FINANCIAL CONSTRAINTS AND EARNINGS MANAGEMENT: A STUDY ACROSS DIFFERENT BRAZILIAN ECONOMIC SCENARIOS

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ABSTRACT

This study aimed to examine the relationship between financial constraints and earnings management during periods of economic crises, exchange rate fluctuations, and variations in the Selic interest rate. The sample consisted of 194 companies listed on [B]3 from 2010 to 2020. Discretionary accruals were estimated using the model proposed by Kothari, Leone, and Wasley (2005). The findings revealed a significant correlation at the 1% level between financial constraints and discretionary accruals. However, the observed relationship needed to align with the initial expectation that financially constrained firms would engage more actively in earnings management. Economic crises positively and significantly impacted the moderating factors, while the exchange rate negatively moderated the relationship between financially constrained firms and earnings management. Additionally, the moderating effect of the interest rate was not statistically significant. This study highlights the economic contexts in which financially constrained firms choose to manage their earnings, noting that the degree of financial constraint influences the level of earnings management, suggesting an optimal level.

Keywords: Earnings Management. Financial Constraints. Economic Scenarios.

RESTRIÇÕES FINANCEIRAS E GERENCIAMENTO DE RESULTADO: UM ESTUDO DIANTE DE DIFERENTES CENÁRIOS ECONÔMICOS BRASILEIROS

RESUMO

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O objetivo dessa pesquisa foi analisar a relação entre as restrições financeiras e o gerenciamento de resultados, em cenários de crises econômicas e mudanças na taxa de câmbio e taxa Selic. A amostra de 194 empresas compreendeu as empresas listadas na [B]3 no período de 2010 a 2020. Os accruals discricionários foram estimados pelo modelo de Kothari, Leone e Wasley (2005). Os resultados indicaram uma relação significativa a 1% entre as restrições financeiras e os accruals discricionários, mas o sinal não atendeu a relação esperada de que as empresas restritas financeiramente gerenciam mais seus resultados. No que diz respeitos às moderações, as crises econômicas apresentaram-se positivas e significativas. Por outro lado, a taxa cambial moderou negativamente a relação entre as empresas com restrições e o gerenciamento de resultados. Por fim, a moderação da taxa de juros não apresentou significância estatística. Como contribuição este estudo identificou em quais cenários econômicos as empresas com restrições financeiras decidiram gerenciar seus resultados, constatando também, que a depender do grau de restrição financeira em que a empresa se encontra, o nível do gerenciamento de resultados tende a variar, ressaltando a presença de um nível ótimo.

Palavras-Chave: Gerenciamento de Resultados. Restrições Financeiras. Cenários Econômicos.

1 INTRODUCTION

Earnings management (EM) refers to a range of accounting decisions that alter a company's reported financial outcomes, adjusting initial figures without such manipulation to achieve specific goals (Mohanram, 2003). For companies facing financial constraints (FC), EM often functions as a means to conceal financial challenges (Dimitras, Kyriakou & Iatridis, 2015), intending to shape investor perceptions by reducing the perceived risk and volatility in earnings. It is essential to recognize that FC arises from imbalances between external and internal resources, mainly due to informational asymmetry (Fazzari, Hubbard & Petersen, 1988). As a result, firms with FC typically experience heightened costs for external financing or encounter more significant difficulties in securing such financing (Kaplan & Zingales, 1997).

Economic environment changes often drive earnings management (EM) practices, as crises can significantly affect financial performance and corporate outcomes (Filip & Raffournier, 2014; Dimitras et al., 2015). Iatridis and Dimitras (2013) observed that companies often adapted their policies during economic downturns to sustain operations, effectively maneuvering through periods of financial instability. In this context, several studies have examined whether firms engage in earnings management during crises, consistently finding an uptick in EM practices (Iatridis & Dimitras, 2013; Silva et al., 2014; Flores et al., 2016; Paulo & Mota, 2019; da Silva Jardim et al., 2022; da Silva Flores et al., 2023). Tardin and de Oliveira (2022) noted that Brazilian companies particularly heightened their earnings management activities in times of crisis, with negative discretionary accruals especially pronounced. Conversely, research by Gorgan et al. (2012), Filip and Raffournier (2014), Cimini (2015), Tortoli and Moraes (2018), and Türegün (2020) indicated a decrease in earnings management practices during such economic downturns.

Movements in exchange rates can significantly influence the adoption of earnings management (EM) practices, as they introduce risks that affect cash flows and the reported earnings of organizations (Lock et al., 2019). Similarly, changes in interest rates – exemplified in this study by the Selic rate – may encourage managers to engage in earnings management. Mishkin (1995) argued that rising interest rates increase external financing costs, reducing investment spending. Consequently, as interest rates rise, firms may be motivated to manage their earnings in order to secure higher loan amounts, attain lower interest rates, and reduce borrowing costs, given that creditors closely scrutinize their financial reports for decision-making purposes (Frame, Srinivasan & Woosley, 2001).

Economic crises significantly affect financial stability and business performance, influencing investment and financing decisions, particularly for firms facing financial constraints (FC). Almeida and Campello (2010) observed that FC tends to become more pronounced during crises, increasing the interdependence between a firm's internal and external resources. Consequently, managers may resort to earnings management (EM) to mitigate the reliance on external credit, reduce financing costs, and circumvent financial constraints (Camargo & Carvalho, 2022).

In light of this context, the research question for this study is: What is the relationship between financial constraints and earnings management during periods of economic crises, changes in exchange rates, and fluctuations in the Selic rate?

Earnings management (EM) may be more prevalent in firms facing financial constraints, as these firms often lack an established reputation. The higher transaction costs associated with obtaining external financing (Kaplan & Zingales, 1997) can amplify the incentive for EM, given the perceived advantages of manipulating earnings. Furthermore, during economic crises, the increased cost of external funds can further limit resource access for financially constrained firms, which are already more vulnerable and less equipped to endure economic downturns (Bernanke, Gertler & Gilchrist, 1996), thereby intensifying the motivation for EM practices. Numerous studies have highlighted the significant effects of economic crises on EM (Habib, Uddin Bhuiyan & Islam, 2013; Silva et al., 2014; Flores et al., 2016; Türegün, 2020).

Related studies on this topic have also been identified. Tortoli and Moraes (2018) investigated the relationship between financial crises and the quality of earnings among public companies in Latin America, taking into account the effects of financial conditions. Conversely, Yan et al. (2022) explored the impact of COVID-19 on earnings management practices, focusing specifically on firms affected by financial conditions. However, there have yet to be studies that examine the relationship between financial conditions and earnings management across various economic scenarios, including economic crises, exchange rates, and interest rates.

Given the potential impact of various economic scenarios on the relationship between financial constraints (FC) and earnings management (EM) and the lack of existing studies exploring this connection, this research is significant in illustrating how different conditions within the Brazilian economy affect financially constrained firms and shape their incentives to adopt EM practices.

During economic crises, for instance, there is often an increased reliance on internal and external resources, heightening financial constraints (Almeida & Campello, 2010). Additionally, exchange rate fluctuations are directly influenced by the severity of these constraints (Chen, Luo & Xiang, 2022). Interest rates also play a crucial role in financing costs (Mishkin, 1995) and, consequently, both financial constraints and incentives related to earnings management. By incorporating various economic scenarios, this study is seen as innovative, significantly contributing to the existing literature in this area.

2 THEORETICAL FRAMEWORK

2.1 Earnings Management

Earnings management (EM) is defined as intentional interventions in financial reporting that aim to secure personal gains (Schipper, 1989) or achieve specific objectives. These interventions shape how users perceive a company's economic and financial conditions (Mohanram, 2003). As a result, EM practices stem from managers' discretion in preparing financial reports, often with the intention of misleading stakeholders about the firm's performance or influencing contractual outcomes based on the reported data (Healy & Wahlen, 1999).

According to Schipper (1989), accrual-based management takes advantage of the opportunities provided by accounting standards. The discretion inherent in these standards allows managers to make decisions that can significantly impact external users' short- and long-term decisions.

