

ARTICLE

Influence of Economic Cycles on the Relationship of Earnings Management and Insolvency of Publicly Traded Companies

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ABSTRACT

The aim of this study is to analyze the influence of economic cycles on the relationship between earnings management and insolvency of publicly traded companies listed on the Brasil, Bolsa, Balcão (B3) stock exchange, from 2010 to 2019. For this purpose, the propensity for earnings management (the quality of discretionary accruals) among both insolvent and financially healthy companies, was analyzed during four phases of economic fluctuations based on variations in Gross Domestic Product (GDP)—expansion and recovery (high), and recession and contraction (low). Insolvency was examined by balance, cash flow, and by the propensity for corporate financial distress, treated by the Z-score. The results indicate that although there is a significant influence of insolvency on the propensity for earnings management, a higher level of insolvency would not necessarily increase earnings management through discretionary accruals. Furthermore, economic cycles influence the relationship between management and corporate insolvency differently, indicating greater influence in the analyzed relationship during periods of high economic activity.

KEYWORDS

Economic Cycles, Earnings Management, Insolvency.

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RESUMO

O objetivo do estudo é analisar a influência dos ciclos econômicos na relação do gerenciamento de resultados com a insolvência de empresas de capital aberto listadas na Brasil, Bolsa, Balcão (B3), no período de 2010 a 2019. Para tanto, analisou-se a propensão ao gerenciamento de resultados (qualidade dos *accruals* discricionários) de companhias insolventes e financeiramente saudáveis durante as quatro fases de oscilações econômicas embasadas na variação do Produto Interno Bruto (PIB): expansão e recuperação (alta); recessão e contração (baixa). Examinou-se a insolvência por saldo, por fluxo e pela propensão ao *financial distress* empresarial, tratada pelo Z-score. Os resultados apontam que, embora exista uma influência significativa da insolvência na propensão ao gerenciamento de resultados, não necessariamente um maior nível de insolvência aumentaria o gerenciamento de resultados por *accruals* discricionários. Ainda, os ciclos econômicos influenciam de forma distinta a relação do gerenciamento com a insolvência empresarial, denotando maior influência na relação analisada em períodos de alta econômica.

PALAVRAS-CHAVE

Ciclos Econômicos, Gerenciamento de Resultados, Insolvência.

1. INTRODUCTION

One of the objectives of accounting is to synthesize relevant data regarding the performance of an entity in order to provide useful information to a wide range of users. With this, it is presupposed that the financial information disclosed will be of quality and will strive to represent the company's situation more faithfully. However, Agency Theory posits that the separation of ownership from control of capital creates a contractual obligation between the principal (shareholder) and the agent (manager) permeated by conflicts of interest (Jensen & Meckling, 1976). Such conflicts can be further aggravated in periods of extreme financial difficulty, making managers more susceptible to the use of earnings management practices (Coelho et al., 2017).

One of the factors that may signal that the company is worsening its financial situation is corporate insolvency. According to Altman and Hotchkiss (2010), insolvency corresponds to the organization's inability to pay its debts, based on its cash flows; or when total liabilities exceed asset value, when related to corporate balances. One of the concerns of companies in this state of insolvency is tied to the possibility of credit to prevent further deterioration. Therefore, incentivized by contractual clauses for current lines of credit, and future credit, prospecting with other creditors (Coelho et al., 2017), companies may be encouraged to manage their results to maintain their covenant-agreed numbers (Healy & Whalen, 1999; Watts & Zimmerman, 1990).

According to Becker et al. (1998), to achieve the expected financial results for the company, managers tend to take advantage of the informational asymmetry that arises from agency conflicts to make use of alternative accounting choices. In situations where covenant contracts are violated, not only does available credit present a higher agency cost, but contractual breaches may give the creditor the right to immediate reimbursement of amounts owed by the borrower (Dyrenge et al., 2020), which may lead to even greater financial distress for companies already in a state of insolvency. In this context, by using accruals adjustments, also known as accruals, earnings management is carried out, generating discretionary accruals aimed at inducing market perception regarding their financial image (Cupertino et al., 2016).

Earnings management by insolvent companies may be further exacerbated in periods of economic downturn (Habib et al., 2013), with this being an influencing factor in the decision-making process of company directors operating in these markets (Paulo & Mota, 2019). Unlike periods of economic growth (expansion and recovery), where governments tend to provide commercial incentives to companies (Warner & Zheng, 2013) and these tend to exhibit more optimistic behaviors and higher marginal efficiency of capital levels (Kothari et al., 2014), in periods of economic decline, such as recession and contraction, market and investment uncertainties are greater, generating higher agency costs (Corradi, 2016), as well as reduced company investments for potential financial distress mitigation (Halling et al., 2016).

In cases where companies already exhibit financial insolvency, uncertainties are further exacerbated, as are credit interest rates, and even the maintenance of already contracted credit lines, making earnings management even more prevalent in periods of economic decline (Trombetta & Imperatore, 2014). These arguments are corroborated by the study of Habib et al. (2013), which analyzed the reality of companies in New Zealand that had recently undergone an economic crisis, demonstrating that managers of struggling companies were more engaged in earnings management practices than healthy firms. Furthermore, managers themselves—in times of crisis—may report higher earnings in order to not decrease their compensation, due to reputational concerns, or even the possibility of losing their jobs (Bergstresser & Philippon, 2006).

Considering that insolvent companies tend to exhibit a higher propensity to manage their earnings (Becker et al., 1998; Coelho et al., 2017), as well as economic environment fluctuations may affect the discretionary decision-making behavior related to organizational outcomes (Habib et al. 2013; Paulo & Mota, 2019; Trombetta & Imperatore, 2014), the research problem is raised: “What is the influence of economic cycles on the association of earnings management with the insolvency of companies listed on the Brasil, Bolsa, Balcão (B3)?”. Therefore, the aim was to analyze the influence of economic cycles on the relationship between earnings management and the insolvency of publicly traded companies listed on the B3 from 2010 to 2019.

As for methodology, the study uses panel data multiple regression for 172 non-financial publicly traded companies. Thus, economic cycles were measured using Schumpeter’s metric (1939), based on the variation of Gross Domestic Product (GDP) to classify the four phases of economic cycles: expansion, recovery (high); recession and contraction (low). For earnings management analysis, accruals quality was used, through discretionary accruals resulting from the application of the Modified Jones (Dechow et al., 1995) and Pae (2005) models. Regarding corporate insolvency, three proxies were examined: balance sheet insolvency, cash flow insolvency, and the propensity for corporate financial distress, treated by the Z-score estimated from the insolvency of the companies composing the sample of this research.

Meanwhile, the results of the research elucidate that, when analyzing balance sheet insolvency and the Z-score, insolvent companies exhibit a higher propensity for earnings management than financially healthy ones, corroborating existing literature (Li et al., 2020; Martins & Ventura, 2020). However, contrary to expectations (Coelho et al., 2017; Queiroz & Dias, 2018), companies insolvent by cash flow shows a lower propensity for earnings management through discretionary accruals compared to financially healthy companies for the analyzed sample, when not considering the stages of economic cycles.

Regarding the influence of economic cycles, it was found that, for the three insolvency proxies, financially healthy companies show a positive relationship between economic downturns and a higher propensity for earnings management, in line with the literature (Habib et al., 2013; Paulo & Mota, 2019; Trombetta & Imperatore, 2014). When considering the stages of economic cycles,

insolvent companies showed mixed results, with only cash flow insolvency indicating a positive relationship with economic downturn cycles and the propensity for earnings management, suggesting different strategies and discretionality for companies in each phase of the economy.

