

The fine line between earnings management and corporate fraud

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Abstract

Objective: To investigate whether the levels of earnings management increase in periods before corporate fraud is uncovered.

Method: Three different samples were analyzed: Sample 1, comprising all non-financial companies listed in Brazil, Bolsa, Balcão (B3); Sample 2, comprising companies convicted of fraud; and Sample 3, in which fraudulent and non-fraudulent companies were matched. Logit regression was performed for panel data in Sample 1; a descriptive analysis was performed by quartiles for Sample 2; and Altman's Z score, Mann-Whitney U test, and graphical analysis were performed for Sample 3.

Results: Generally, the results indicate that companies involved with fraud more frequently resourced earnings management companies not involved with fraud; however, it was impossible to identify the exact period when fraud was committed.

Contributions: This study contributes to organizations and their respective gatekeepers. Its contributions include innovations upon previous studies: (i) it proposes different variable and modeling approaches; (ii) it is a pioneer study in the Brazilian context; (iii) it encourages a reflection upon the impact of competition between reliable information and quality of profits.

Keywords: Earnings management; Corporate fraud; financial statements.

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1. Introduction

This study aimed to investigate whether there was an increased level of earnings management in periods before corporate fraud.

Companies can distort financial statements by managing earnings or committing fraud (Perols & Lougee, 2011). The difference is that fraud involves illegal manipulations (Niyama, Rodrigues, & Rodrigues, 2015). As it turns out, companies must deal with consequences as accruals reverse over time or commit fraud for compensation (Beneish, 1997; Dechow, Sloan, & Sweeney, 1996). Therefore, there may be a close relationship between these two practices (Dechow et. al, 1996; Perols & Lougee, 2011; Ramírez-Orellana, Martínez-Romero & Mariño-Garrido, 2017).

Despite the literature's discussions, measuring corporate fraud and earnings management is challenging, and perhaps this is why research is still developing in emerging markets, especially Brazil. Therefore, this study advances knowledge on this subject by discussing the relationship between these practices and how they can be measured. Furthermore, identifying the preliminary factors of fraud can promote behaviors and actions to prevent such a crime and encourage reflections upon the impact of competition on reliable information and quality of profits.

Research is relevant because misleading financial reporting negatively impacts stakeholders. Financial records are the primary source of information on a company's financial stability, economic activity, and financial health (Svabova *et al.*, 2020), influencing the organization and its respective gatekeepers.

Hence, three samples were analyzed to achieve the objective proposed here: Sample 1 (all non-financial companies listed on B3) was analyzed using Logit regression for panel data; Sample 2 (companies convicted of fraud) was analyzed through a descriptive analysis by quartiles; and Sample 3 (matching fraudulent and non-fraudulent companies) was analyzed using Altman's Z-score, Mann-Whitney U test, and a graphical analysis. The results from the quarters between 2010 and 2020 show that companies involved in fraud more frequently perform earning management; however, we could not identify the exact period when fraud was committed.

2. Literatura Review

The companies' financial reports are designed to communicate the companies' financial position, operational performance, and cash flows. However, when a listed company is facing financial problems, its earnings may not meet the investors' expectations, resulting in a drop in share prices and company value, potentially culminating in a financial crisis, which would increase the costs of issuing debts and make financing more difficult (Li, Li, Xiang & Geri Djajadikerta, 2020).

In an attempt to avoid potential crises, managers may resort to practices that distort financial information, including earnings management, which is when managers deliberately change the accuracy and impartiality of a financial statement to conceal their companies' actual economic condition or obtain personal gain from contractual results that depend on accounting numbers (Healy & Wahlen, 1999). Therefore, earnings management represents a competition between faithful representation and the quality of profits (Espahbodi, Liu & Weigand, 2021), which may compromise a company in the medium/long term. Numerous corporate fraud cases are found among companies experiencing management problems (Hamid, Hashim, & Salleh, 2012).

However, unlike fraud, which is a crime, earnings management is not considered a practice that violates accounting standards/norms (Wells, 2008). However, even though corporate fraud goes beyond the limits of legality, some aspects intertwine both practices.