Accruals are defined as the difference between net income and operating cash flow (Healy, 1985; Mohanram, 2003), resulting from timing discrepancies in revenue and expense recognition under the cash and accrual accounting methods. While they modify reported earnings, accrual-based earnings management (EM) does not impact the cash flow of the current period. Since it does not influence cash flow, there is a reduced risk of negatively affecting the company's long-term value. Furthermore, stakeholders may not always be able to detect such practices.

Accruals can be categorized into discretionary and non-discretionary components. Non-discretionary accruals pertain to accounting adjustments required by laws and accounting standards. In contrast, discretionary accruals relate to earnings management and arise from accounting choices made by managers to achieve specific objectives (Healy, 1985). Positive accruals indicate that a manager intends to inflate earnings to enhance business performance, while negative accruals suggest the opposite.

2.2 Financial Constraints as a Driver for Earnings Management

Financial constraints (FC) emerge from the gap between external and internal resources, influenced by informational asymmetry (Fazzari et al., 1988). Kaplan and Zingales (1997) define firms as financially constrained if the costs or availability of external resources impede their ability to pursue new investments.

These constraints compel companies to depend on internal financing, as market imperfections render external resources more expensive than internal alternatives (Almeida, Campello & Weisbach, 2004). According to Almeida and Campello (2001), even when financially constrained firms are prepared to incur higher costs for acquiring external funding, there is still a limit to the amount of external capital accessible to them.

Therefore, financial constraints can be understood as either an increase in the costs associated with external financing or more significant difficulties in obtaining such funding (Kaplan & Zingales, 1997). Portal, Zani, and Silva (2012) noted that firms are financially constrained when they make suboptimal investment choices due to a lack of internal and external financing opportunities, ultimately diminishing their firm value. FC can also be viewed as obstacles that hinder firms from pursuing desired investments due to credit restrictions, challenges securing loans, and insufficient asset liquidity (Lamont, Polk & Saaá-Requejo, 2001).

To mitigate financial constraints (FC), reduce difficulties in accessing credit, and lower financing costs (Camargo & Carvalho, 2022), managers might feel compelled to engage in earnings management through discretionary accruals (Linck, Netter & Shub, 2013). Companies facing FC often resort to earnings management (EM) to avert the adverse effects associated with disclosing financial difficulties (Park & Shin, 2004) and to lessen earnings volatility or risk, which can, in turn, shape investor perceptions.

Given that EM can be employed to sway creditors' perceptions regarding a company's risk and repayment capabilities (Camargo & Carvalho, 2022), research by Linck et al. (2013) and Tortoli and Moraes (2018) has identified a correlation between EM and FC. Thus, as studies have shown that financially constrained firms engage in earnings management through discretionary accruals (Linck et al., 2013), the current research proposes the following hypothesis: ***H(1)*** *A significant and positive relationship exists between financial constraints and earnings management through accruals.*

2.3 Earnings Management and Economic Scenarios

An economic crisis is a disruption resulting from an imbalance between production and consumption, which threatens businesses by altering consumer behavior and impacting operations. Flores et al. (2016) noted that these crises can arise from inconsistencies in the financial market. In this context, Asel, Posch, and Speckbacher (2011) observed that economic crises increase uncertainty, prompting managers to make immediate and short-term decisions. Beyond the necessity for prompt decision-making, managers need to ensure that their choices support the continuity of the entity and enable it to achieve its established objectives.

It is crucial to recognize that the effects of a crisis do not uniformly affect all economic sectors. Some industries may experience benefits during economic recessions, which can lead to expanding production capacity, as Flores et al. (2016) described. On the other hand, Zeitun, Temimi, and Mimouni (2017) highlighted that access to loans typically diminishes during crises, limiting

companies' ability to incur debt. In such situations, managers may seek ways to enhance corporate cash flow to sustain operational activities.

Several studies – including those conducted by Gorgan et al. (2012), Machado, Martins, and Miranda (2012), Habib et al. (2013), Iatridis and Dimitras (2013), Filip and Raffournier (2014), Silva et al. (2014), Cimini (2015), Dimitras et al. (2015), Flores et al. (2016), Tortoli and Moraes (2018), Paulo and Mota (2019), Türegün (2020), Tardin and de Oliveira (2022), da Silva Jardim et al. (2022), and da Silva Flores et al. (2023) – have examined the impact of economic crises on whether companies engage in earnings management (EM) to achieve specific objectives under challenging conditions.

Machado et al. (2012) posited that increased asymmetry and decreased economic activity can motivate companies to use EM strategies to enhance profitability or counteract the repercussions of previous EM practices. However, contrasting findings have emerged, indicating a decline in EM during economic downturns, attributed to factors such as new regulations, increased investor scrutiny (Gorgan et al., 2012), and enhanced quality of accounting information (Cimini, 2015; Türegün, 2020).

EM is often perceived as a necessary component of corporate policy for firms facing financial constraints, which are more vulnerable to the adverse effects of credit shortages. In contrast, unconstrained firms may not feel compelled to adopt such protective measures against potential future investment and liquidity challenges (Almeida et al., 2004).

Given the tendency for recessions to accompany economic crises, financial constraints are likely to become more pronounced during these periods (Almeida & Campello, 2010), thereby amplifying incentives for earnings management. Consequently, this research proposes the following hypothesis: ***H(2)*** *A significant and positive relationship exists between financial constraints and earnings management through accruals moderated by economic crises.*

Economic crises affect financial conditions and business performance (Filip & Raffournier, 2014; Dimitras et al., 2015). This study examines the interactions of the analyzed relationships and the Selic rates as moderating factors. According to Serafini and Sheng (2011), these variables considerably impact corporate outcomes and the broader national economy.

The exchange and Selic rates analyzed in this study are integral to economic scenarios. They represent mechanisms within the transmission of monetary policy associated with the exchange rate and interest rate channels. As Mishkin (1995) states, monetary policy encompasses measures to maximize societal welfare, with transmission mechanisms disseminating policy changes throughout the economy.

In their study, Chang, Hsin, and Shiah-Hou (2013) observed that the volatility associated with exchange rate fluctuations prompts companies to adopt earnings management practices to mitigate currency exposure. Santos and Paulo (2006) examined Brazilian companies from 1999 to 2001 in this context. They found compelling evidence of EM among firms that defer exchange losses to avoid revealing negative financial results.

Sticca (2018) analyzed Brazilian companies from 2010 to 2017. The findings indicated that significant financial exposure to currency risk and a volatile exchange environment compelled companies to recognize deferred currency losses in their other comprehensive income. According to Sticca, this practice implies that the firms' actual earnings are not accurately represented, suggesting emerging markets should refrain from reporting such losses.

Unexpected fluctuations in exchange rates can significantly affect a company's cash flows, profits, and overall market value (Chang et al., 2013), which drives companies to engage in earnings management (EM). The volatility stemming from exchange rate variations may also prompt firms to manage their earnings to reduce currency exposure (Chang et al., 2013) and prevent the disclosure of unfavorable financial outcomes (Santos & Paulo, 2006; Sticca, 2018). According to Chang et al. (2013) and Lock et al. (2019), changes in exchange rates can result in currency devaluation, encouraging companies to manage their earnings positively. This leads to the following research hypothesis: ***H(3)*** *A significant and positive relationship exists between financial constraints and earnings management through accruals moderated by the exchange rate.*

Conversely, the Selic rate is the primary monetary policy tool the Central Bank of Brazil (BCB) uses to control inflation. It affects all interest rates nationwide and affects price levels and economic activity. The BCB describes the Selic rate as the foundational interest rate of the economy.

Preparing financial reports promptly can be costly during economic crises and expansions. Moreover, factors such as corporate reputation and the pursuit of objectives motivate managers to make accounting decisions that obscure losses (Sticca, 2018). In essence, managers are driven to engage in earnings management practices to present improved results to investors and analysts.