The study is based on Agency Theory (Jensen & Meckling, 1976), aiming to elucidate to external users the practices of results manipulation linked to the financial health of companies throughout a country's economic variations. Thus, it aims to provide analysis parameters for the continuity of entity operations, optimization of decision-making, and even prevention of future financial problems through the reduction of informational asymmetry. It can be emphasized that, among the contributions of this study, discussion is fostered on the topic of earnings management, in an emerging nation where entities tend to exhibit greater financial and economic instability, generating incentives for the manipulation of agency costs in relation to insolvency costs (Terreno et al., 2017).

Unlike previous research that analyzed earnings management for insolvent companies in crisis scenarios (Habib et al., 2013), the present study stands out not only by analyzing different phases of economic cycles and their characteristics regarding incentives for management, but also by the robustness of the analysis of management results by different models for estimating discretionary accruals and their robustness for positive and negative accruals in these scenarios.

Furthermore, it fosters debate regarding the relationship between corporate insolvency and earnings management in each period of the economic cycles, to characterize the idiosyncrasies attributed to each stage and their influence on results manipulation for financially insolvent companies compared to financially healthy ones. Another aspect related to the relevance of the research is based on the segmented analysis of corporate insolvency in these relationships, through their balances and flows, treated as accounting and market insolvency, respectively, as well as the financial distress indicator (Z-score), analyzed through accounting and market variables, with a model re-estimated for the specific reality of the companies under study. Thus, this study helps users of information understand the financial complexities associated with each aspect of corporate insolvency in relation to results manipulation in the face of economic fluctuations.

2. THEORETICAL FRAMEWORK

2.1. EARNINGS MANAGEMENT

Earnings management occurs when managers intentionally utilize the subjectivity of accounting standards to intervene in the financial statement's disclosure process, influencing users' perception of the entity's economic performance (Healy & Wahlen, 1999). According to Domingos et al. (2017), it involves the intentional alteration of the company's accounting results, driven by the pursuit of achieving and/or meeting specific motivations.

As measures of such results manipulation, there is the discretion of managers' judgment in alternative accounting choices (discretionary accruals), as well as in operational decisions derived from business best practices (Cupertino et al., 2016; Gunny, 2010; Roychowdhury, 2006). Discretionary accruals are considered the main form of results management, with accruals being all accounts that are part of the company's net income but not part of its cash flow (Li et al., 2020; Martinez, 2001).

Martinez (2001) considers three types of earnings management. Target earnings result from improvements or deteriorations in accounting results depending on established contractual targets (Kasanen et al., 1996; McNichols, 2000; Guidry et al., 1999); income smoothing occurs when results are manipulated to stabilize their fluctuations (Barnea et al., 1976; Givoly & Ronen,

1981; Hayn, 1995; Burgstahler & Dichev 1997); and finally, take bath accounting, or big bath accounting, is characterized by the reduction of accounting results with the purpose of increasing future results (Walsh et al., 1991). It can be considered that this manipulation becomes possible through conflicts of interest arising from Agency Theory, which elucidates that the contractual relationship between the principal and the agent is not harmonious regarding the quantity and quality of information (Jensen & Meckling, 1976). In this context, Oliveira (2008) exposes that managers tend to manage results whenever there are sufficiently advantageous reasons for them or the company that outweigh the costs associated with manipulation.

2.2. CORPORATE INSOLVENCY AND EARNINGS MANAGEMENT

A company is in financial distress when its cash flows are insufficient to cover its current contractual obligations (Wruck, 1990), amplifying conflicts of interest and leaving users most in need of information vulnerable to informational asymmetry. However, a company is only considered insolvent when its financial situation reaches its maximum deterioration, rendering it unable to meet its obligations or settle its debts (Perez, 2008).

A company's insolvency may be associated with both balances, when the organization has negative net worth, and flows, when the resources generated by operational activities are insufficient to meet the commitments made (Altman & Hotchkiss, 2010). Mário and Aquino (2012) emphasize the importance of distinguishing the state of corporate insolvency, characterized by the company's inability to fulfill its commitments, from the state of corporate bankruptcy, defined as the breach of all contractual obligations rendering the company economically unviable. In such cases, companies require greater capital injection from third parties to continue their activities and honor their contracts with creditors and related parties (Miller & Friesen, 1984).

Managers of these financially troubled companies, pressured by the idea of bankruptcy, tend to manipulate their earnings in order to improve the company's viability and credibility in the market (Rosner, 2003). In line with this, Queiroz and Dias (2018) affirm that insolvent companies are more prone to earnings management aimed at demonstrating an improvement in their financial capacity. Coelho et al. (2017) found that earnings manipulation increased as the financial stress of the entity worsened. One of the potential incentives for earnings management observed in the literature (Healy & Whalen, 1999; Watts & Zimmerman, 1990) is related to the maintenance of companies' covenants regarding their indebtedness, so that these contractual motivations would be directly linked to credit lines—both current and potential future lines with new creditors (Coelho et al., 2017). When a covenant contract is violated, for example, the creditor has the right to demand immediate repayment of the amounts owed by the borrower (Dyrenge et al., 2020), a factor even more concerning if the company is already in a state of financial insolvency, which could even lead to a state of corporate bankruptcy.

Coelho et al. (2017) analyzed the relationship between accounting earnings management and stages of insolvency in publicly traded companies in BRICS countries, using the Modified Jones Model (Dechow et al., 1995) for the earnings management variable calculation, while insolvency was addressed through Altman and Hotchkiss' concept (2010). The research found a significant relationship between flow-based insolvency and earnings management. Correspondingly, Li et al. (2020) confirmed that internal control is a mechanism that helps to restrict earnings management. Additionally, these authors, who investigated companies listed on the China Stock Exchange from 2007 to 2015, also reinforce that companies in financial distress are more likely to manage their results through discretionary accruals.

Based on this literature, Hypothesis 1 (H₁) was raised:

- **H₁:** Companies with higher corporate insolvency show a greater propensity for earnings management in Brazilian publicly traded companies.

2.3. ECONOMIC CYCLES

Economic cycles can be described as the fluctuations in a country's economic activities over a specific period, measurable by variations in real GDP (Paulo & Mota, 2019). Among their characteristics, Burns and Mitchell (1946) state that economic cycles vary in size, amplitude, and duration, and are considered as long-term, asymmetric, and unpredictable oscillations. The National Bureau of Economic Research (NBER) defines a complete economic cycle as the oscillation between recession (GDP decline) and expansion (GDP growth), with cycles measured through troughs and peaks, respectively (Knoop, 2010).

However, Schumpeter (1939) and Burns and Mitchell (1946) argue that economic cycles represent changes in the aggregated economic activity of nations, following a cyclical process based on the alternation of four phases. These phases are marked by periods of growth, which can be divided into expansion and recovery, followed by recessions and contractions, during which there is a decline or stagnation in economic development. According to Mitchell (1927), economic cycles affect the business activity of companies. In this regard, Lagesh et al. (2018) analyzed 87 companies listed on the Indian stock exchange and found that economic cycles were an important macroeconomic variable in entity strategic planning, highlighting the impact of economic cycles on strategic decision-making in the corporate sector overall.