The objective of both practices is similar: misrepresent, distort, or deliberately omit data on financial statements to deceive readers and create a false impression of an organization's financial quality (Grasso *et al.*, 2009). The environment where these practices generally occur should also be considered (Albrecht *et al.*, 2019; Zhao & Chen, 2008). There is usually economic pressure and incentives for a company to meet or exceed profit benchmarks (Beardsley, Robinson, & Wong, 2021), consequently misleading stakeholders regarding its underlying financial performance (Campa & Camacho-Miñano, 2015; Graham *et al.*, 2005; Zang, 2012).

Therefore, one of the most complex tasks is to unravel when manipulation in financial statements is a management practice and when it is a fraud, and to what extent they influence each other (Young, 2020), considering that the limit of legality, which can vary from country to country (Baskaran *et al.*, 2020; Dechow *et al.*, 1995), does not seem to be a sufficient measure.

The literature (Lee, Ingram & Howard, 1999; Im & Nam, 2019; Perols & Lougee, 2011; Ramírez-Orellana *et al.*, 2017; Song, Lee & Cho, 2013) shows that fraudulent companies are more likely to resource to earnings management in previous years, with evidence that companies performed earnings management three years before the fraud occurred (Dechow *et al.*, 1996; Rahman, Sulaiman, Fadel, & Kazemian, 2016). Hence, based on such evidence, the following research hypothesis is proposed:

H_1 : Companies with higher levels of earnings management are more likely to commit fraud.

3. Method

3.1 Sampling

Tests were performed with three different samples of non-financial companies listed on B3 to achieve the objective proposed here.

Sample 1 comprised all the companies (316);

Table 1

Sample's Composition 1

Description	Total
Companies listed in B3 – <i>Eikon Refinitiv</i>	463
(-) <i>Financial</i>	(71)
(-) <i>Real State</i>	(76)
(=) Sample 1	316

Source: developed by the authors based on Eikon Refinitiv.

- (i) Sample 2 comprises companies convicted of fraud (27); and
- (ii) Sample 3 matched fraudulent and non-fraudulent companies (40).

Table 2

Sample's composition 3

Description	Total
Fraudulent companies included in the matching	27
(-) Companies without a match	(6)
(-) One company lacked information regarding earnings management	(1)
(=) Sample 3	20

Source: developed by the authors

The Administrative Sanctioning Processes (PAS) of the Securities and Exchange Commission (CVM in Portuguese) were analyzed to identify fraudulent and non-fraudulent companies and allocated them in the samples. Hence, the following search was performed on the CVM website > Processes > Advanced search. The field “Term” remained blank, “period” was from 1/1/2010 to 12/31/2020, and the field “Type” was completed with “*processos sancionadores julgados*” [judged sanctioning proceedings]. There were 536 proceedings; one proceeding may include more than one company, or more than one proceeding may deal with the same company. Hence, proceedings involving fraud (118 cases) and those already convicted were selected, totaling 31 cases that included 27 companies.

For data modeling purposes, the period in which fraud occurred was considered to be linked to the period prior to the opening of the proceedings (e.g., if a company had its proceedings opened in 2015, the fraud period was considered to be from 2010 to 2015). This criterion was established *ad hoc*, considering that one cannot be sure when a fraud started. However, we know that fraud must occur before the case is opened (and subsequently, a conviction occurs); hence, this criterion is an alternative to prevent classification errors.

The initial period for calculating earnings management in Sample 1 differs from that for fraud classification (2010 to 2020). The period considered for earnings management includes from 2006 to 2020, i.e., four more years. The objective was to analyze the sample from the perspective of earnings management performed the years before the occurrence of fraud. Thus, the earnings management analysis was performed at least four years before the judicial process started and was extended in cases when processes started more recently.

The companies in Sample 3 were matched using the ‘sector and size’ criteria. Risk analysis was performed using Altman’s Z-score (Kukreja, Gupta, Sarea, & Kumaraswamy, 2020; Maccarthy, 2017). The period analyzed was the same as that established for fraud – 2010 to 2020.

