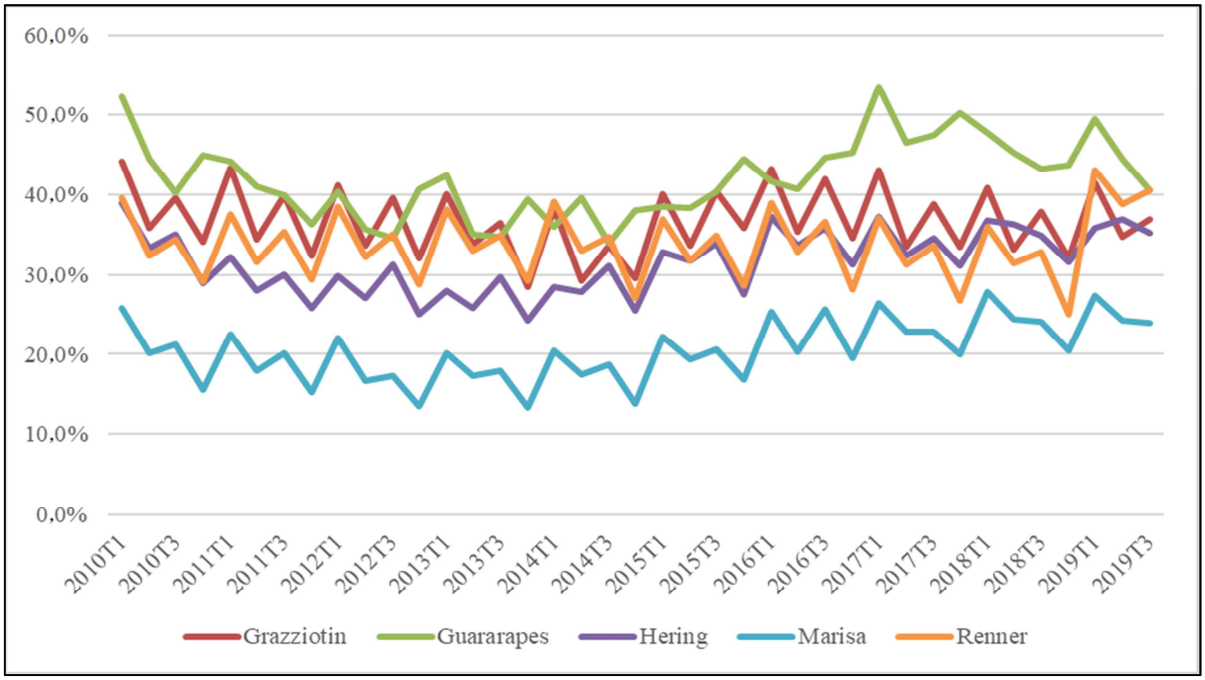

Figure 3 - Proportion of FCE to TCE (Estimated)
Source: Research data

The graph (Figure 3) presents that the average proportion of the FCE to the TCE of the companies studied is around 33%. According to the model estimates, the companies Hering, Marisa, and Renner have, on average, a lower FCE/TCE ratio than Grazziotin and Guararapes. The Marisa company had the lowest FCE/TCE ratio (average of 22% over the period), consistent with the β_1 value, which indicates a higher share of COGSs in this company's cost structure. The company with the highest share of FCE in the TCE is Guararapes, with an average of approximately 42% in the period. Information about the cost structure is vital in analyzing competitors to verify information such as expected performance and the type of cost that has the largest participation. In the work of Souza (2011), for example, it was verified that the estimated

FCE/TCE ratio was approximately 20% for companies with above-average performance in the textile sector from 2005 to 2009. It is noteworthy that the model used by Souza (2011) considered several companies in the period and used logarithmic variables.

Regression model 2 in a panel format was employed to identify the average cost behavior of the studied segment and analyze the asymmetric cost behavior. The results of this regression are presented in Table 3. Based on the Hausman test, the most appropriate model for regression with panel data was the random effects model, and due to the heteroscedasticity problem, robust regression was used. According to the Wooldridge test, there was no autocorrelation problem in the data.

Table 3
Asymmetric Behavior of Average Costs

			Wald Chi²	**446.36**
Overall R^2 =	**0.9092**		**Prob > Chi²**	**0.0000**
	Coefficient	**Std. Error (Robust)**	**z**	**P> | z |**
Log. Δ Revenue (β_1)	0.703925	0.0497532	14.15	0.000***
Reduction Dummy (β_2)	0.0263823	0.0331425	0.80	0.426
Constant	-0.0098763	0.015329	-0.64	0.519

*, **, *** statistically significant at 10%, 5% and 1% significance, respectively.
Source: Research data

The information obtained from the regression presented in Table 3 indicates that, on average, the elasticity of the TCE does not differ significantly between the periods of increasing and decreasing revenue. It indicates that, on average, the cost behavior of firms in the apparel segment is symmetrical.