During periods of economic expansion, companies tend to exhibit more optimistic behavior and higher levels of marginal capital efficiency (Kothari et al., 2014), with a greater chance of financial prosperity in a growth-friendly environment. In times of economic recovery, governments tend to provide commercial incentives to companies through tax reductions, labor support, and planning (Warner & Zheng, 2013). Thus, when the recovery phase is reached, the economy tends to stimulate consumption to mitigate the negative impacts of contraction.

According to the literature, during periods of economic slowdown, there is a greater propensity for security litigation (Huijgen & Lubberink, 2001), increased uncertainty among investors and the market (Jenkins et al., 2009), as well as a higher tendency to seek third-party resources (Myers, 1984), requiring initiatives for greater injection of capital into the market through government tax incentives (Halling et al., 2016; Warner & Zheng, 2013). For Halling et al. (2016), during economic downturns, the main theoretical determinants of companies' capital structures undergo significant shocks, such as a decline in their corporate cash flows, leading to variations in the demand for these companies' optimal capital structures.

Therefore, Trombetta and Imperatore (2014) report an increase in informational asymmetry during recessionary periods. This occurs because managers feel pressured by the demands of the investor market, which is reluctant to invest or demands higher returns on their investments. It is understood that agency problems intensify during conflicting periods between the principal and the agent, and that earnings management objectives change according to the severity of the crisis and intensify during recessions.

The relationship between economic downturns and insolvency is also observed in the literature, indicating that during economic crises, companies are more likely to face business insolvency, requiring mechanisms to mitigate agency problems (Coelho, 2016). Thus, the macroeconomic

environment not only can influence companies' earnings management (Habib et al., 2013; Paulo & Mota, 2019) but can also exacerbate problems related to business insolvency (Coelho, 2016).

Habib et al. (2013) examined the influence of the macroeconomic environment by studying how the 2008 global financial crisis affected earnings management in insolvent companies, considering whether manipulation practices changed during this period of instability. The study concluded that managers of financially distressed companies engaged more in earnings management practices that reduced revenues. This practice, considered as a big bath, according to the authors, occurs due to investors' expectations that in "bad" periods, the company will tend to report higher losses, as well as to boost the possibility of reporting high and positive earnings in the post-crisis period. Furthermore, in Paulo and Mota (2019), the influence of the economic environment on earnings management in 247 Brazilian publicly traded companies during the period from 2000 to 2015 was verified. The study showed that managers tend to manage earnings during recession or contraction phases through operational decisions, as well as increasing earnings management through discretionary accruals in the contraction phase and decrease it during the recovery phase.

In this context, based on previous studies, Hypotheses 2 and 3 (H₂ and H₃) are presented.

- **H₂:** In economic downturn (upturn) cycles, there is a higher (lower) propensity for earnings management among Brazilian publicly traded companies.
- **H₃:** Economic downturn (upturn) cycles have a greater (lesser) influence on the relationship between earnings management and insolvency among Brazilian publicly traded companies.

3. METHODOLOGICAL PROCEDURES

Through a quantitative, descriptive, and documentary research approach, panel data regression was conducted to analyze the influence of economic cycles on the relationship between earnings management and insolvency of publicly traded companies listed on the Brasil, Bolsa, Balcão (B3) exchange from 2010 to 2019. Thus, the study was based on data from Economatica® and financial reports available on the B3, collected in August 2020, from all active companies on the B3.

The study population was selected from the total set of 415 Brazilian publicly traded companies listed on the B3. Financial institutions were excluded due to their different results measurement compared to other entities, as well as entities that did not provide all the necessary information, thus making it impossible to conduct a proper analysis using the models used (Peasnell et al., 2000). This resulted in a sample of 172 companies whose data were collected annually, as shown in Table 1.

The selected period is justified due to being the initial period of full adoption of international accounting standards in Brazil. Furthermore, the chosen time interval is initially marked by the economic expansion in 2010, during which the Brazilian GDP reached levels not seen in over 20 years, followed by a deep recession.

Table 1
Sample by Sector

Criteria	Number of Firms	% of Population	% of Sample
Active companies listed on B3	415	100.0%	–
(-) Unavailable at Economatica	65	15.7%	–
(-) Financial sector	77	18.6%	–
(-) Cash flow inconsistencies	101	24.3%	–
(=) Sample	172	41.4%	–
Industrial goods	32	7.7%	18.6%
Communications	4	1.0%	2.3%
Cyclical consumption	50	12.0%	29.1%
Non-cyclical consumption	16	3.9%	9.3%
Basic materials	23	5.5%	13.4%
Oil, gas and biofuels	4	1.0%	2.3%
Health	9	2.2%	5.2%
Information Technology	2	0.5%	1.2%
Public utility	32	7.7%	18.6%

To estimate the influence of corporate insolvency on earnings management, panel data regression was used. Thus, the dependent and independent variables of the research were listed, as shown in Table 2:

Table 2
Definition of study variables

Variables		Sigla	Formula	M	Referência
Dependent	Discretionary Accrual	AC	Discretionary accruals using the Modified Jones model (JM) and Pae (2005) (Pae)	Quanto maior a dispersão dos accruals discricionários (desvio-padrão), maior tende a ser o GR	Dechow et al. (1995) and Pae (2005).
	Insolvency by Balance	ISc	Variable continues when Shareholders' Equity, weighted by the company's total assets, is negative; and 0 otherwise	Quanto maior o valor, maior a insolvência por saldo (valor em módulo)	Adapted of Altman and Hotchkiss (2010) and Coelho et al. (2017).
Independent of Interest	Insolvency by Flow	IFc	Continuous variable when there is a reduction of 30% or more in the share price compared to the previous year, and 0 otherwise	Quanto maior o valor, maior a insolvência por fluxo (valor em módulo)	Altman and Hotchkiss (2010) and Coelho et al. (2017).
	Insolvency by Z-score	Zscorec	Altman Z-score estimated for study reality based on logit regression.	Quanto maior o valor, maior a propensão à insolvência por Z-score	Altman et al. (1979).
	Economic Cycles	Ciclos	Classification for each stage of the cycles (Contraction, Expansion, Recession and Recovery)	Variáveis binárias para cada uma das 4 etapas (sendo 1 quando da sua ocorrência e 0 as demais)	Schumpeter (1939) and Paulo and Mota (2019).

Table 2

Cont.

	Variables	Sigla	Formula	M	Referência
9	Size	TAM	Total Active log	Quanto maior o valor, maior o tamanho	Watts and Zimmerman (1990).
	Control				
	Return on Assets	ROA	operating profit/total assets	Quanto maior o valor, maior o ROA	Bowen et al. (2008).
	Growth	CRE	Total assets _{it} - Total assets _{it-1} / Total assets _{it-1}	Quanto maior o valor, maior o crescimento	Nardi and Nakao (2009).

Source: Prepared from different authors (2020).