3.2 EM Model by Dechow *et al.* (1995) adjusted by Collins *et al.* (2017)

Collins *et al.* (2017) propose advances to the Jones-type earnings management model (Dechow *et al.*, 1995) to control better the effects of non-linear growth and financial performance in the discretionary accruals calculation model. This model suits the Brazilian context, where companies have distinct characteristics and behaviors. Its application in this context controls for these effects, ensuring that data is not mistaken for earnings management.

The model is described below:

$$ACCT_{i,t} = \beta + \beta_1 Q_{1,it} + \beta_2 Q_{2,it} + \beta_3 Q_{3,it} + \beta_4 Q_{4,it} + \beta_5 (\Delta SALES_{it} - \Delta AR_{i,t}) + \beta_6 ACCT_{i,t-4} + \sum_k \beta_{7,k} ROA_Dum_{k,i,t} + \sum_k \beta_{8,k} SG_Dum_{k,i,t-4} + \sum_k \beta_{9,k} MB_Dum_{k,i,t-1} + \varepsilon_{i,t} \quad (1)$$

Where:

$ACCT_{i,t}$: total accruals measured by the sum of increases/decreases in cash flow in accounts receivable, inventories, accounts payable, and other accounts that affect provisions for company i in quarter t ;

$Q_{i,t}$: fiscal quarter dummies, which allow for possible fiscal quarter effects on accrual;

$\Delta SALES_{i,t}$: variation in sales of company i in quarter t and in $t-1$;

$\Delta AR_{i,t}$: variation in accounts receivable from company i in quarter t and in $t-1$;

$ROA_Dum_{k,i,t}$: dummy assumes 1 if ROA (return on assets) of quarter t of company i belongs to the k^{th} quintile and 0 otherwise;

$SG_Dum_{k,i,t-4}$: dummy assumes 1, if $SG \left(\frac{Sales_t - Sales_{t-4}}{Sales_{t-4}} \right)$ if quarter $t-4$ of company i belongs to k^{th} quintile and 0 otherwise;

$MB_Dum_{k,i,t-1}$: dummy assumes 1, if MB (*Market-to-book*) of quarter $t-1$ of company i belongs to k^{th} quintile and 0 otherwise; and

$\varepsilon_{i,t}$: residual value estimated from the regression.

Discretionary accruals are calculated directly using the residual value estimated from the regression.

3.3 Description of Empirical Tests

Three stages of analysis were performed. The model estimated for Sample 1 is described below:

$$FRAUD(z) = \beta_0 + \beta_1 GR_{it} + \beta_2 TAM_{it} + \beta_3 LEV_{it} + \beta_4 BIG4_{it} + \varepsilon_{it} \quad (2)$$

Where:

$FRAUD$: dummy assumes 1 before the fraud process is opened and 0 after it is opened, of company i , in time t ;

EM : number of discretionary accruals in absolute terms of company i , in time t ;

TAM : company's size measured by the natural logarithm of local assets of company i , in time t ;

LEV : financial leverage of company i , in time t ;

$BIG4$: dummy assumes 1 when the company responsible for auditing is one of the Big Four and 0 otherwise, of company i , in time t ; and

$\varepsilon_{i,t}$: random regression error.

Figure 1 summarizes the variables' foundations

Variable	Foundation	Expected sign
Earnings management	The volume of earnings management is more significant in the years before corporate fraud than otherwise (Dechow <i>et al.</i> , 1996; Ramírez-Orellana <i>et al.</i> , 2017; Perols and Lougee, 2011).	(+)
Size	Larger companies would have less incentive to distort information, as they are more heavily controlled and oversighted (Dechow & Dichev, 2002).	(-)
Leverage	A high degree of leverage is a financial stress factor in companies, consequently becoming a determining factor for fraud (Adi, Baridwan & Mardiati, 2018).	(+)
Big Four	Organizations audited by large auditing companies would be less likely to distort information when compared to others (Apostolou & Hassell, 1993; Dichev, Graham, Harvey, & Rajgopal, 2016; Lim, Lim Xiu Yun, Liu, & Jiang, 2012; Moyes, 2007).	(-)

Source: developed by the author.