The same procedure was performed in the second stage of the asymmetric cost behavior analysis; however, this time, with data from each company separately. Thus, five regressions were performed, one for each company, according to model 2. Again, robust regressions were used to minimize the heteroscedasticity problem, and all models were statistically significant according to the F-test statistic. The information obtained from these regressions is presented in Table 4.

According to the regression results (Table 4), the responses of the TCE to revenue variations do not differ significantly between the periods of increase and decrease in the levels of activity for Guararapes and Hering. It indicates that the cost behavior of these companies was symmetrical in the period analyzed. Such a finding may result from an adequate level of adjustment of the installed capacity (and the associated costs and expenses) to the level of activity or a quick response to changes in sales volume.

Table 4
Asymmetric Cost Behavior by Company

	Grazziotin	**Guararapes**	**Hering**	**Marisa**	**Renner**
No. of Observations	**38**	**38**	**38**	**37**	**36**
R^2	0.9909	0.8182	0.9637	0.8945	0.9881
Log. Δ Revenue (β_1)	0.757920***	0.763227***	0.7890935***	0.7528461***	0.7989914***
Reduction Dummy (β_2)	0.122336***	-0.0069963	0.0132874	0.0933437**	0.0985818***
Constant (β_0)	-0.05966***	0.0027729	-0.0036691	-0.0329571	-0.044622***
REV Reduction ($\beta_1 + \beta_2$)	0.8802569	-	-	0.8461898	0.8975732
Sticky/Anti-Sticky Costs (REV Reduction - β_1)	0.1223364	Non Significant	Non Significant	0.0933437	0.0985818

*, **, *** statistically significant at 10%, 5% and 1% significance, respectively.
Source: Research data

For Grazziotin, Marisa, and Renner, the difference in cost response between increases and decreases in the activity level was statistically significant. For a 1% increase in these companies' revenue, there was an average increase of 0.75%, 0.78%, and 0.79%, respectively. For a 1% decrease in revenue, there was a decrease of 0.88%, 0.84%, and 0.89%, respectively. In other words, for these companies, the

response was stronger to decreases than to increases in the activity level, configuring an anti-sticky behavior. These results can be attributed to the capacity used, as explained by Balakrishnan et al. (2004), because these companies may be opting to maintain an idle capacity in periods of low demand, thus avoiding, for example, dismissal and rehiring costs. This unused capacity maintenance can negatively affect performance, as shown in the sequence. The seasonality in sales volume between quarters can also be an influential factor in the results found. In this sense, the same tests with annual data could lead to different results.

To support the argument that the information presented so far has value for the cost analysis of competitors, an analysis regarding the relationship between the cost structure (share of fixed costs and expenses to total costs and expenses), the behavior of costs (sticky/anti-sticky costs), and the performance of the companies studied was also conducted. For this, model 3 with panel data was used. The regression results are presented in Table 5.

According to the tests performed for selecting the best model, the panel data regression model used was the random effects one. The Wooldridge test indicated that the model does not present an autocorrelation problem between the explanatory variables. The information generated by the regressions was analyzed with caution because the data presented a heteroscedasticity problem. Then, the regression model with robust standard error was used to minimize the effects of heteroscedasticity. One of the causes for this problem is the sample size (190 observations).

Table 5
Relationship between Cost Structure, Sticky Costs, and Performance

	ROA	ROIC	NM %	Log.EBITDA
Wald Chi^2 (Prob.)	3.13 (0.37)	4.28 (0.23)	110.08 (0.00)	67.38 (0.00)
Overall R^2 =	0.1965	0.2689	0.6465	0.8624
FCE/TCE	**-33.53***	**-62.80***	**138.55*****	**-3.19****
Sticky	**-94.39***	**-103.91***	**-58.67****	**-4.52**
Log.Asset	0.84	-2.16	**10.95*****	**1.13*****
Constant	15.31	71.05	**-179.54*****	-2.65

*, **, *** statistically significant at 10%, 5% and 1% significance, respectively.
Source: Research data

Table 5 shows that only the models explaining the variables NM% and LogEBITDA presented statistical significance. The non-statistical significance of the models for the variables ROA and ROIC can be explained by the problem of heteroscedasticity since all models without adjusted standard errors were statistically significant. The indicator that showed the highest explanatory power was Log.EBITDA, with an overall R^2 of 86.24%. In all four models, the sticky variable exerted a negative influence on performance; however, the model as a whole for the ROA and ROIC variables was not statistically significant, indicating that companies with asymmetric cost behavior (anti-sticky in the case of the companies analyzed in this study) have a lower performance, on average, compared to companies with symmetric cost behavior. It suggests that companies that better adjust their cost structures to the level of demand have a higher average performance relative to their competitors. According to Balakrishnan et al. (2004), the anti-sticky behavior can be attributed to the idle capacity of the companies. In that respect, the results presented collaborate with the explanation of Balakrishnan et al. (2004) for the anti-sticky behavior since this idle capacity generates costs and expenses for the company without generating revenues to cover them, thus reducing its profitability.