The dependent variable in this study is earnings management through discretionary accruals, calculated using the Modified Jones Model (Dechow et al., 1995), as well as the Pae Model (2005). To do so, consistent with the studies of Healy (1985), Jones (1991), and Dechow et al. (1995), the following Equation 1 was used to estimate Total Accruals.

$$TA_{it} = (\Delta AC_{it} - \Delta Disp_{it}) - (\Delta PC_{it} - \Delta Div_{it}) - Depr_{it} \quad (1)$$

In which: TA_{it} = total accruals of company i in period t , weighted by total assets at the beginning of period t ; ΔAC_{it} = change in current assets of company i from the end of period $t-1$ to the end of period t , weighted by total assets at the beginning of period t ; ΔPC_{it} = change in current liabilities of company i from the end of period $t-1$ to the end of period t , weighted by total assets at the beginning of period t ; $\Delta Disp_{it}$ = change in cash and cash equivalents of company i from the end of period $t-1$ to the end of period t , weighted by total assets at the beginning of period t ; ΔDiv_{it} = change in short-term borrowings and loans of company i from the end of period $t-1$ to the end of period t , weighted by total assets at the beginning of period t ; and $Depr_{it}$ = depreciation and amortization expenses of company i during period t , weighted by total assets at the beginning of period t .

We chose to analyze discretionary accruals through the Modified Jones Model due to its widespread use in studies on the subject and the acceptability of the modeling for time series as one of the most used methods to estimate such accruals, as shown in Equations 2, 3, and 4.

$$TA_{it} = \alpha_1 (1/A_{it-1}) + \beta_2 ((\Delta R_{it} / A_{it-1})) + \beta_3 (PPE_{it}) + \varepsilon_{it} \quad (2)$$

$$NDA_{it} = \widehat{\alpha}_1 (1/A_{it-1}) + \widehat{\beta}_2 ((\Delta R_{it} - \Delta CR_{it}) / A_{it-1}) + \widehat{\beta}_3 (PPE_{it} / A_{it-1}) \quad (3)$$

$$ACJMit = AT_{it} - NDA_{it} \quad (4)$$

Where: TA_{it} = total accruals of company i in period t ; ΔR_{it} = change in net revenues of company i from period $t-1$ to period t , weighted by total assets at the end of period $t-1$; ΔCR_{it} = change in accounts receivable (customers) of company i from period $t-1$ to period t , weighted by total assets at the end of period $t-1$; PPE_{it} = balance of the Fixed Assets account of company i at the end of period t , weighted by total assets at the end of period $t-1$; A_{it-1} = total assets of the company at the end of period $t-1$; NDA_{it} = non-discretionary accruals of company i in period t ; $ACJMit$ = discretionary accruals by the Modified Jones model of company i in period t ; ε_{it} = regression residual for company i in year t . β_1 , β_2 , and β_3 = estimated coefficients of the regression.

Additionally, modeling was also estimated using the Pae model (2005), for robustness purposes, considering that previous studies, such as Paulo (2007), indicate the improvements proposed by the model compared to the Modified Jones with the addition of variables such as present and past operational cash flow. It is worth noting that the Pae model (2005) tends to be more suitable for the Brazilian reality, with greater explanatory power of the model's variables (Domingos et al., 2017; Paulo, 2007).

$$TA_{it} = \alpha (1/At-1) + \beta_1 \Delta Rit + \beta_2 PPE_{it} + \beta_3 FCO_{it} + \beta_4 FCO_{it-1} + \beta_5 TA_{it-1} + \varepsilon_{it} \quad (5)$$

Where TA_{it} represents the total accruals of company i in the current period t , weighted by total assets at the beginning of period t ; ΔRit is the change in net revenues of company i from period $t-1$ to period t , weighted by total assets at the beginning of period t ; PPE_{it} refers to the balances of the Fixed Assets and Deferred Assets (gross) accounts of company i at the end of period t , weighted by total assets at the beginning of period t ; A_{it-1} corresponds to the total assets of company i at the end of period $t-1$, weighted by total assets at the beginning of period t ; FCO_{it} is the operational cash flow of company i in period t , weighted by total assets at the beginning of period t ; FCO_{it-1} is the operational cash flow of company i in period $t-1$, weighted by total assets at the beginning of period t ; TA_{it-1} represents the total accruals of company i in period $t-1$, weighted by total assets at the beginning of period t ; and ε_{it} is the regression error, considered as the discretionary accruals of the Pae model ($ACPae_{it}$).

It is highlighted that, for the analysis of discretionary accruals by the Pae model, the residuals of the regressions for the analyzed sample were used, as done in previous studies (Costa et al., 2018), considering that they correspond to the abnormal values of estimation that are not explained by the non-discretionary accruals proposed by the models in question, generating the variable $ACPae_{it}$.

For the classification of insolvent companies, the concept of Altman and Hotchkiss (2010) was considered, considering that insolvency can be based on balance (IS) and/or flow (IF), using accounting and market variables, respectively. According to Altman and Hotchkiss (2010), balance-based insolvency occurs when companies hold a higher value of liabilities compared to their assets, resulting in negative equity. Additionally, according to the authors, another type of insolvency that the company may incur is based on flow, represented by situations where the resources generated throughout the companies' activities become insufficient in relation to their current obligations. As a parameter for such insufficient balances, Coelho et al. (2017) believe that flow insolvency occurs when there is a substantial decrease in the company's share price, exceeding 30%, compared to the previous year.

In this context, for the present research, in the balance-based insolvency variable (ISc), it is considered that when the Equity (EQ) value was negative, this respective value was considered, weighted by the total assets of that period t for company i . In cases where the Equity of the period was positive, 0 was considered for the variable. Thus, the ISc variable only presents the continuous value of balance-based insolvency of the analyzed companies, aiming to provide a character of intensity of balance-based insolvency. The same idea applies to the flow-based insolvency variable (IFc), given that in cases where there was a reduction of 30% or more in the share price of the period compared to the previous period, the respective reduction percentage was considered to provide information on the intensity of flow-based insolvency. In cases where the reduction was less than 30%, it was considered as "non-insolvency" of flow, attributing 0 to the variable.

For the prediction of bankruptcies, the Z-score parameters follow the Altman et al. (1979) model, as it is believed that this model is more accepted in emerging economies (Altman & Hotchkiss, 2010; Altman et al., 1979). Thus, the parameters were estimated based on the research sample, with the ISFc variable as the dependent variable when examined continuously (Zscorec), and ISF for binary investigation (Zscore). It is emphasized that the logit regression was used, since the distribution of the error term is not normal (Equation 6).

$$Z\text{-score} = -0,2142475 + (-2,358437 * X1) + (-4,065094 * X3) + (-0,8192831 * X4) + (0,2971314 * X5) \quad (6)$$

Where: $X1 = (\text{Current Assets}_{it} - \text{Current Liabilities}_{it}) / \text{Total Assets}_{it}$; $X3 = \text{Earnings Before Interest and Taxes}_{it} / \text{Total Assets}_{it}$; $X4 = \text{Market Value}_{it} / \text{Total Liabilities}_{it}$; $X5 = \text{Sales}_{it} / \text{Total Assets}_{it}$.

As done in a previous study re-estimating the Z-score variable for the Brazilian context (Martins & Ventura, 2020), the coefficients were re-estimated to reflect the current business reality based on the modeling of Altman et al. (1979), resulting in Equation 4. Considering the peculiarities of the Brazilian scenario and the reliability of the model, Martins and Ventura (2020) consider the number 0.80 as a parameter of financial distress in these Z-score estimations, so that values above 0.80 would denote possible continuity problems for companies' operations, corresponding to a higher propensity for insolvency. On the other hand, Z-score values equal to or less than 0.80 would signal that companies are financially healthy with a better business continuity outlook. For the purposes of this study, it was considered that the higher the Zscorec variable, the higher its propensity for insolvency by the Z-score.