Figure 1. Summarizes the variables' foundations

A descriptive analysis was performed with Sample 2 to verify whether the companies had similar behaviors before and after the fraud.

After matching the 27 fraudulent companies in Sample 3, the Altman Z-score (model for measuring the risk of fraud) was performed to confirm whether the companies were a good match. The model is described below:

$$Z = 1,2X_1 + 1,4X_2 + 3,3X_3 + 0,6X_4 + 1,0X_5 \quad (3)$$

Where:

X_1 : net working capital/total assets;

X_2 : retained profits/total assets;

X_3 : EBIT/ total assets;

X_4 : market value/total liabilities; and

X_5 : sales/total assets.

The independent variables for the model are X_1 , X_2 , X_3 , X_4 , and X_5 , which were used to determine the dependent variable, the Z-score in equation (3). The result of the Z-score value is obtained and compared with the cutoff point shown in the following table:

Altman's Z-score	Cutoff point (meaning)
$Z > 2,67$	No danger zone
$1,81 < Z < 2,67$	Gray zone
$Z < 1,81$	Risk zone

Source: Altman (1968).

Figure 2. Altman's Z-score – classification

A new matching was performed in case a matched company (non-fraudulent) was in the “risk zone” to identify a company without the risk of fraud.

Mann-Whitney U test was performed after matching the companies. Hence, the earnings management accumulated in the year (sum of the quarters) was considered. Finally, the years before and after the proceedings started were considered in the test, in which case, the year when the proceedings were opened was discarded.

The same number of years before and after the case was opened was considered to ensure data were balanced. For example, if a company had its process opened at the CVM in 2014, previous years include from 2008 to 2013, except 2014, and subsequent years include from 2015 to 2020.

A graphical analysis was performed with the corresponding pairs for those companies that presented significant differences.

4. Analysis and Discussion of Results

Table 3 presents the results of descriptive statistics for the continuous variables for Sample 1.

Table 3
Descriptive statistics for the continuous variables

Variables	Observations	Mean	Median	SD	Minimum	Maximum
Earnings management	6522	0,191	0,054	0,354	0,000	2,301
Size	9540	21,369	21,508	2,182	5,857	27,646
Leverage	7903	0,000	3,222	0,004	-0,036	0,360

Source: developed by the authors

The number of observations for each variable differs due to a lack of information, especially when discretionary accruals (earnings management) were calculated. The data did not present dispersions that could distort the analysis; hence, no treatment was required.

Table 4 presents descriptive statistics for the categorical variables.

Table 4
Descriptive statistics for categorical variables

Variables	Observations	Frequency (0)	Frequency (1)
Corporate Fraud	12.640	91,46%	8,54%
Big Four	9.052	29,56%	70,44%

Source: developed by the authors.

Regarding the Fraud variable, no fraud was found in 91.46% of the quarters compared to 8.54% in which fraud occurred. This piece of information suggests a discrepancy between the two groups. For this reason, additional tests were performed.

Regarding the companies responsible for auditing, one of the Big Four performed auditing in most companies (70.44%), while in only 29.56% of the companies, auditing was performed by a company other than the Big Four.

We proceeded to the multivariate analysis of Sample 1. Table 5 shows the estimation of a Logit regression for panel data with random effects.

Table 5

Results of the Logit regression for panel data with random effects – Dependent variable = Fraud

$$FRAUD(z) = \beta_0 + \beta_1 GR_{it} + \beta_3 TAM_{it} + \beta_4 LEV_{it} + \beta_5 BIG4_{it} + \varepsilon_{it}$$

Variables	Coefficient	Standard deviation	t
Earnings management	1,708***	0,657	2,60
Size	-2,823***	0,602	-4,69
Leverage	-0,043	0,031	-1,37
Big Four	-0,687*	0,383	0,63
Cons.	40,966***	11,019	3,72
Observation	5504		
Prob > chi2	0,000		
Wald chi2	30,605		

Note: Level of statistical significance: *** at 1%; ** at 5%; and * at 10% (two-tailed).