According to these results and based on studies such as those of Weiss (2010) and Warganegara and Tamara (2014), asymmetric cost behavior harms performance, regardless of whether it is anti-sticky or sticky. Both situations of asymmetry indicate the existence of idle installed capacity; the difference is whether this idleness already existed before a drop in the level of activity (anti-sticky), or if such a drop generated excess capacity (sticky). This information allows a comparison of the behavior of costs among competitors and verifies which is less influential. For instance, Weiss (2010) found that analysts' absolute consensus earnings forecasts for firms with sticky behavior are 25% less accurate on average than those with anti-sticky behavior. This implies that more sticky costs indicate more volatile future earnings for the investor. Thus, cost behavior information can affect cost management internally (decision on the level of installed capacity) and externally (return forecast and company value perceived by the analyst/investor), both of which impact results. Weiss (2010) also found that companies with more sticky type costs and less accurate earnings forecasts have lower analyst coverage, i.e., are of less interest for analysis, and that cost behavior is

essential in shaping investors' beliefs about company value.

In three of the four estimated models, the FCE/TCE variable had a negative relationship with performance, which indicates that firms with a higher proportion of fixed costs perform less on average. This result follows the literature, such as in the study by Baiochi et al. (2019, p. 11), in which the authors state that "the higher the fixed cost, the higher the risk for the firm in terms of market operation due to operating leverage."

Companies with a higher FCE/TCE ratio have more difficulty in adjusting their costs to the level of demand and, thus, are proportionally affected more when there is a reduction in activity levels. These results also reinforce the conclusions of Souza, Rocha, and Souza (2010), who found that cost structures and expenses with a lower FCE share resulted in the better economic performance of companies in the electric power sector, and Souza (2011), who found a strong negative correlation between the FCE/TCE ratio and the performance (operating margin and operating return) of companies in the textile and steel/metal sectors.

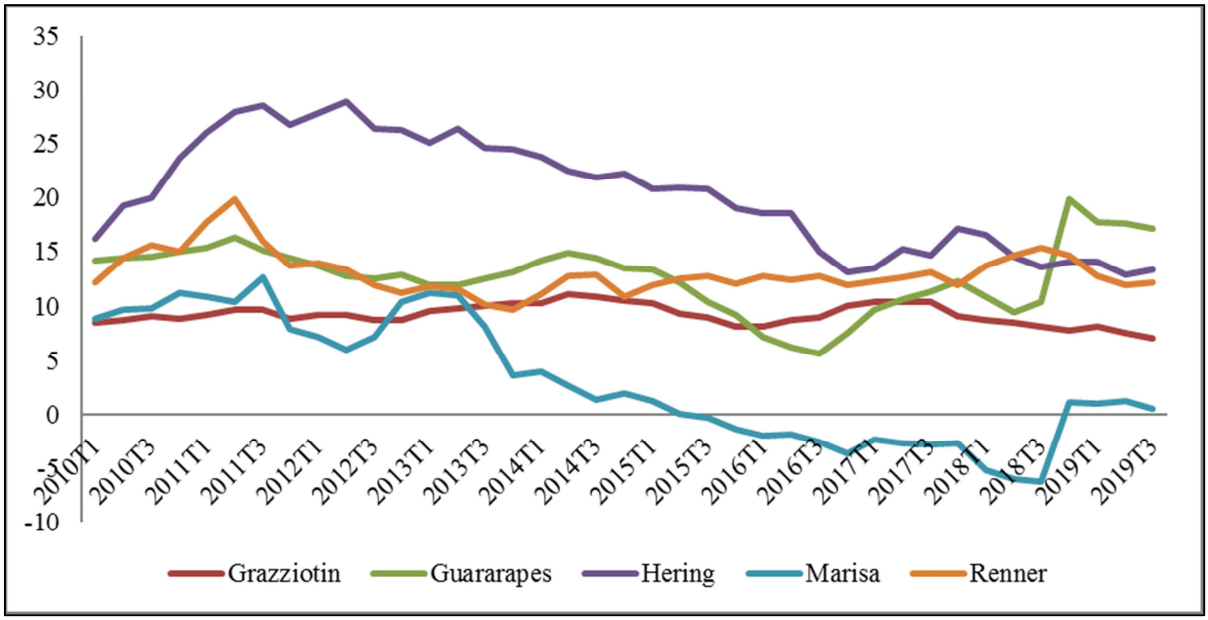

Figure 4 - Return on Assets % (ROA) from 2010 to 2019
Source: Research data

As previously reported, Guararapes presented a higher proportion of fixed costs in its cost composition compared to the others analyzed (Figure 3). Considering this result and the evidence that a higher share of fixed costs harms performance, it was expected that Guararapes would tend to perform less well than its competitors. Nonetheless, the ROA data of the analyzed companies showed that Guararapes presented a superior performance in the last year, as presented in Figure 4. It could be plausible that this result may lie in the evidence that the cost behavior of this company is symmetrical.