Regarding interest rates, managers are often motivated to manage earnings before negotiating a loan agreement to enhance their borrowing capacity. This tactic allows them to secure more significant loan amounts, lower interest rates, and reduce financing costs. The approval of loans and interest rates largely depends on the financial conditions presented in financial statements (Watts & Zimmerman, 1986; Frame et al., 2001).

Under the challenging conditions of an economic crisis, managers are mainly driven to manage earnings to present improved financial conditions, thereby increasing their borrowing potential (Watts & Zimmerman, 1986; Frame et al., 2001; Mafrolla & D'Amico, 2017). Accordingly, the fourth research hypothesis can be articulated as follows: ***H(4)*** *A significant and positive relationship exists between financial constraints and earnings management through accruals moderated by the interest rate.*

3 METHODOLOGICAL PROCEDURES

3.1 Research Sample and Classification of Financially Constrained and Unconstrained Firms

This study investigated the relationship between financial constraints and earnings management in various economic contexts, including economic crises,

exchange rates, and interest rates, spanning from 2010 to 2020. The analysis also considered the influence of control variables on these relationships for Brazilian publicly traded companies listed on [B]3. Companies in the financial sector and investment funds were excluded from the sample due to specific characteristics related to accounting records and procedures that could affect the measurement of the proxies employed in this study, resulting in 164 companies. Following this, an additional 212 companies were eliminated from consideration due to missing data for any variable in the EM model over the 2010–2020 period, bringing the final sample down to 194 companies.

Criteria were then applied to classify the sample into financially constrained and unconstrained firms. While various methodologies exist for this classification, Hadlock and Pierce (2010) evaluated studies by Kaplan and Zingales (1997), Almeida et al. (2004), and Whited and Wu (2006) to determine the most appropriate variable for distinguishing firms based on their FC status. These studies highlighted different criteria for identifying financially constrained versus unconstrained firms. According to Hadlock and Pierce (2010), the size and age variables demonstrated the most substantial significance in the results, making them particularly suitable for FC classification.

Based on Hadlock and Pierce's (2010) findings that firm size and age are significant predictors of financial constraints (FC) levels, the current study employed the natural logarithm of total assets as an indicator of size and the duration since listing on [B]3 as a measure of age to categorize firms as either financially constrained or unconstrained. Furthermore, firms were classified according to their economic sectors, as sector-specific characteristics may encompass companies of varying sizes that could influence FC classification (Kirch, Procianoy & Terra, 2014).

Initially, companies were classified annually by sector (Kirch et al., 2014) and ranked in ascending order based on size and age. Subsequently, these companies were divided into deciles, with smaller and younger firms more likely to experience financial constraints than their larger, more established counterparts.

The methodology proposed by Kirch (2012) was utilized to group firms into deciles, segmenting the sample into four upper and four lower deciles. As a result, firms in the bottom four deciles were classified as constrained for each year and economic sector, while those in the top four deciles were categorized as unconstrained. A dummy variable was then employed to operationalize financial constraints, assigning a value of one to financially constrained firms and zero to financially unconstrained firms.

3.2 Model for Estimating Discretionary Accruals

Discretionary accruals (DA) are determined by the difference between total accruals (TA) and non-discretionary accruals (NDA). This study employs the cash flow statement (CFS) approach to estimate total accruals, as highlighted by Hribar and Collins (2002), who suggested that the balance sheet approach may introduce estimation errors.

In this framework, TA is computed using the CFS method, defined as the difference between net income and operating cash flow, as illustrated in Equation (1). Conversely, NDA, which pertains to accounting adjustments, is calculated using the model proposed by Kothari et al. (2005). This model incorporates an intercept and the return on assets (ROA) variable into the modified Jones Model (Dechow, Sloan & Sweeney, 1995) to account for the impact of firm performance on the estimation of DA (see Equation 2).

To estimate the NDA, the coefficients a1, β1, β2, β3, and β4 were derived as shown in Equation (3). In this context, DA served as a proxy for EM, and the difference between TA and NDA was calculated (as outlined in Equation 4). Here, the regression residuals reflect DA, indicating that a more significant deviation between the residual value and zero suggests a higher level of EM.

$$TA_{i,t} = \frac{NI_{i,t}}{AT_{i,t-1}} - \frac{OCF_{i,t}}{AT_{i,t-1}}$$

Eq. 1

$$NDA_{i,t} = \alpha_1 + \beta_1\left(\frac{1}{AT_{i,t-1}}\right) + \beta_2\left(\frac{\Delta NR_{i,t} - \Delta AR_{i,t}}{AT_{i,t-1}}\right) + \beta_3\left(\frac{PPE_{i,t}}{AT_{i,t-1}}\right) + \beta_4\left(ROA_{i,t}\right)$$

Eq. 2

$$TA_{i,t} = \hat{a}_1 + \widehat{\beta_1}\left(\frac{1}{AT_{i,t-1}}\right) + \widehat{\beta_2}\left(\frac{\Delta NR_{i,t} - \Delta CR_{i,t}}{AT_{i,t-1}}\right) + \widehat{\beta_3}\left(\frac{PPE_{i,t}}{AT_{i,t-1}}\right) + \widehat{\beta_4}\left(ROA_{i,t}\right) + \varepsilon_{i,t}$$

Eq. 3

$$DA_{i,t} = TA_{i,t} - NDA_{i,t}$$

Eq. 4

on what:

$TA_{i,t}$: Total Accruals of i firm in t period
$NDA_{i,t}$: Non-Discretionary Accruals of i firm in t period
$DA_{i,t}$: Discretionary Accruals of i firm in t period
$NI_{i,t}$: Net Income of i firm at the end of t period
$OCF_{i,t}$: Operating Cash Flow of i firm at the end of t period
$AT_{i,t-1}$: Total Assets of i firm at the end of the t-1 period
$\Delta NR_{i,t}$: Net Revenues Variation of i firm from t-1 period to period t
$\Delta CR_{i,t}$: Accounts Receivable Variation of i firm from t-1 period to period t
$PPE_{i,t}$: Gross balance of Property, Plant, and Equipment accounts for i firm at the end of t period
$ROA_{i,t}$: Return On Assets for i firm in t period, calculated as net income divided by total assets
$\hat{a}_1, \widehat{\beta_1}, \widehat{\beta_2}, \widehat{\beta_3}, \widehat{\beta_4}$: Estimated coefficients.
$\varepsilon_{i,t}$: Error term (residuals) for i firm in t period

3.3 Research Variables

O objetivo desta pesquisa foi analisar a relação entre as RF e o GR, diante de diferentes cenários econômicos. De modo a auxiliar na análise dessa relação,

as variáveis independentes tamanho (TAM), alavancagem (ALAV), e crescimento (CRESC) foram adotadas por apresentarem potencial explicativo para a relação previamente estabelecida. As variáveis utilizadas para mensurar os DA (variável dependente) e as variáveis independentes foram coletadas anualmente na plataforma EIKON da Thomson Reuters®. Por outro lado, as variáveis moderadoras, representadas pelos cenários econômicos, foram constituídas pelas crises econômicas, taxas de câmbio e taxas de juros, obtidas por meio do CODACE, IPEA e BCB, respectivamente. A Tabela 1 apresenta as variáveis de controle e moderadoras deste estudo.

Table 1
Operationalization of Control and Moderator Variables

Control Variables			
Variables	**Operationalization**	**References**	**Expected signs**
Size	Natural logarithm of total assets	Habib et al. (2013), Silva et al. (2014), Flores et al. (2016).	Negative
Leverage	$\frac{(\text{Current and non Current Liabilities})}{\text{Total Assets}}$	DeFond & Jiambalvo (1994), Habib et al. (2013), Sincerre et al. (2016).	Positive
		Silva et al. (2014)	Negative
Growth	$\frac{\text{Net Revenue}_{i,t} - \text{Net Revenue}_{i,t-1}}{\text{Net Revenue}_{i,t-1}}$	Iatridis & Dimitras (2013), Sincerre et al. (2016).	Positive
Moderator Variables			
Variables	**Operationalization**	**References**	**Expected signs**
Economic crisis	*Dummy*	Silva et al. (2014)	Positive
Exchange rate	*Dummy*	Chang et al. (2013), Sticca (2018), Lock et al. (2019)	Positive
Interests rate	*Dummy*	Mafrolla e D'Amico (2017)	Positive

Source: Developed by Authors.