Source: developed by the authors

The results show a positive and significant association between the Earnings Management variable (in pre-fraud periods) and the occurrence of fraud, meaning that the frequency of earnings management was higher before the occurrence of corporate fraud than after fraud was uncovered. This finding was expected as companies with a higher level of earnings management need to reverse discretionary accruals over time and commit fraud to compensate for the reversals and achieve their objectives (Beneish, 1997; Dechow, Sloan, & Sweeney, 1996; Perols & Lougee, 2011). These results corroborate those found by other authors (Dechow et. al., 1996; Im & Nam, 2019; Perols & Lougee, 2011; Ramírez-Orellana *et al.*, 2017; Song, Lee & Cho, 2013).

These findings imply that “good results” in the short term, when impacted by earnings management, may compromise a company’s medium/long terms, considering that high levels of earnings management in one period naturally lead to reversals in subsequent periods (Espahbodi *et al.*, 2021). Corporate fraud becomes an almost inevitable consequence, indicating a path between poor financial performance, increased earnings management, and finally, corporate fraud.

Earnings management alone does not cause fraud, but evidence shows that increased earnings management over successive periods leads to fraud. Studies analyzing the earnings management variable found no companies with zero EM, either because it represents the differences between the accrual and cash basis or because of the factors that affect a company’s value, including income smoothing and high-quality profit (Espahbodi *et al.*, 2021). Nonetheless, earnings management is expected to be nearly zero (DeMarzo & Fishman, 2007).

Regarding the control variables (Big Four and Size), as expected, both were significantly negative.

Despite the consistent results presented in Table 5, the proportion between fraudulent and non-fraudulent quarters is discrepant, and additional approaches were adopted to separate the sample into different groups to prevent biased interpretations and validate the results.

Therefore, Sample 2, which contains only companies that were involved in fraud at some point, was analyzed. These companies’ earnings management was analyzed throughout the quarters, considering the pre-fraud and post-fraud periods. The results are presented below.

Table 6

Distribution of fraudulent companies according to earnings management quartile before and after fraud was uncovered.

Period	Quartiles (earnings management)				Total
	1°	2°	3°	4°	
Before fraud was uncovered	68 24,37%	67 24,01%	61 21,86%	83 29,75%	279 100%
After fraud was uncovered	123 25,20%	125 25,61%	131 26,84%	109 22,34%	488 100%
Total	191	192	192	192	767

Source: developed by the authors.

In most companies (29.75%), earnings management was concentrated in the last quarter before fraud occurred. An analysis of the same companies in the post-discovery period (2nd line) shows that earnings management in most companies (26.84%) was most frequent in the third quartile, i.e., before the process was opened. Although it was impossible to specify the exact date when a fraud was initiated, we can state that it necessarily occurred before the proceedings were opened and with greater intensity.

These results corroborate the findings of Sample 1, in which most companies involved in fraud presented higher levels of earnings management before the process was opened, which is precisely the earnings management/fraud transition period.

We then proceeded to Sample 3 and performed the following procedures to deepen the discussion further:

- (i) Altman's *Z-score* was performed for the 20 matched companies, resulting in 12 companies in the risk zone (*Z-score* < 1.81);
- (ii) a secondary matching was performed using Altman's *Z-score*, in which 6 new matches remained in the risk zone; and
- (iii) a third matching was performed using Altman's *Z-score*, in which 5 new matches remained in the risk zone.

Thus, 15 companies were matched within reliability parameters, and a final sample of 30 companies was found.

The Mann-Whitney U test was initially performed, considering the same number of years before and after the proceedings were opened. The results are presented in Table 7.