For the estimation of economic cycles, the Schumpeter model (1939) was used, with cycles divided into phases of expansion, recession, contraction, and recovery using annual variations in GDP (PIB) as a proxy. Thus, a cycle is in the recession phase when it reaches its total trough, whereas it is in the expansion phase when it reaches its total peak, with the contraction and recovery phases being the connection between these points. Therefore, each stage of the cycle is a dummy (0 or 1), which are subsequently analyzed as distinct samples. To classify these phases, as in Paulo and Mota (2019), the study by Claessens et al. (2012) was used to identify peaks and troughs in GDP variation during the analyzed period, as elucidated in Equations 7, 8, and 9.

$$\Delta PIB_t = \left(\frac{PIB_t}{PIB_{t-4}} - 1 \right) \times 100 \quad (7)$$

$$\{(y_t - y_{t-2}) > 0, (y_t - y_{t-1}) > 0\} \text{ e } \{(y_{t+2} - y_t) < 0, (y_{t+1} - y_t) < 0\} \quad (8)$$

$$\{(y_t - y_{t-2}) < 0, (y_t - y_{t-1}) < 0\} \text{ e } \{(y_{t+2} - y_t) > 0, (y_{t+1} - y_t) > 0\} \quad (9)$$

Where: "Expansion" = ΔPIB_t is increasing and above the total period average; "Recovery" = ΔPIB_t is increasing and below the total period average; "Recession" = ΔPIB_t is decreasing and above the total period average; and "Contraction" = ΔPIB_t is decreasing and below the total period average. According to the Economic Cycle methodology applied in the research, Expansion is evidenced in the years 2012 and 2017; Recovery in the years 2016 and 2019; Recession in 2010, 2011, and 2013; and Contraction in 2014, 2015, and 2018.

To address the research problem and test the hypotheses, multiple regressions of unbalanced panel data were used, as well as the Hausman, Breusch-Pagan, and Chow tests to estimate and fit the model, with fixed effects being the most appropriate. Furthermore, autocorrelation (0.1636), multicollinearity (1.0), and heteroskedasticity (0.000) tests were conducted, revealing only

heteroskedasticity issues that were minimized by using robust cluster-robust standard errors. The regressions are performed in three stages: 1) estimation of the earnings management variables, using OLS (Ordinary Least Squares) regression separately by sector and year for the analyzed companies; 2) estimation of insolvency and Z-score variables, according to the characteristics of the analyzed sample; and 3) estimation of the final study regressions to answer hypotheses 1 (H1), 2 (H2), and 3 (H3), based on the study variables already estimated with organization indicated in Table 2, with robust standard errors and fixed effects by sector and year.

To address the research hypotheses, regressions were analyzed both by sample (considering each stage of the economic cycles separately), and through the interaction of binary variables of each stage of the economic cycles (as independent variables of the model and their interaction with the insolvency variables). To address H1, the signs, significances, and economic coefficients of the insolvency variables (ISc, IFc, and Zscorec) in relation to their explicability of the sample companies' discretionary accruals were analyzed (Tables 5 and 6). To address H2, not only the dispersion (standard deviation) of the estimated discretionary accruals in each stage of the economic cycles (Table 4) was analyzed, but also the relationship of binary variables represented by Cycles with the dependent variables ACJM and ACPae (Table 6). Finally, for H3, the significances and economic coefficients of the insolvency variables (ISc, IFc, and Zscorec) for the sample analysis (Table 5); and ISc, IFc, and Zscorec and their interactions with the variables represented by "Cycles," for the interaction analysis (Table 6), were comparatively considered.

4. DATA ANALYSIS

To analyze the descriptive statistics of the research variables, Table 3 was created.

In the descriptive analysis (Table 3), it is observed that, for all the insolvency proxies analyzed (ISc, IFc, and Zscorec), there was an increase in the mean value of the respective variables over the analyzed period, especially when considering the initial and final years of the analysis. However, it is worth noting that for both the insolvency by balance (ISc) and the financial distress represented by Z-score (Zscorec), a peak of insolvency among the sample companies was evidenced in the period of 2014 and 2015, on average, and that after this period, the sampled companies achieved increasingly better financial improvement over the last 5 years of analysis. When analyzing insolvency by cash flow (IFc), a reduction in stock prices over the years is evident, based on the increase in insolvency by cash flow. This result is consistent with the findings of Machado et al. (2020), which showed that Brazilian companies have experienced increasing insolvency over time.

Although the research considers insolvency as a continuous variable for the three analyzed proxies, for the purpose of better comparability between insolvent companies and their financially healthy counterparts, the residuals found from the Modified Jones (Dechow et al., 1995) and Pae (2005) models were analyzed distributed across the phases of economic cycles, as shown in Table 4.

In the descriptive analysis (Table 3), it is observed that the larger the standard deviation, the higher the chances companies indicate of managing their results, given that the adjustments made by these companies' managers are more dispersed. When considering the overall panorama of earnings management and insolvency based on the descriptive statistics of discretionary accruals, it is found that in the Pae (2005) model, there is greater dispersion of accruals in companies that exhibit insolvency across the three analyzed proxies: 0.0579 for IS; 0.0504 for IF, and 0.0568 for Zscore. Such a result supports the idea that companies in stages of insolvency are more likely to engage in earnings management practices, as financially distressed companies are more prone to managing their results through discretionary accruals (Li et al., 2020; Martins & Ventura, 2020; Oliveira, 2008).

Table 3

Descriptive Statistics

Variables	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	Total	
AC _{JM}	Obs.	0	159	163	164	165	168	168	166	167	164	1484
	Mean	0	0.014	0.038	0.047	0.033	0.012	0.040	0.059	0.087	0.032	0.021
	Std. Dev.	0	0.077	0.112	0.066	0.058	0.060	0.054	0.090	0.720	0.072	0.255
	Min.	0	0.198	0.607	0.234	0.197	0.160	0.157	0.484	0.201	0.213	0.607
	Max.	0	0.123	0.117	0.096	0.072	0.125	0.081	0.068	4.647	0.104	4.647
AC _{PAE}	Obs.	0	159	163	164	165	168	168	166	167	164	1484
	Mean	0	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	Std. Dev.	0	0.047	0.051	0.046	0.048	0.049	0.045	0.054	0.053	0.052	0.049
	Min.	0	-0.098	-0.135	-0.127	-0.134	-0.125	-0.097	-0.107	-0.159	-0.131	-0.159
	Max.	0	0.111	0.134	0.135	0.112	0.106	0.138	0.144	0.155	0.122	0.155
ISc	Obs.	172	172	172	172	172	172	172	172	172	172	1.720
	Mean	0.023	0.118	0.079	0.082	0.144	0.161	0.042	0.018	0.06	0.02	0.075
	Std. Dev.	0.092	0.182	0.163	0.165	0.197	0.202	0.125	0.085	0.144	0.085	0.158
	Min.	0	0	0	0	0	0	0	0	0	0	0
	Max.	0.439	0.439	0.439	0.439	0.439	0.439	0.439	0.439	0.439	0.439	0.439
IFc	Obs.	172	172	172	172	172	172	172	172	172	172	1.720
	Mean	0.015	0.016	0.017	0.018	0.02	0.026	0.032	0.035	0.035	0.035	0.025
	Std. Dev.	0.053	0.055	0.055	0.058	0.06	0.066	0.075	0.078	0.078	0.077	0.067
	Min.	0	0	0	0	0	0	0	0	0	0	0
	Max.	0.212	0.212	0.212	0.212	0.212	0.212	0.212	0.212	0.212	0.212	0.212
Zscorec	Obs.	172	172	172	172	172	172	172	171	172	171	1.718
	Mean	-1.998	-1.73	-1.708	-1.594	-1.389	-1.083	-1.226	-1.387	-1.414	-1.657	-1.519
	Std. Dev.	1.393	1.396	1.458	1.394	1.374	1.329	1.362	1.452	1.423	1.515	1.43
	Min.	-4.38	-4.38	-4.38	-4.38	-4.38	-4.38	-4.38	-4.38	-4.38	-4.38	-4.38
	Max.	0.498	0.498	0.498	0.498	0.498	0.498	0.498	0.498	0.498	0.498	0.498

Table 3
Cont.