To operationalize the economic crisis variable, defined as a dummy, a value of 1 was assigned for economic crisis periods and 0 for non-crisis periods. The periods of the economic crisis were identified using the methodology employed by Kappel (2017), which determined Brazilian economic crises through adverse exogenous shocks as reported by CODACE in the Brazilian Business Cycle Chronology as of the June 29, 2020, meeting. According to this chronology, recessions occurred from Q4 2008 to Q1 2009 and from Q2 2014 to Q4 2016. Expansion periods were identified from Q2 2009 to Q1 2014 and from Q1 2017 to Q4 2019.

In addition, CODACE held a meeting on June 26, 2020, to identify a peak in the national business cycle. The meeting indicated that Brazil experienced an expansion phase from Q1 2017 to Q4 2019, followed by a recession. This study's economic crisis periods included 2014, 2015, 2016, and 2020.

To operationalize the exchange rate and interest rate variables, also defined as dummies, a value of 1 was assigned for periods in which the exchange

rate and interest rate increased annually. Conversely, 0 was assigned for periods in which these rates declined. The nominal exchange rate and Selic rate published by IPEA and BCB, respectively, were used to determine these variables.

3.4 Econometric Models

The research strategies adopted to achieve the proposed objectives were divided into descriptive statistics, parametric hypothesis testing, and panel data regression analysis. First, a descriptive data analysis was conducted, examining the correlation matrix (Appendix A) to identify initial relationships between variables. Data normality was assessed using the Shapiro-Wilk and Shapiro-Francia tests, which helped select the appropriate correlation test.

Following the initial tests, panel data regression analysis was applied. In adopting the panel data technique, it was necessary to determine the most suitable approach for this study: Pooled Ordinary Least Squares (POLS), Fixed Effects, or Random Effects. To determine the best approach, several tests were conducted. According to Fávero, Belfiore, Silva, and Chan (2009), the first test to perform is the Chow test, which identifies whether POLS or Fixed Effects is more appropriate. Then, to choose between POLS or Random Effects, the Breusch-Pagan test was applied. Finally, the Hausman test was performed to determine the best choice between Fixed and Random Effects.

After identifying the most appropriate panel data technique (POLS, Fixed Effects, or Random Effects), the regression coefficients for the model by Kothari et al. (2005) were estimated, along with the coefficients of the regressions used to describe the relationship between FC and EM, which is moderated by economic crises, exchange rates, and interest rates. All statistical tests and panel data regression analyses were performed using Stata® 17 software.

The econometric model used to test Hypothesis 1 – namely, that there is a significant and positive relationship between FC and EM through accruals – is represented by the following Equation (5): $DA_{i,t} = \beta_0 + \beta_1 FC_{i,t} + \beta_2 SIZ_{i,t} + \beta_3 LEV_{i,t} + \beta_4 GROW_{i,t} + \varepsilon_{i,t}$ **(Eq. 5)**

The model for testing Hypothesis 2 – there is a significant and positive relationship between financial constraints (FC) and earnings management (EM) through accruals when moderated by economic crises – is represented by Equation (6): $DA_{i,t} = \beta_0 + \beta_1 FC_{i,t} + \beta_2 CRI_t + \beta_3 (FC_{i,t} \times CRI_t) + \beta_4 SIZ_{i,t} + \beta_5 LEV_{i,t} + \beta_6 GROW_{i,t} + \varepsilon_{i,t}$ **(Eq. 6)**

The model for testing Hypothesis 3 – there is a significant and positive relationship between FC and EM through accruals when moderated by the exchange rate – is shown by Equation (7): $DA_{i,t} = \beta_0 + \beta_1 FC_{i,t} + \beta_2 EXCH_t + \beta_3 (FC_{i,t} \times EXCH_t) + \beta_4 SIZ_{i,t} + \beta_5 LEV_{i,t} + \beta_6 GROW_{i,t} + \varepsilon_{i,t}$ **(Eq. 7)**

The model for testing Hypothesis 4 – there is a significant and positive relationship between FC and EM through accruals when moderated by the interest rate – is given by Equation (8): $DA_{i,t} = \beta_0 + \beta_1 FC_{i,t} + \beta_2 INTR_t + \beta_3 (FC_{i,t} \times INTR_t) + \beta_4 SIZ_{i,t} + \beta_5 LEV_{i,t} + \beta_6 GROW_{i,t} + \varepsilon_{i,t}$ **(Eq. 8)**

on what:

$DA_{i,t}$: Discretionary Accruals of i firm in t period (dependent variable)
$FC_{i,t}$: Financial Constraints of i firm in t period
CRI_t: Economic Crisis in t period
$EXCH_t$: Exchange Rate in t period
$INTR_t$: Interest Rate in t period
$SIZ_{i,t}$: Size of i firm at the end of t period, represented by the natural logarithm of total assets
$LEV_{i,t}$: Leverage of i firm from t-1 period to period t, calculated as $Total\ Liabilities\ /\ Total\ Assets$
$GROW_{i,t}$: Growth of i firm in t period
β_0: Intercept
β_1, β_2, β_3, β_4, β_5, β_6: Independent variables coefficients.
$\varepsilon_{i,t}$: Error term (residuals) for i firm in t period

4 ANALYSIS AND DISCUSSION OF RESULTS

4.1 Descriptive Statistics

This section presents descriptive and inferential analyses of the relationship between financial constraints and earnings management for publicly traded companies listed on [B]3 across various economic scenarios, as shown in Table 2. The sample consists of 1,495 observations.

Table 2
Descriptive Analysis of Variables

Variables	Obs.	Average	Standard Deviation	Variation Coefficient	Minimum	Maximum
ACCRUALS_T	1.495	0.94	26.80	28.49	(15.33)	968.86
DA (res)	1.495	0.96	0.38	0.40	0	3.38
$ASSETS_{(t-1)}^{-1}$	1.495	3.3x10^{9}	1.85x10^{8}	5.67	1x10^{12}	6.35x10^{7}
$\Delta(NREV - AR)$	1.495	0.23	2.70	11.91	(24.47)	66.01
PPE	1.495	0.40	0.39	0.97	0	3.97
$ROA_{(t-1)}$	1.495	0.01	0.15	14.57	(1.72)	1.22
FC	1.495	0.50	0.50	1.00	0	1
SIZE	1.495	21.78	2.11	0.10	16.30	27.62
LEV	1.495	0.54	0.23	0.43	0	1.13
GROW	1.495	0.22	0.28	1.29	2x10^{4}	4.42
CRI	1.495	0.37	0.48	1.29	0	1
EXCH	1.495	0.83	0.38	0.45	0	1
INTR	1.495	0.35	0.48	1.37	0	1
$(FC \times CRI)$	1.495	0.19	0.39	2.06	0	1
$(FC \times EXCH)$	1.495	0.42	0.49	1.18	0	1
$(FC \times INTR)$	1.495	0.18	0.38	2.15	0	1

Notes: Dependent variables include ACCRUALS_T (total accruals) and DA (discretionary accruals); independent variables are $ASSETS_{(t-1)}^{-1}$(lagged total assets) and FC (dummy for financial constraints); control variables include $\Delta(NREV - AR)$ (net revenue and accounts receivable variation), PPE (property, plant, and equipment), $ROA_{(t-1)}$ (lagged return on assets), SIZ (size), LEV (leverage), GROW (growth), CRI (dummy for economic crisis), EXCH (dummy for exchange rate), and INTR (dummy for interest rate); interaction dummies include FC and Crisis $(FC \times CRI)$, FC and Exchange Rate $(FC \times EXCH)$, FC and Interest Rate $(FC \times INTR)$.

Source: Developed by Authors.