Table 7

Mann-Whitney U Test for the matched fraudulent companies

Year of proceedings	Identification	Prob > z
2010	Empresa A	0,1266
2010	Empresa B	0,5127
2012	Empresa C	0,7540
2013	Empresa D	0,3907
2013	Empresa E	0,8858
2014	Empresa F	0,0250*
2014	Empresa G	0,0547*
2014	Empresa H	0,0065***
2014	Empresa I	0,0547*
2015	Empresa J	0,1745
2016	Empresa K	0,0209*
2016	Empresa L	0,2482
2016	Empresa M	0,1489
2016	Empresa N	1,0000
2018	Empresa O	0,1213

Note 1: Prob > |z| - Mann-Whitney U Test.

Note 2: level of statistical significance: *** at 1%; ** at 5%; and * at 10% (two-tailed).

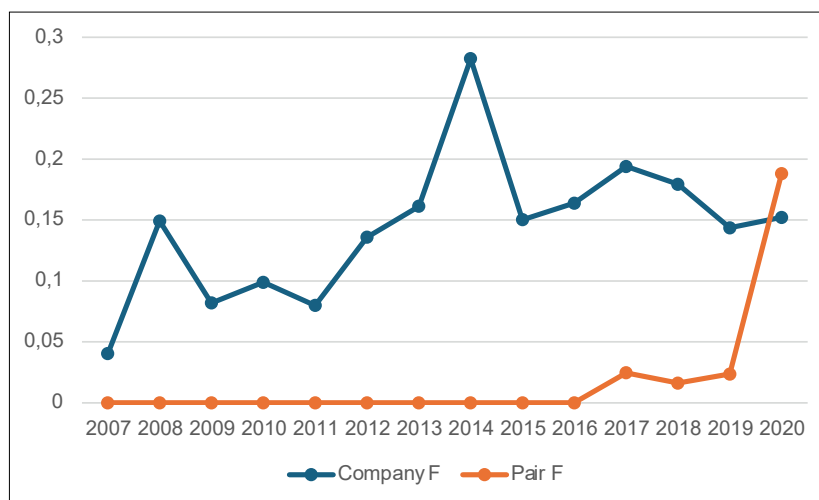
Note 3: Letters from "A" to "O" were used to identify the companies.

Source: developed by the authors.

The test results show that only 5 out of the 15 fraudulent companies presented different medians when comparing the pre- and post-fraud periods. Four of these companies' cases were opened in 2014, and one was opened in 2016. Therefore, graph representations (earnings management x years) were prepared for each of these companies with their matches.

The graphs show each company's and their corresponding pairs' earnings management peak, showing whether such an increase is related to the business itself or may be related to a fraudulent strategy.

Figures 3 to 7 show the matching for the proceedings opened in 2014.

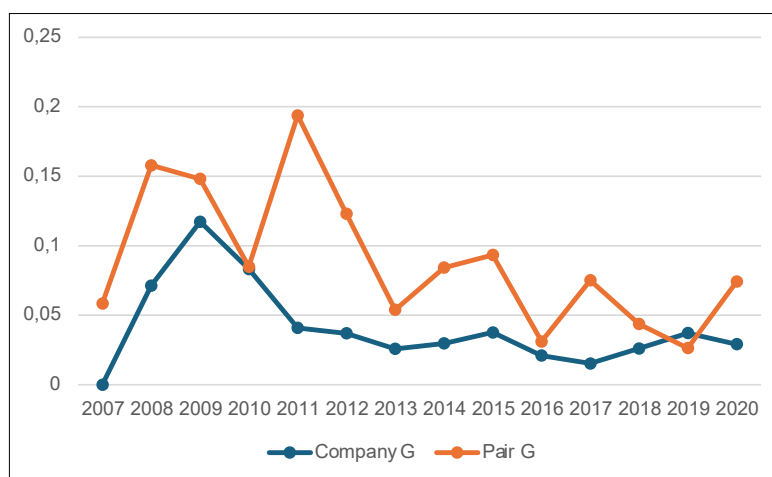


Sources: developed by the authors.