Variables	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	Total	
ROA	Obs.	172	172	172	172	172	172	172	172	172	172	1.720
	Mean	4.004	2.594	1.78	1.845	0.957	-0.61	0.216	1.207	1.376	1.682	1.505
	Std. Dev.	6.438	6.861	7.372	7.157	7.261	7.641	7.481	7.535	8.083	7.152	7.388
	Min.	-13.675	-13.675	-13.675	-13.675	-13.675	-13.675	-13.675	-13.675	-13.675	-13.675	-13.675
	Max.	11.047	11.047	11.047	11.047	11.047	11.047	11.047	11.047	11.047	11.047	11.047
TAM	Obs.	172	172	172	172	172	172	172	172	172	172	1.720
	Mean	14.522	14.637	14.677	14.729	14.779	14.804	14.794	14.815	14.859	14.932	14.755
	Std. Dev.	1.478	1.485	1.507	1.499	1.528	1.56	1.564	1.589	1.601	1.621	1.544
	Min.	12.325	12.325	12.325	12.325	12.325	12.325	12.325	12.325	12.325	12.325	12.325
	Max.	17.21	17.21	17.21	17.21	17.21	17.21	17.21	17.21	17.21	17.21	17.21
CRE	Obs.	172	172	172	172	172	172	172	172	172	172	1.720
	Mean	0.184	0.111	0.073	0.064	0.064	0.068	0.009	0.035	0.065	0.088	0.076
	Std. Dev.	0.124	0.122	0.122	0.12	0.114	0.118	0.106	0.104	0.104	0.121	0.124
	Min.	-0.104	-0.104	-0.104	-0.104	-0.104	-0.104	-0.104	-0.104	-0.104	-0.104	-0.104
	Max.	0.301	0.301	0.301	0.301	0.301	0.301	0.301	0.301	0.301	0.301	0.301

Note. ACJM = discretionary accruals by the Modified Jones Model; ACPae = discretionary accruals by the Pae model (2005); ISc = Balance Sheet Insolvency; IFc = Cash Flow Insolvency; Zscorec = Z-score Insolvency; ROA = Return on Assets; TAM = Size; CRE = Growth. Data winsorized at the 1% level.

Table 4
Analysis of the descriptive statistics of residuals

Discricionary Accruals (AC)		General	Downturn		Upturn		Mann-Whitney by INS	
			Contraction	Recession	Expantion	Recovery		
Jones Modificado								
IS	No	Observations	1303	288	438	290	287	0.0000
		Mean	-0.0146	-0.0272	0.0174	-0.0437	-0.0214	
		Standard Deviation	0.2685	0.0616	0.4507	0.0910	0.0562	
		Kruskal–Wallis by cycle		0.012				
	Yes	Observations	181	41	52	39	49	
		Mean	-0.0651	-0.0703	-0.0585	-0.0844	-0.0524	
		Standard Deviation	0.0991	0.0777	0.0803	0.1596	0.0651	
		Kruskal–Wallis by cycle			0.669			
IF	No	Observations	1199	265	388	292	254	0.0005
		Mean	-0.0184	-0.0278	0.0113	-0.0446	-0.0239	
		Standard Deviation	0.2452	0.0650	0.4158	0.0947	0.0569	
		Kruskal–Wallis by cycle		0.028				
	Yes	Observations	285	64	102	37	82	
		Mean	-0.0308	-0.0524	0.0018	-0.0798	-0.0323	
		Standard Deviation	0.2907	0.0628	0.4713	0.1459	0.0631	
		Kruskal–Wallis by cycle			0.246			
Zscore	No	Observations	1361	302	458	303	298	0.0000
		Mean	-0.0149	-0.0281	0.0162	-0.0425	-0.0213	
		Standard Deviation	0.263	0.063	0.441	0.090	0.055	
		Kruskal–Wallis by cycle		0.016				
	Yes	Observations	123	27	32	26	38	
		Mean	-0.0855	-0.0831	-0.0878	-0.1194	-0.0621	
		Standard Deviation	0.1046	0.0673	0.0711	0.1818	0.0701	
		Kruskal–Wallis by cycle			0.618			

Table 4
Cont.

Discricionary Accruals (AC)		General	Downturn		Upturn		Mann-Whitney by INS	
			Contraction	Recession	Expantion	Recovery		
Pae								
IS	No	Observations	1303	288	438	290	287	0.0000
		Mean	0.0032	0.0044	0.0025	0.0012	0.0049	
		Standard Deviation	0.0471	0.0468	0.0467	0.0504	0.0449	
		Kruskal–Wallis by cycle		0.808				
	Yes	Observations	181	41	52	39	49	
		Mean	-0.0230	-0.0312	-0.0215	-0.0090	-0.0286	
		Standard Deviation	0.0579	0.0577	0.0590	0.0653	0.0498	
		Kruskal–Wallis by cycle		0.451				
IF	No	Observations	1199	265	388	292	254	0.0000
		Mean	0.0032	0.0036	0.0032	0.0015	0.0046	
		Standard Deviation	0.0485	0.0486	0.0483	0.0516	0.0453	
		Kruskal–Wallis by cycle		0.995				
	Yes	Observations	285	64	102	37	82	
		Mean	-0.0133	-0.0147	-0.0121	-0.0121	-0.0141	
		Standard Deviation	0.0504	0.0515	0.0483	0.0572	0.0499	
		Kruskal–Wallis by cycle		0.898				
Zscore	No	Observations	1361	302	458	303	298	0.0000
		Mean	0.0028	0.0035	0.0028	0.0011	0.0040	
		Standard Deviation	0.0476	0.0480	0.0470	0.0505	0.0453	
		Kruskal–Wallis by cycle		0.891				
	Yes	Observations	123	27	32	26	38	
		Mean	-0.0314	-0.0392	-0.0405	-0.0123	-0.0312	
		Standard Deviation	0.0568	0.0513	0.0550	0.0710	0.0499	
		Kruskal–Wallis by cycle		0.524				

Note. IS = Insolvency by Balance; IF = Insolvency by Flow; Zscore = Insolvency by Z-score; JM = Modified Jones Model; Pae = Pae Model (2005). For this analysis, “Yes” was considered when: a) Insolvency by Balance, if the Equity, weighted by the total assets of the company, is negative; b) Insolvency by Flow, if there is a reduction of 30% or more in the stock price compared to the previous year; c) Insolvency by Z-score, if the estimated value is equal to or greater than 0.80.

Similarly to the Pae model, the overall panorama of residual dispersion for companies exhibiting Cash Flow Insolvency (0.2907) is higher than those that do not exhibit such insolvencies, as expected. However, it is important to note that, when analyzing the Modified Jones model, unlike expected, the results for the IS and Zscore variables differ from what was evidenced by the Pae model, indicating a higher propensity for earnings management in companies without balance sheet insolvency (0.2685) and Z-score insolvency (0.2630) compared to insolvent companies, contrasting the findings of Queiroz and Dias (2018) and Coelho et al. (2017).