The sample companies reported a median total asset value of BRL 3.4 billion, a mean of BRL 20.21 billion, and a standard deviation of BRL 75.62 billion, indicating that the sample is not restricted to large firms. This variability is also observed in the high coefficients of variation for total accruals (2,849%), lagged assets (567%), the change between revenue and accounts receivable (1,191%), and lagged return on assets (1,457%).

Examining the descriptive statistics of the variables reveals data variability. The average leverage during the period was 0.54 (standard deviation of 0.23, coefficient of variation of 43%), indicating that, on average, the sample firms opted to use third-party capital to finance their assets. The average growth rate was 0.22 (standard deviation of 0.28, coefficient of variation of 129%), highlighting considerable variance in the sample, which will contribute to the parameter estimations in the models. For the size proxy, total assets in natural logarithm form showed a mean of 21.78, a standard deviation of 2.11, and a coefficient of variation of 10%, indicating that the sample includes companies of diverse sizes and is not limited to a specific firm size range.

4.2 Analysis of Results for the Earnings Management Model

Total Accruals (TA) were calculated using this stage's Cash Flow Statement approach (Equation 1). The model by Kothari et al. (2005) was applied to estimate discretionary accruals (DA). Using a fixed-effects panel data approach for the Kothari et al. (2005) model, the estimation results comprised 1,494 observations. The results are presented in Table 3.

Table 3
Fixed-Effects Estimation Results for Discretionary Accruals

Fixed-effects (within) regression					Number of obs. =	1,494
Group variable: **ID_Co**					Number of groups =	180
R-squared:					Obs. per group:	
within	= 0.5591				min =	1
between	= 0.0012				avg =	8.3
overall	= 0.0365				max =	11
corr(u_i, Xb) =	- 0.9461				F (4,1310) =	415.29
					Prob > F =	0.0000
t_*accruals*	**Coefficient**	**std. errors**	**T**	**P>|t|**	**[95% conf. Interval]**	
$ASSETS_{(t-1)}^{-1}$	3.81e+09	1.12e+08	33.94	0.000	3.59e+09	4.03e+09
$\Delta\ (NREV - AR)$	-2.575581	.2437913	-10.56	0.000	-3.053845	-2.097317
PPE	12.01551	2.135561	5.63	0.000	7.826019	16.20501
$ROA_{(t-1)}$	11.96826	3.137039	3.82	0.000	5.814088	18.12243
_const	-15.82304	.9427519	-16.78	0.000	-17.67251	-13.97357
sigma_u	182.36942					
sigma_e	14.723522					
rho	.99352413	(fraction of variance due to u_i)				
F test that all u_i = 0	F (179, 1310) = 18.42				Prob > F	= 0.0000

Source: Developed by Authors.

Data normality was assessed using the Shapiro-Wilk and Shapiro-Francia tests when estimating DA. The results from both tests (SW: p-value 0.00; SF: p-value 0.00) led to the rejection of the normal data distribution null hypothesis. To check for autocorrelation, the Durbin-Watson and Breusch-Godfrey tests were conducted, yielding results of (p-value 0.8371; p-value 0.8368) respectively, indicating no presence of autocorrelation. Following this, the Breusch-Pagan/Cook-Weisberg test (p-value 0.000) was applied to assess the normal distribution of residuals, confirming the presence of heteroscedasticity. Finally, the Variance Inflation Factor (VIF) test was conducted, and the model's average VIF was 1.04, indicating no multicollinearity issues.

Consequently, a fixed-effects estimation was employed. The results indicated that the variables $ASSETS_{(t-1)}^{-1}$, $\Delta\,(NREV - AR)$, PPE, $ROA_{(t-1)}$, and the constant term were statistically significant at the 1% level (p-value 0.00). The positive ROA coefficient suggests that entity performance contributes to explaining accruals, as noted by Kothari et al. (2005). Additionally, the statistical significance of the F-test (p-value 0.00) demonstrated that the model's variables explain the variations in the dependent variable, with an approximately *within* R^2 of 56% for explaining TA behavior. These results suggest that firms engage in earnings management.

4.3 Analysis of Results for the Relationship Between Financial Constraints, Earnings Management, and Economic Scenarios

To examine the relationship between FC and EM, panel data estimations were performed using pooled ordinary least squares (POLS), fixed effects (FE), and random effects (RE) estimators for Equation (5) as well as for Equations (6), (7), and (8).

The Chow test result (p-value 0.000) rejected the null hypothesis that the model's intercept and slope coefficients are constant over time and across entities (POLS model). Additionally, the IM test (White) and White test (1980) results (Table 4) rejected the hypothesis of homoscedasticity of error terms, indicating non-normally distributed residuals and supporting the use of panel data.

The LM Breusch-Pagan and Hausman tests were conducted to select the appropriate panel data estimator. The Breusch-Pagan test result (p-value 0.000) rejected the null hypothesis that the variance of residuals reflecting individual differences is zero (POLS). Finally, the Hausman test rejected its null hypothesis (p-value 0.000), indicating that the fixed-effects estimator is more appropriate.

Based on the test results presented in Table 4 and Appendices B, C, and D, this study adopted fixed effects as the panel data estimator for Equations (5), (6), (7), and (8). Following this, Equation (5) was estimated to assess the relationship between financial constraints (FC) and earnings management (EM), expressed as follows: $DA_{i,t} = \beta_0 + \beta_1 FC_{i,t} + \beta_2 SIZ_{i,t} + \beta_3 LEV_{i,t} + \beta_4 GROW_{i,t} + \varepsilon_{i,t}$.

Initially, data normality was assessed using the Shapiro-Wilk and Shapiro-Francia tests; both rejected the null hypothesis of normal data distribution (p-value 0.00) with 1% statistical significance. To detect potential autocorrelation issues, the

Durbin-Watson and Breusch-Godfrey tests were conducted, both of which failed to reject the null hypothesis of no autocorrelation (p-value 0.7773; p-value 0.7773).

The Breusch-Pagan/Cook-Weisberg test (p-value 0.000) was performed to analyze residual normality. Given the statistically significant result, heteroscedasticity was identified in the residuals. Finally, the Variance Inflation Factor (VIF) test showed an average VIF of 1.70, suggesting no multicollinearity issues, as the value is close to 1.0.

After verifying the assumptions of linear regression, the relationship between FC and DA was examined, as presented in Table 4.

Table 4
Estimation Results for POLS, Fixed Effects, and Random Effects Models: Relationship between FC and EM

Earnings Management (EM)	Discretionary Accruals (DA)		Discretionary Accruals (DA)		Discretionary Accruals (DA)	
194 firms	coefficient	p-value	coefficient	p-value	coefficient	p-value
Financial Constraints	– 0.266	0.000***	– 0.127	0.001***	– 0.153	0.000***
Size	– 4.563	0.000***	– 3.400	0.000***	– 3.868	0.000***
Leverage	0.295	0.000***	0.064	0.050**	0.080	0.013**
Growth	0.184	0.000***	0.038	0.024**	0.054	0.011**
_constant	6.991	0.000***	5.521	0.000***	6.143	0.000***
n° observations	1,495		1,495		1,495	
Prob > F		0.000		0.000		0.000
R^2 *adjust*	0.168					
R^2 *within*			0.032		0.032	
R^2 *between*			0.176		0.180	
R^2 *overall*			0.125		0.130	
sigma_u			0.3667		0.3470	
sigma_e			0.1886		0.1890	
Rho			0,7908		0,7720	
Estimator	*Pooled Least Square*		Fixed Effects (robust)		Random Effects	
Chow Test / chi²	75.22		10.90		76.15	
Prob > F		0.000		0.000		0.000
IM-Test / chi²	313.78					
Prob > F		0.000				
Breusch-Pagan / chi²					2457.93	
Prob > F						0.000
Hausman Test					12.34	
Prob > F						0.015

Source: Developed by Authors.