These findings may indicate that cost behavior (symmetry/asymmetry) is a moderating variable in the relationship between cost structure and performance. This possibility is due to the evidence that both Guararapes and Hering (FCE/TCE ratio of, on average, 42% and 30%, respectively) presented symmetric cost behavior. This symmetry in cost behavior may minimize the effects of fixed cost on performance. Similarly, the combination of high fixed cost share and asymmetry in cost behavior can lead to inferior performance. It can be verified, for example, in Marisa, which, even having the lowest FCE/TCE ratio, presented the lowest performance (according to ROA).

These results reinforce the importance of using information about cost behavior in competitor analysis. In a less in-depth analysis, it can be assumed that companies with higher FCE/TCE participation have more difficulty adapting to demand fluctuations, negatively impacting performance. Nevertheless, by adding the information about cost asymmetry, the scenario changes so that the asymmetric behavior can influence the company's result and affect the forecasts of returns and the interest of analysts/investors in the company's capital.

5 Final Considerations

Given the research objective of identifying how information about the asymmetric behavior of costs can be used for the cost analysis of competitors, we highlight that results confirmed the possibility of comparability between the asymmetric behavior of competitors' costs. This information can be used by managers to evaluate the efficiency of cost adjustment to the level of sales in their company and relative to their competitors, and can be critical, especially in sectors with high demand seasonality, such as the

clothing segment, and to signal the market (analysts/investors) about the type of cost behavior in relation to competitors and other companies. The relevance of this information is reinforced by evidence that asymmetric cost behavior, even in the anti-sticky case, has a negative relationship with the performance of the firms studied, as discussed by Weiss (2010). An implication of the research results is the hypothesis that asymmetric cost behavior may be a moderating variable between cost structure and performance. This type of test was not found in the works researched on the subject. Thus, it remains a suggestion for future research.

The results of this research also collaborate additional evidence to the work of Souza (2011) and Souza, Rocha, and Souza (2010) regarding the effect of the share of fixed costs and expenses on organizational performance, indicating that cost behavior is important when analyzing/comparing cost structure since it can influence the result/return.

The sample of companies studied in this research was not probabilistic; consequently, the results cannot be generalized to the population. Other limitations are in the data collected, which, in some models, presented autocorrelation and heteroscedasticity problems. Future research can also explore other sectors and use other ways of identifying cost behavior, such as the models of Weiss (2010) and Richartz et al. (2014). The results can also be compared in larger samples between firms with sticky and anti-sticky behavior.

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NOTES

ACKNOWLEDGMENT
Does not apply.

AUTHORSHIP CONTRIBUTION
Conception and preparation of the manuscript: J. A. S. Melo.
Literature Review: J. A. S. Melo, S. L. S. S. Wencel.
Data collection: J. A. S. Melo.
Data analysis: J. A. S. Melo, S. L. S. S. Wencel.
Discussion of results: J. A. S. Melo, S. L. S. S. Wencel, K. C. M. Marques, K. Abbas.
Review and approval: K. C. M. Marques, K. Abbas.

DATASET
The entire dataset supporting the results of this study was taken from the Economatica platform and was published in the article and in the "Supplementary materials" section.

FINANCING
Does not apply.

CONSENT TO USE IMAGE
Does not apply.

APPROVAL OF THE RESEARCH ETHICS COMMITTEE
Does not apply.

CONFLICT OF INTERESTS
Does not apply.

PUBLISHER
Federal University of Santa Catarina. Accounting Sciences Course and Postgraduate Program in Accounting. Publication on the UFSC Journal Portal. The ideas expressed in this article are the responsibility of their authors, and do not necessarily represent the opinion of the editors or the university.

EDITORS
José Alonso Borba, Denize Demarche Minatti Ferreira, Carlos Eduardo Facin Lavarda.

HISTORIC
Received on: 27/07/2021 - Peer reviewed on: 30/05/2022 - Reformulated on: 25/06/2022 - Recommended for publication on: 10/11/2022 - Published on: 22/12/2022

** A preprint version of the paper was presented at the XX USP International Conference in Accounting, 2020*

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