When comparing the dispersions of discretionary accruals at each stage of the economic cycles for insolvent companies, it was possible to observe that, both in the JM model and Pae, the highest dispersions occurred during periods of economic expansion, namely: 0.1596 and 0.0653 for Balance Sheet Insolvency, and 0.1818 and 0.0710 for Z-score Insolvency, respectively. However, for companies' insolvent by Cash Flow, in the JM model, the stage with the highest dispersion is the recession (0.4713), while in the Pae model, the logic still holds during the expansion period (0.0572). This suggests that, overall, insolvent companies are more prone to managing their results during periods of economic growth, contrary to expectations. A possible explanation for this result is that during these periods, companies tend to thrive financially due to the favorable operating environment, leading to higher marginal efficiency of capital levels (Kothari et al., 2014), serving as an incentive for financially troubled companies to manage their results as a means of signaling to the market that they remain prosperous and capable of meeting contractual obligations to creditors (covenants).

In the analysis of companies that do not present financial insolvency (Non), some divergences are noted in the two models analyzed (JM and Pae) regarding which stages of the economic cycles companies show a greater propensity for earnings management. In the analysis of the Pae model, companies that do not exhibit insolvency, like insolvent companies, tend to manage their results more during periods of economic expansion, unlike expectations (0.0504, 0.0516, and 0.0505). On the other hand, accruals estimated by the Modified Jones model show that financially healthy companies (Non) for IS (0.4507), IF (0.4158), and Zscore (0.4410) analyzed in the study exhibit greater residual dispersion during economic recession periods. This suggests that during these periods of economic downturn, companies that do not exhibit insolvency tend to rely more on accruals arising from accrual accounting, managing their results, which can be explained by a higher propensity for securities litigation (Huijgen & Lubberink, 2001), increased uncertainty (Jenkins et al., 2009), and a greater tendency to seek third-party resources (Myers, 1984), corroborating Trombetta and Imperatore (2014), Habib et al. (2013), and Paulo and Mota (2019).

To analyze the influence of economic cycles on the relationship between earnings management and insolvency, a panel data regression is presented in Table 5, with discretionary accruals (Modified Jones and Pae), insolvency (ISc, IFc, and Zscorec), and control variables (ROA, TAM, and CRE), for each of the stages of economic cycles in the sampled period.

Table 5

Relationship between GR and insolvency across different economic cycles (by stage)

Variable	ACJM				ACPae			
	Downturn		Upturn		Downturn		Upturn	
	Con	Rece	Exp	Recu	Con	Rece	Exp	Recu
Constant	0.061	-0.548	0.170	-0.088	0.061	-0.185	-0.280	-0.276
ISc	0.000	0.009	-0.128	-0.029	0.004	-0.002	-0.043	-0.034*
IFc	0.061	-0.643	-0.207	0.179	-0.008	-0.014	0.158*	0.022
Zscorec	-0.018**	0.059	0.003	-0.013	-0.007	-0.017***	0.002	-0.019***
ROA	-0.001	0.017*	0.003	0.002	0.001	0.000	0.002	0.001
TAM	-0.008	0.045	-0.014	0.004	-0.005	0.010	0.019	0.017
CRE	0.077	-0.569	0.068	0.099**	0.069*	0.075**	0.063	0.023
FE by sector	Yes							
FE by year	Yes							
Observations	328	490	328	336	328	490	328	336
Firms	166	168	166	168	166	168	166	168
Ajusted R ²	0.029	0.050	0.080	0.248	0.048	0.107	0.091	0.120
F test	1.576	2.448	2.894	9.100	1.540	5.537	3.686	7.097
Prob > F	0.0833 (*)				0.0002 (***)			

Nota. Con = Contração; Rece = Recessão; Exp = Expansão; Recu = Recuperação. ***, ** e * são significâncias a 1%, 5% e 10%.

Table 5 demonstrates that the only insolvency proxy used in the study to show significance in both estimations of discretionary accruals (ACJM and ACPae) was Zscorec, which exhibited a significant negative relationship between insolvency and the propensity for earnings management during contraction periods in relation to ACJM (-0.018, significant at 5%) and during recession (-0.017, significant at 1%) and recovery (-0.019, significant at 1%) periods in relation to ACPae, with larger economic magnitude of coefficients compared to other stages. This result demonstrates that although not all proxies analyzed for the degree of entity insolvency proved significant, they interfere with the use of discretionary practices arising from accrual accounting (Li et al., 2020), as is the case with Zscorec and ISc, so that H1 cannot be rejected. Furthermore, the negative sign evidenced in these relationships may occur because these insolvent companies can use downturn periods to decrease their results for the period and, thus, demonstrate an improvement in their results above expectations in subsequent periods, a practice known as big bath (Habib et al., 2013).

Moreover, it is noted that earnings management in insolvent companies varies according to the cyclical fluctuations of the country's economy, validating the results of Trombetta and Imperatore's (2014) research, which considered macroeconomics as an important ally of managers in decision-making. In these milder periods of economic downturn (recession) and upturn (recovery), the higher the insolvency, the lower the values of accruals tend to be, contrary to what is advocated in the literature (Li et al., 2020; Martins & Ventura, 2020).

Another insolvency proxy analyzed in the research that presented a significant relationship with the propensity for earnings management was cash flow insolvency (IFc), even if only by the JM model, having the highest coefficient of explanation among the significant variables of interest and being significant (10%) and negatively related to the estimated discretionary accruals in the model during recovery periods (-0.034). In this case, the greater the drop in the companies' stock prices analyzed, the lower the value of adjustments arising from accrual accounting, and thus their earnings management. These results may be explained by commercial incentives to company consumption (Warner & Zheng, 2013) that occur in these periods and the need to signal good performance to the market for covenant compliance purposes.

However, although it was possible to notice that there is an influence of economic cycles on the relationship between earnings management and insolvency, this relationship differs from what was advocated in the literature and what was raised in this research. Based on the results, not necessarily in periods of decline will companies manage their results more, let alone companies with higher insolvency, given that these tend to have a lower propensity for earnings management, as raised in the study, leading to the rejection of H2 and H3.

For the robustness of the analysis, the relationship between earnings management and insolvency under the influence of economic cycles was estimated by interacting the independent variables of the research with each of the stages of the economic cycles, as shown in Table 6.