In analyzing Equation 5, estimated using robust fixed effects, an inverse relationship was found between financial constraints (FC) and earnings management (EM), with statistical significance at the 1% level. This suggests that companies' tendency to manage earnings diminishes as they face increased credit rationing. This is a key finding, as it implies that financially constrained firms might be less likely to engage in EM to avoid limitations in securing the credit needed for operational leverage, as seen in studies by Linck et al. (2013), Farrell, Unlu and Yu (2014), and Hao and Li (2016).

Linck et al. (2013) observed that firms with FC and good investment opportunities displayed significantly higher discretionary accruals before making investments than firms without FC. Farrell et al. (2014) found that FC increased discretionary accruals for firms prone to EM. Similarly, Hao and Li (2016) noted that financially constrained firms had higher discretionary accruals than unconstrained firms, which were related to anticipated external financing. Although FC is associated with high costs for obtaining external capital – characterized by credit rationing (Kaplan & Zingales, 1997; Lamont et al., 2001; Camargo & Carvalho, 2022) – Almeida and Campello (2001) indicated that there is a limit to the external funds available to financially constrained firms. Thus, different levels of debt financing led to varying levels of EM (Thanh, Canh & Hà, 2020).

The inverse relationship between FC and EM (Table 4) can be explained by the nonlinear relationship between the two variables (Thanh et al., 2020), as debt financing levels influence EM practices. Furthermore, the high costs associated with EM for financially constrained firms may deter such practices, as companies may need to perceive sufficient benefit to justify the manipulation.

According to Mu, Wang, and Yang (2017), if debt ratios exceed a certain level, managers may adopt the opposite behavior by refraining from EM due to the rising costs. Therefore, managers should monitor optimal debt levels to help reduce bankruptcy risk for their firms.

As Chang, Kao, and Chen (2018) found, EM can impact cash liquidity. They observed that, between 1989 and 2014, companies in the I/B/E/S and CRSP databases engaged in EM showed a deterioration in cash liquidity, especially pronounced in financially constrained firms. The authors noted that FC heightened the cost of using EM while emphasizing the benefits of maintaining cash reserves.

In this context, the result shown in Table 4 aligns with the notion that FC limits the use of EM, thereby preventing significant reductions in cash reserves by investors when companies face high credit rationing. In summary, this inverse relationship is explained by FC's effect on increasing the costs associated with EM and the benefits of maintaining cash reserves.

Although several studies associate FC positively with EM (Park & Shin, 2004; Linck et al., 2013; Camargo & Carvalho, 2022), aiming to mitigate risk or earnings volatility and influence investor perceptions, other studies have reported divergent findings (Thanh et al., 2020; Ghorbani & Salehi, 2020).

Considering the statistical significance of the econometric model (Equation 5), it can be inferred that financially constrained firms manage their earnings. Additionally, smaller Brazilian firms, with positive parameters for leverage and

growth, engage more in EM, as observed by Iatridis and Dimitras (2013), Habib et al. (2013), and Flores et al. (2016).

Earnings management (EM) practices can increase or decrease due to adopting investment policies on internal or external financing in financially constrained companies. Accompanied by both positive and negative effects, EM indicates that there may be a trade-off involved. Its evolution can occur to attract external resources (Ghorbani & Salehi, 2020) and leverage operations and projects without disrupting activities.

On the other hand, adopting internal or external financing for companies facing credit rationing can negatively impact firm value at certain levels of EM. When companies facing financial constraints maintain high levels of management to reduce credit rationing, they incur additional financing costs and increased credit risk. These factors can lead to situations of default or even potential bankruptcy.

Given these considerations, it is understood that financially constrained Brazilian companies exhibit lower levels of EM due to the high debt costs they face. Thus, an optimal level of EM balances costs and benefits.

Based on these observations, Hypothesis 1 is rejected due to the inverse relationship between EM and FC, contrary to the inferences made throughout the text. However, the results indicated statistical significance at the 1% level.

Continuing with the study's hypotheses, Table 5 presents the results for the relationship between FC and EM, which is intensified by economic scenarios involving economic crises, exchange rate increases, and interest rate hikes, as specified in Equations (6), (7), and (8).

$$DA_{i,t} = \beta_0 + \beta_1 FC_{i,t} + \beta_2 CRI_t + \beta_3 (FC_{i,t} \times CRI_t) + \beta_4 SIZ_{i,t} + \beta_5 LEV_{i,t} + \beta_6 GRO_{i,t} + \varepsilon_{i,t} \quad \textbf{(6)}$$

$$DA_{i,t} = \beta_0 + \beta_1 FC_{i,t} + \beta_2 EXCH_t + \beta_3 (FC_{i,t} \times EXCH_t) + \beta_4 SIZ_{i,t} + \beta_5 LEV_{i,t} + \beta_6 GRO_{i,t} + \varepsilon_{i,t} \quad \textbf{(7)}$$

$$DA_{i,t} = \beta_0 + \beta_1 FC_{i,t} + \beta_2 INTR_t + \beta_3 (FC_{i,t} \times INTR_t) + \beta_4 SIZ_{i,t} + \beta_5 LEV_{i,t} + \beta_6 GRO_{i,t} + \varepsilon_{i,t} \quad \textbf{(8)}$$

The results indicated a rejection of normal data distribution and the absence of autocorrelation (Equation 6: p-value 0.000 and p-value 0.1994; Equation 7: p-value 0.000 and p-value 0.1783; Equation 8: p-value 0.000 and p-value 0.1766). Heteroscedasticity was also confirmed in the residuals, as was the absence of multicollinearity (Equation 6 VIF: 2.01; Equation 7 VIF: 3.42; Equation 8 VIF: 2.00).

After analyzing these diagnostic tests, POLS, fixed effects (FE), and random effects (RE) estimations were conducted. Consistent with Equation (5), the tests indicated that the fixed effects estimation was appropriate. Table 5 presents the results of the three estimations moderated by the economic crisis, exchange rate, and interest rate using fixed effects (with robust standard errors).

Table 5
Fixed Effects (FE) Estimation Results for the Relationship between FC and EM, Moderated by Economic Crisis, Exchange Rate, and Interest Rate

Earnings Management	*Equation 6 Crisis Moderation*		*Equation 7 Exchange Moderation*		*Equation 8 Interest Moderation*	
194 firms	coefficient	p-value	coefficient	p-value	coefficient	p-value
Financial Constraints FC	– 0.120	0.001***	– 0.079	0.060*	– 0.125	0.001***
Crisis	0.041	0.006***				
FC x Crisis	– 0.027	0.046**				
Exchange Rate			0.017	0.057*		
FC x Exchange			– 0.061	0.020**		
Interest Rate					0.015	0.333
FC x Interest					– 0.004	0.866
Size	– 3.685	0.000***	– 3.346	0.000***	– 3.320	0.000***
Leverage	0.062	0.058*	0.065	0.047*	0.063	0.052*
Growth	0.047	0.026**	0.047	0.028**	0.048	0.025**
_constant	5,890	0.000***	5.435	0.000***	5.408	0.000***
n° observations	1,495		1,495		1,495	
Prob > F		0.000		0.000		0.000
R^2 *within*	0.038		0.037		0.033	
R^2 *between*	0.175		0.173		0.177	
R^2 *overall*	0.122		0.128		0.123	
sigma_u	0.3651		0.3676		0.3671	
sigma_e	0.1881		0.1883		0.1886	
Rho	0.7902		0.7922		0.7911	
Estimator	Fixed Effects (robust)		Fixed Effects (robust)		Fixed Effects (robust)	
Chow Test / chi²	8.71		8.37		7.52	
Prob > F		0.000		0.000		0.000

Source: Developed by Authors.

Initially, comparing the effects of financial constraints (FC) across the three moderated models reveals statistically significant results for financially constrained firms. Significance levels were at 1% when moderated by crisis and interest rates and 10% when moderated by the exchange rate. Interestingly, the crisis moderation positively affected ($\beta_2 + \beta_3 = 0.041 - 0.027$) the relationship between FC and earnings management (EM). In contrast, although significant, the exchange rate moderation negatively affected this relationship ($\beta_2 + \beta_3 = 0.017 - 0.061$). Meanwhile, interest rate moderation was not statistically significant but displayed a positive effect ($\beta_2 + \beta_3 = 0.015 - 0.004$).