Figure 3. Earnings management behavior – proceedings 2014

Figure 3 shows that the company “Pair F” presents low earning management levels virtually throughout the entire period (2007-2019), only slightly higher in 2020. Another interesting aspect is that the peak in earnings management occurs in the year the case is opened, though it had been increasing since 2011, being more accentuated from 2013 onwards. The level of earnings management falls after the case is opened; however, it is still higher than in previous years. Therefore, the earnings management level for “Company F” is similar before and after the case is opened, though with more significant variations in previous years.

Figure 4 depicts a new matching, and the opposite of what happened in Figure 3 happens to this new pair. The matching company presents a higher earnings management volume virtually throughout the entire period (except for 2019).

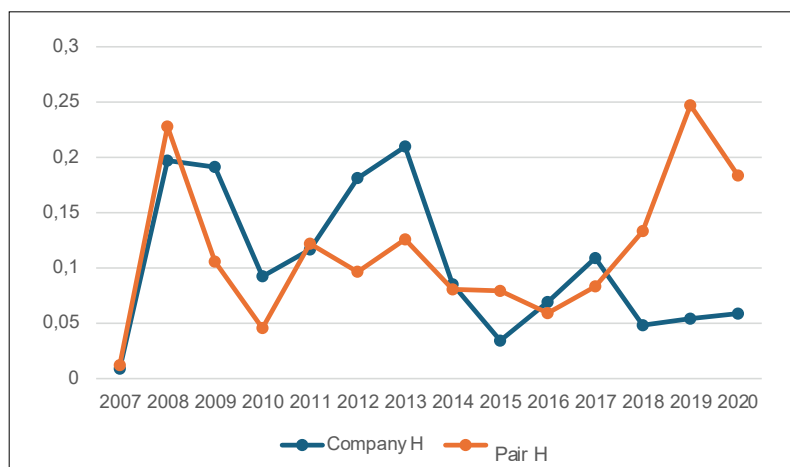


Source: developed by the authors.

Figure 4. Earnings Management behavior – proceedings 2014

When only the management behavior of the fraudulent company, represented by “Company G,” is analyzed, we note that a peak in earnings management occurred in 2009, around 4 years before the case was opened. However, the matched company also had a peak in that year. A similar fact to Figure 3 is that, after 2014, earnings management not only decreased but also became less variable.

Figure 5, which also analyzes the cases opened in 2014, shows that fraudulent and non-fraudulent companies’ earnings management behavior is quite variable.

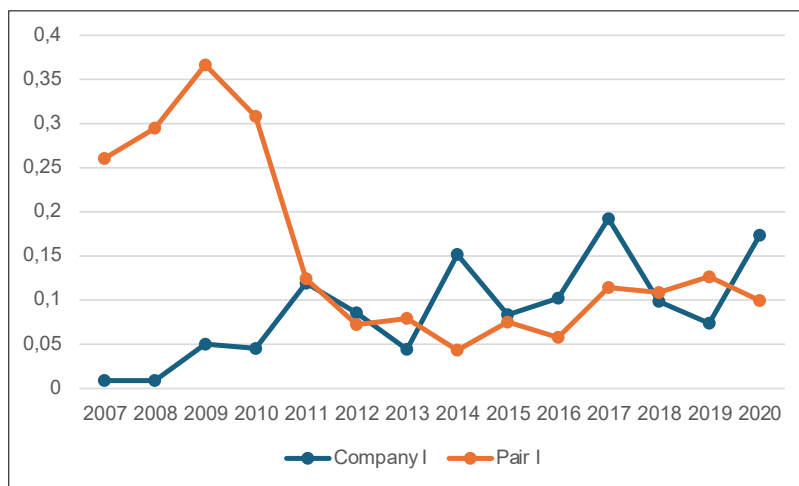


Source: developed by the authors.

Figure 5. Earnings management behavior – proceedings 2014

However, higher levels of earnings management were found in the years before 2014, even though the matched company also presents earnings management. The difference between the companies is the years after 2014 when the fraudulent company decreased its level of earnings management while the matched company reached 0.25 (its highest point) in 2019. Another aspect to be highlighted is that, in 2013, “Company H” reached its maximum level of earnings management, one year before the case was opened, while “Pair H” decreased earnings management that year.