Table 6

Relationship of EM with insolvency under the influence of economic cycles (interactions)

Variables	ACJM					ACPaC				
	General	Downturn		Upturn		General	Downturn		Upturn	
		Con	Rece	Exp	Recu		Con	Rece	Exp	Recu
Constant	-0.169	-0.173	-0.174	-0.17	-0.162	-0.150*	-0.153*	-0.149*	-0.143*	-0.145*
ISc	-0.019	-0.007	-0.067	-0.005	-0.009	-0.01	-0.009	-0.015	-0.008	-0.009
IFc	-0.314*	-0.347*	-0.166	-0.378*	-0.342*	0.014	0.026	0.028	-0.024	0.023
Zscorec	0.007	0.007	0.005	0.006	0.008	-0.008**	-0.009***	-0.008**	-0.008***	-0.007**
Ciclo		-0.02	0.018	-0.046	-0.031		0.006	0.002	0.005	0.004
ISc*Ciclo		-0.053	0.126	-0.114*	-0.04		-0.005	0.013	-0.018	-0.004
IFc*Ciclo		0.188	-0.429*	0.232	0.134		-0.064	-0.036	0.141**	-0.025
Zscorec*Ciclo		-0.002	0.004	0.000	-0.003		0.003	0.001	0.001	-0.005***
ROA	0.006*	0.006*	0.006*	0.006*	0.006	0.001**	0.001**	0.001**	0.001***	0.001**
TAM	0.012	0.012	0.011	0.011	0.011	0.009	0.009	0.008	0.008	0.008
CRE	-0.121	-0.123	-0.129	-0.121	-0.123	0.055***	0.056***	0.055***	0.056***	0.056***
FE by sector			Yes					Yes		
FE by year			Yes					Yes		
Observations	1.482	1.482	1.482	1.482	1.482	1.482	1.482	1.482	1.482	1.482
Firms	168	168	168	168	168	168	168	168	168	168
Ajusted R ²	0.032	0.030	0.033	0.031	0.030	0.067	0.067	0.066	0.073	0.072
F test	7.592	6.556	6.323	6.831	7.048	6.338	5.756	5.620	5.939	6.178
Prob > F			0.2103					0.0760 (')		

Note. Cycle represents each stage of the economic cycles in a binary form, with each cycle arranged in its respective column. Con = Contraction; Rec = Recession; Exp = Expansion; Recov = Recovery. ***, **, and * denote significance at 1%, 5%, and 10%, respectively.

As presented in Table 5, Table 6 reaffirms the relevance of the variable Zscorec in discretionary accruals in both models under study (JM and Pae), both without considering economic cycles (Overall) and considering the interaction with each respective stage, through the significance of coefficients. With a negative relationship between the insolvency variable and adjustments arising from accrual accounting, these results reaffirm those elucidated in Table 5, that companies with higher insolvency tend to have lower accrual values, consistent with Habib et al. (2013). Additionally, when analyzing the economic magnitude of coefficients presented in the table, it is noticeable that when the dependent variable (discretionary accruals) is estimated by the Modified Jones model, there is greater explanatory power of the variables compared to the Pae model.

When considering the sums of the coefficients of the insolvency variables (ISc, IFc, Zscorec) and the interactions of these variables with the stages of economic cycles (ISc*Cycles, IFc*Cycles, Zscorec*Cycles), it can be observed that ISc shows significance only when considering the expansion stage, with a potentialized negative relation in this stage ($-0.005 + (-0.114) = -0.119$), contrary to what is advocated in studies such as those of Habib et al. (2013) and Paulo and Mota (2019). This reinforces that even though there is a significant influence of these relationships, accrual values are not necessarily lower in periods of decline than in periods of growth.

For the IFc variable, these results diverge slightly, so that in the JM model, the negative potentialization occurs for the recession stage ($-0.166 + (-0.429) = -0.595$), and for the Pae model, the positive sign generated by the interaction with the expansion stage cancels out the positive relation of insolvency with discretionary accruals ($-0.024 + 0.141 = 0.117$). Thus, when considering the persistence of cash flows for earnings management estimation in the expansion period, cash flow insolvency is positively related to discretionary accrual values.

When considering the Zscorec variable, although its relationship appears significant and negative with earnings management by the Pae model, the interaction with the stages of economic cycles only presents a potentialized negative relation in the economic recovery stage ($-0.007 + (-0.005) = -0.012$), different from what was advocated, suggesting that downturn periods would foster a greater propensity for downward management. Based on this, as evidenced in Table 5, the results obtained by Table 6 also lead to the rejection of H2 and H3.

In the analysis of positive and negative discretionary accruals of the sample concerning corporate insolvency in each phase of economic cycles, which were not tabulated but were estimated for analysis robustness, different results can be noticed when each of the accrual estimation models is analyzed. Regarding the Modified Jones model, negative earnings management, where companies worsen their results, only shows no significance concerning insolvency variables in periods of economic recession, supporting the idea that companies tend to engage in big bath practices when insolvent and during economic downturns, as raised by Habib et al. (2013).

Positive accruals, on the other hand, are significant and negative only in the interaction of IFc with the recession period, so that, in these periods, the higher the insolvency, the lower the management to increase results. Unlike the results obtained by the Modified Jones model, in the analysis of positive accruals estimated by the Pae (2005) model, it is evident that the only scenario in which there was no statistical significance of the interactions of insolvency variables with the stages of economic cycles was the economic contraction stage.

Finally, the assumptions of Agency Theory are corroborated, indicating that periods of financial stress in companies can lead to increased conflicts of interest by managers regarding reported results, generating greater informational asymmetry among stakeholders of the business.

Through the analysis of the influence of economic cycles on the relationship between earnings management and corporate insolvency in companies listed on the Brasil, Bolsa, Balcão (B3) stock exchange from 2010 to 2019, it was evidenced that, although there is a significant influence of insolvency on the propensity for earnings management, a higher level of insolvency does not necessarily lead to earnings management through discretionary accruals to inflate results, but rather to decrease them. This is because variables such as insolvency by Z-score, for example, showed a negative relationship with earnings management, both when analyzed overall and under the focus of economic cycles. Another issue evidenced is that, in general, periods of economic downturn tend to have a greater influence on the analyzed relationship, both by cash flow and by the Z-score indicator.

The results obtained in the study provide, from a theoretical point of view, the evolution and development of the literature as well as the debate about how economic cycles affect earnings management in insolvent companies compared to their solvent counterparts, highlighting that these results assist in understanding the importance of studying economic cycles as a relevant macroeconomic factor for decision-making by managers. Thus, unlike other authors such as Trombetta and Imperatore (2014), Queiroz and Dias (2018), Coelho et al. (2017), and Li et al. (2020), this research related the dependent variable, discretionary accruals, to the independent variables of insolvency and economic cycles which, according to the literature, are characterized as motivating agents for earnings management practices.

Additionally, another significant aspect of the study is listed with the fact that the analysis considers three different proxies to characterize insolvency, thus providing external users with greater knowledge about the financial complexity of corporate insolvency in the face of manipulation practices throughout the fluctuation of the economic activity of an emerging country, in full development of its capital market. In this way, it contributes to Agency Theory by mitigating informational asymmetry among interested parties by demonstrating to external users how variations in a country's economy can affect a company's results considering the financial health and continuity of the company.

Among the limitations of the research, the temporal interval of data collection can be mentioned, as well as the Schumpeter model for economic cycles, since although it is still one of the most used by the literature, its classification may not faithfully represent the macroeconomic situation of a developing economy like Brazil. Thus, it is suggested to investigate the reasons why managers of insolvent companies manage their results in periods of expansion as well as to study whether the results of this research remain when applied in countries with more developed economies. Finally, studies are also suggested that address the impact of this relationship on financial institutions, enabling the comparison of financial institutions with non-financial ones.

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DATA AVAILABILITY STATEMENT

Not applicable.

AUTHOR'S CONTRIBUTION

BP: Research concept; data curation; formal analysis; investigation; methodology; validation; writing – original draft.

MB: Conceptualization; formal analysis; investigation; methodology; project administration; supervision; validation; writing – original draft.

VM: Conceptualization; formal analysis; investigation; methodology; project administration; supervision; software; data validation; writing – review & editing.

CONFLICTS OF INTEREST

There are no conflicts of interest.

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