Control variables such as size, leverage, and growth were statistically significant across all models moderated by economic crisis, exchange rate, and interest rate. Size showed 1% significance with a negative coefficient, leverage

had 10% significance with a positive coefficient, and growth had 5% significance with a positive coefficient.

The negative relationship of size indicates that larger firms exhibited higher information quality and lower accrual variability. The positive leverage coefficient aligns with DeFond and Jiambalvo (1994), who suggest that firms engage in EM to avoid contract violations and secure favorable terms from creditors. The positive growth coefficient implies that higher growth rates correspond to increased discretionary accruals, as expanding firms generate internal resources or access financial markets (Iatridis & Dimitras, 2013; Sincerre et al., 2016; Flores et al., 2016).

Examining the crisis moderation effect, the positive sign ($\beta_2 + \beta_3 = 0.041 - 0.027 = 0.014$) and the intercept ($\beta_0$ = 5.890) indicate that financially constrained firms facing credit rationing during socioeconomic crises engage more in EM than in non-crisis periods. Comparing this model's intercept (Equation 6) with the unmoderated model (Equation 5) suggests an approximate 7% increase in EM in crisis periods.

During crises, managers face pressure to make immediate, short-term decisions to ensure organizational continuity (Asel et al., 2011). In this situation, constrained firms may turn to EM to meet targets, improve working capital management, and preserve cash reserves, enabling them to finance internal activities.

Consistent with these findings, studies by Iatridis and Dimitras (2013) and Silva et al. (2014) highlighted that crises influence managers to engage in EM. Paulo and Mota (2019) observed elevated EM during economic contractions from 2000 to 2015, which declined during economic recovery. Similarly, Machado et al. (2012) found that negative discretionary accruals were used to maximize profitability during the 2009 recession compared to the 2007 expansion.

Tortoli and Moraes (2018) supported this study's findings by finding that financial constraints intensified EM practices in Latin American firms during financial crises. Therefore, Hypothesis 2 – that there is a significant and positive relationship between FC and EM when moderated by economic crises – is not rejected.

Unlike crisis moderation, exchange rate moderation negatively impacted the FC-EM relationship. The negative coefficient ($\beta_2 + \beta_3 = 0.017 - 0.061 = -0.044$) and intercept ($\beta_0$ = 5.435) suggest that firms facing credit rationing during currency depreciation engaged less in EM. Comparing this intercept (Equation 7) to the unmoderated model (Equation 5) shows approximately a 2% reduction in EM during periods of high exchange rates.

Studies investigating exchange rate influences on EM (Santos & Paulo, 2006; Chang et al., 2013; Sticca, 2018; Lock et al., 2019) found that exchange rate volatility often motivates EM as a means of deferring currency losses. However, the current study finds that financially constrained firms reduce EM during high exchange rate volatility, likely due to economic uncertainty.

Economic uncertainty is one reason constrained firms reduce EM during high exchange rate volatility. High exchange rates may inhibit managers from engaging in EM, as the benefits could be more evident. For exporting companies,

currency depreciation leads to financial gains from foreign currency contracts, thus making EM unnecessary.

According to Xu and Guo (2021), currency depreciation in traditional trade models incentivizes exports. However, this effect may be mitigated for financially constrained firms as high exchange rates increase fixed export costs, making expansion challenging. The FC may explain the inverse relationship observed in Table 5, as FC interferes with a company's response to exchange rate fluctuations (Xu & Guo, 2021; Sequeira, 2021). Furthermore, Xu and Guo (2021) noted that firms with profits could export but might lack liquidity to cover export costs, supporting the notion that EM does not yield benefits without liquidity.

Chen et al. (2022) also observed that the intensity of financial constraints directly impacted currency transmission, finding that financially constrained firms had a higher exchange rate pass-through. Analyzing Chinese firms from 2000 to 2009, the authors found that constrained firms responded more strongly to exchange rate changes. Thus, Hypothesis 3 – there is a significant and positive relationship between FC and EM when moderated by the exchange rate – is rejected, as the relationship was significant but negative.

Finally, the effect of interest rate moderation on the FC-EM relationship was not statistically significant in this model. Therefore, Hypothesis 4 – that there is a significant and positive relationship between FC and EM when interest rates moderate it – is rejected.

Despite the rejection of Hypothesis 4, the positive coefficient aligns with expectations, suggesting that firms may be incentivized to engage in EM during periods of rising Selic rates to improve their debt profile. Managers may seek to secure larger loans at lower interest rates through EM by presenting a favorable financial position (Watts & Zimmerman, 1986; Frame et al., 2001). However, creditors tend to raise interest rates for companies that engage heavily in EM due to perceived repayment risk.

In this context, financially constrained firms may also be incentivized to manage earnings, as national economic policies and international factors such as exchange rate and Selic rate fluctuations influence them. Under these economic conditions, constrained firms are motivated to manage earnings to ease credit access, reduce financing costs, and avoid disclosing financial difficulties (Park & Shin, 2004; Camargo & Carvalho, 2022).

An important consideration for the insignificance of the Selic rate moderation in the specified model (Equation 8) is the lag effect in monetary policy transmission. Decisions by the Monetary Policy Committee (COPOM) on the Selic rate typically impact the economy after approximately eight months. This delay likely contributes to this model's lack of statistical significance for interest rate moderation.

5 CONCLUSIONS

The disclosure of economic and financial results is a communication channel between publicly traded companies and stakeholders. However, the quality of these disclosures may be compromised by earnings management,

which aims to keep information that could affect set goals and future investments private. In this context, credit rationing, even if temporary, acts as a motivational factor for companies to engage in EM. Financial constraints occur when an entity relies on external capital offered at a premium cost that does not accurately reflect its level of risk.

This study aimed to achieve two main objectives: first, to analyze the relationship between FC and EM in Brazilian publicly traded companies, and second, to explore the relationship between FC and EM under various economic conditions.

Four hypotheses were developed to address these goals. The first hypothesis posited a significant positive relationship between FC and EM through accruals. Based on the findings, this hypothesis was rejected, as despite the statistical significance of the FC and EM relationship, an inverse relationship was found, contrary to the expected direction. This negative result is explained by the non-linear relationship between constrained companies and EM, consistent with the studies of Portal et al. (2012), Ghorbani and Salehi (2020), and Thanh et al. (2020).

The second hypothesis proposed a significant positive relationship between FC and EM through accruals moderated by economic crises. This hypothesis was not rejected, suggesting that economic crises influence financially constrained firms to engage in EM, as observed by Machado et al. (2012), Iatridis and Dimitras (2013), Silva et al. (2014), Paulo and Mota (2019), and Tortoli and Moraes (2018).

The third hypothesis assumed a significant positive relationship between FC and EM through accruals moderated by the exchange rate. This hypothesis was rejected because, despite statistical significance, a negative relationship was identified, contrary to expectations. A possible explanation for this negative relationship lies in the economic uncertainty associated with currency depreciation, which may discourage managers from engaging in EM due to uncertain future outcomes. FC may also justify this inverse relationship, as Xu and Guo (2021) and Sequeira (2021) found that FC affects firms' responses to exchange rate fluctuations. Chen et al. (2022) also noted that FC influences exchange rate transmission.

The fourth hypothesis proposed a significant positive relationship between FC and EM through accruals moderated by the interest rate. However, this hypothesis was rejected because the effects of interest rates were not statistically significant.

In conclusion, the findings confirm that financially constrained Brazilian companies manage their earnings, with this relationship intensifying in adverse economic scenarios. This study brings originality and innovation by identifying that the relationship between FC and EM is not linear; the level of EM varies depending on the degree of financial constraint a company faces. By providing evidence of a non-linear relationship between FC and EM, this study contributes to the literature by highlighting the specific characteristics of Brazilian publicly traded firms.