Still, regarding 2014, Figure 6 shows that the earnings management level of “Pair I” is superior to “Company I” until 2011, when the behavior reverses.

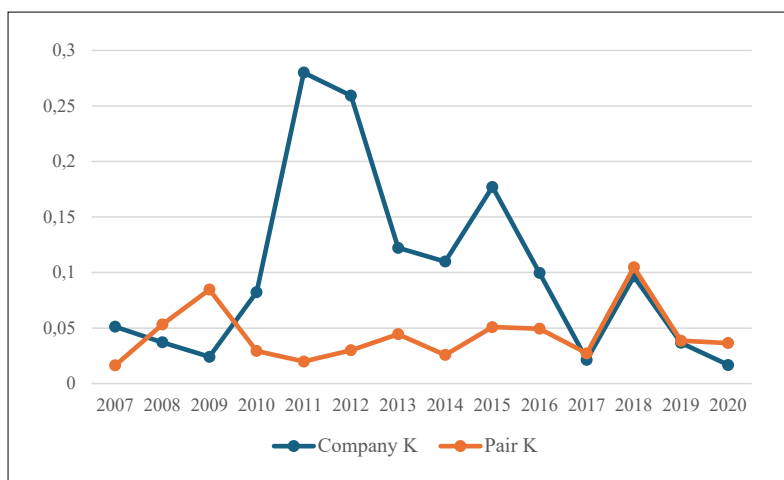


Source: developed by the authors

Figure 6. Earnings management behavior – proceedings 2014

Like Figure 3, earnings management increased in 2014; however, earnings management continued to increase in the years following the judicial process.

Figure 7 presents the matching of “Company K,” which showed higher management levels than its match virtually throughout the entire study period. Two values stand out: the maximum reached in 2011 and the second highest in 2015, one year before the case was opened.



Source: developed by the authors.

Figure 7. Earnings management behavior – proceedings 2016

Furthermore, earnings management after 2016 was lower than management before it, reaching almost 0.00 in the year following the opening of the proceedings.

The five figures are restricted from the perspective of sample representation due to the difficulty in matching companies. However, in general, they show that most (3 of the 5) fraudulent companies presented higher levels of earnings management than their peers similar in size and in the same sector, and, therefore, the exogenous impacts (economy, inflation, etc.) have similar repercussions. In most companies (3 out of 5), earnings management decreased after the Securities and Exchange Commission administrative process was opened, corroborating the findings for Samples 1 and 2.

5. Final Considerations

This study aimed to investigate whether earnings management levels increase in periods before corporate fraud is uncovered. In general, the results show that high levels of earnings management precede corporate fraud, corroborating the research hypothesis (Dechow *et al.*, 1996; Im & Nam, 2019; Perols & Lougee, 2011; Ramírez-Orellana *et al.*, 2017; Song, Lee & Cho, 2013) and leading to important reflections.

Despite the apparent benefits of earnings management for companies in the short term, such a practice may cause serious problems for a company's financial health in the medium/long term. The behavior of fraudulent companies shows that this practice tends to increase over the years, potentially culminating in the manipulation of financial information through fraud.

Even though earnings management is argued to be within normative limits, which remains controversial, considering the definition of earnings management by Healy and Wahlen (1999), the results show that such a practice must be, at least, closely monitored by gatekeepers at the risk of normalizing biased behavior in financial statements that results in fraudulent practices.

Hence, monitoring companies' increasing earning management practices is essential, as it might represent a warning factor. Hence, it is important to consider not only accounting practices *per se* but also analyzing the organization's internal environment, as it may lead to or encourage such a practice (Beardsley, Robinson, & Wong, 2021).

This study presents statistical limitations, considering the small sample, which is expected in studies matching samples with fraudulent companies (Lenard, Watkins, & Alam, 2007); hence, the inferences may not represent the entire population's behavior. Future studies are suggested to use different methodologies, not only to classify but also to analyze data. For instance, comparing countries is also interesting in verifying such behavior in emerging countries *versus* developed countries.

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