The negative relationship between constrained firms and EM presents an opportunity for future research. One suggestion is to estimate the optimal debt cost threshold that encourages EM, considering a non-linear relationship. Another

suggestion is to examine the lag effect of interest rates on the relationship between constraints and EM to assess the significance of this delayed effect.

Despite the methodological rigor, this study has limitations regarding the metrics used to classify companies by their constraints. International metrics were employed to assess financial constraint conditions, but more specific research needs to be conducted to address these metrics for domestic companies.

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APPENDIX A – Correlation Matrix

	GR	RF	Size	Leverage	Growth	Crisis	Exchange rate	Interest rate	RF*Crisis	RF*TC	RF*TJ
GR	1.0000										
RF	0.0120	1.0000									
	0.6417										
Size	-0.2367	-0.7486	1.0000								
	0.0000	**0.0000**									
Leverage	0.1306	-0.2361	0.2524	1.0000							
	0.0000	**0.0000**	**0.0000**								
Growth	0.1980	0.1495	-0.2234	-0.0115	1.0000						
	0.0000	**0.0010**	**0.0000**	0.6557							
Crisis	0.0309	0.0130	0.0255	0.0096	0.0042	1.0000					
	0.2325	0.6166	0.3248	0.7121	0.8700						
Exchange rate	-0.0229	-0.0014	0.0243	0.0144	-0.0412	-0.1467	1.0000				
	0.3759	0.9555	0.3477	0.5786	0.1110	**0.0000**					
Interest rate	0.0220	0.0106	-0.0125	-0.0006	0.0165	0.5928	-0.1730	1.0000			
	0.3953	0.6821	0.6282	0.9805	0.5248	**0.0000**	**0.0000**				
RF*Crisis	0.0097	0.4841	-0.3446	-0.1209	0.0868	0.6285	-0.0969	0.3751	1.0000		
	0.7073	**0.0000**	**0.0000**	**0.0000**	**0.0008**	**0.0000**	**0.0002**	**0.0000**			
RF*TC	-0.0055	0.8413	-0.6252	-0.1926	0.1037	-0.0487	0.3824	-0.0613	0.3340	1.0000	
	0.8321	**0.0000**	**0.0000**	**0.0000**	**0.0001**	**0.0599**	**0.0000**	**0.0178**	**0.0000**		
RF*TJ	0.0023	0.4631	-0.3401	-0.1039	0.0635	0.3807	-0.1155	0.6352	0.6853	0.3021	1.0000
	0.9304	**0.0000**	**0.0000**	**0.0001**	**0.0141**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	

Source: Developed by Authors. RF (Financial Constraints); Tx (Rate); TC (Exchange Rate); TJ (Interest Rate).

APPENDIX B – Results Estimation moderated by the Crisis

Earnings Management (EM)	Discretionary Accruals (DA)		Discretionary Accruals (DA)		Discretionary Accruals (DA)	
194 firms	coefficient	p-value	coefficient	p-value	coefficient	p-value
Financial Constrainsts	– 0,253	0,000***	– 0,127	0,001***	– 0,148	0,000***
Crisis	0,057	0,029***	0,046	0,006***	0,043	0,003***
Financial Constrainsts. x Crisis	– 0,042	0,054*	– 0,027	0,048**	– 0,029	0,162
Size	– 4,600	0,000***	– 3,690	0,000***	– 4,057	0,000***
Leverage	0,294	0,000***	0,062	0,058*	0,078	0,015**
Growth	0,184	0,000***	0,047	0,026**	0,053	0,012**
_constant	7,020	0,000***	5,890	0,000***	6,384	0,000***
n° observations	1495		1495		1495	
Prob > F		0,000		0,000		0,000
R² *adjust*	0,170					
R² *within*			0,038		0,038	
R² *between*			0,175		0,183	
R² *overall*			0,122		0,130	
sigma_u			0,3651		0,3441	
sigma_e			0,1881		0,1880	
rho			0,7902		0,7699	
Estimator	*Pooled Least Square*		Fixed Effects (robust)		Random Effects	
Chow Test / chi²	51,11		8,71		86,39	
Prob > F		0,000		0,000		0,000
IM-Test / chi²	329,12					
Prob > F		0,000				
Breusch-Pagan / chi²					2471,47	
Prob > F						0,000
Hausman Test					16,89	
Prob > F						0,0097

Source: Developed by Authors. *** indicates significance at the 1% level; ** indicates significance at the 5% level; * indicates significance at the 10% level.

APPENDIX C – Results Estimation moderated by the Exchange Rate

Earnings Management (EM)	Discretionary Accruals (DA)		Discretionary Accruals (DA)		Discretionary Accruals (DA)	
194 firms	coefficient	p-value	coefficient	p-value	coefficient	p-value
Financial Constraints	– 0,230	0,000***	– 0,079	0,060*	– 0,106	0,007***
Exchange Rate (TC)	0,014	0,675	0,017	0,057*	0,200	0,288
Financial Constraints x TC	– 0,044	0,357	– 0,061	0,020**	– 0,061	0,022**
Size	– 4,567	0,000***	– 3,346	0,000***	– 3,878	0,000***
Leverage	0,296	0,000***	0,065	0,047*	0,081	0,011**
Growth	0,183	0,000***	0,047	0,028**	0,054	0,013**
_constant	6,983	0,000***	5,435	0,000***	6,141	0,000***
n° observations	1495		1495		1495	
Prob > F		0,000		0,000		0,000
R^2 *adjust*	0,165					
R^2 *within*			0,037		0,037	
R^2 *between*			0,173		0,177	
R^2 *overall*			0,128		0,131	
sigma_u			0,3676		0,3399	
sigma_e			0,1883		0,1883	
rho			0,7922		0,7652	
Estimator	*Pooled Least Square*		Fixed Effects (robust)		Random Effects	
Chow Test / chi²	50,27		8,37		83,05	
Prob > F		0,000		0,000		0,000
IM-Test / chi²	318,54					
Prob > F		0,000				
Breusch-Pagan / chi²					2464,42	
Prob > F						0,000
Hausman Test					6,05	
Prob > F						0,000

Source: Developed by Authors. *** indicates significance at the 1% level; ** indicates significance at the 5% level; * indicates significance at the 10% level.

APPENDIX D – Results Estimation Moderated by Interest Rate

Earnings Management (EM)	Discretionary Accruals (DA)		Discretionary Accruals (DA)		Discretionary Accruals (DA)	
194 firms	coefficient	p-value	coefficient	p-value	coefficient	p-value
Financial Constraints	– 0,256	0,000***	– 0,125	0,001***	– 0,152	0,000***
Interest rate (TJ)	0,027	0,300	0,015	0,333	0,014	0,342
Financial Constraints x TJ	– 0,028	0,459	– 0,004	0,866	– 0,005	0,804
Size	– 4,563	0,000***	– 3,320	0,000***	– 3,840	0,000***
Leverage	0,295	0,000***	0,063	0,052*	0,080	0,012**
Growth	0,184	0,000***	0,048	0,025**	0,053	0,012**
_constant	6,991	0,000***	5,408	0,000***	6,100	0,000***
n° observations	1495		1495		1495	
Prob > F		0,000		0,000		0,000
R^2 *adjust*	0,165					
R^2 *within*			0,033		0,033	
R^2 *between*			0,177		0,181	
R^2 *overall*			0,123		0,130	
sigma_u			0,3671		0,3392	
sigma_e			0,1886		0,1886	
rho			0,7911		0,7638	
Estimator	*Pooled Least Square*		Fixed Effects (robust)		Random Effects	
Chow Test / chi²	50,29		7,52		78,41	
Prob > F		0,000		0,000		0,000
IM-Test / chi²	313,78					
Prob > F		0,000				
Breusch-Pagan / chi²					2458,65	
Prob > F						0,000
Hausman Test					230,36	
Prob > F						0,000

Source: Developed by Authors. *** indicates significance at the 1% level; ** indicates significance at the 5% level; * indicates significance at the 10% level.