

Red Flags Contributions to Detect Corporate Fraud

Contribuições de *Red Flags* para Detecção de Fraudes Corporativas

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Abstract

The aim of this paper was to investigate the contributions of the red flags obtained from financial reports in detecting corporate fraud. The sample is comprised of 277 publicly held companies listed on B3 (Bolsa Brasil Balcão) with data from 2006 to 2018. Data and information were collected from the explanatory notes of the companies, on Refinitiv® database, on the Brazilian Securities and Exchange Commission and Federal Police Websites. Based on the Logistic Regression for panel data, the variables: auditing firm, inventory growth, liability representativeness, profitability and operational losses were analyzed. The variables were selected by taking into consideration their identified relevance in the literature as having potential to identify fraud risks. The results have shown that the red flags auditing firms and indebtedness measured by the weighting of the liabilities by the total assets contribute to the risk identification of the corporate frauds. The study contributes to the analysts, creditors and investors so that they identify companies with corporate fraud risk based on the red flags. Corporate fraud is a crime that affects all companies and the study on red flags is relevant for investors and analysts so that they identify companies with fraud signs or if the management identifies them in their early stage. The study results can influence the work of internal and external auditors, inspection bodies, investors, analysts, credit rating agencies and banking system.

Keywords: Corporate frauds. Red Flags. Prevention.

Resumo

O objetivo desta pesquisa foi investigar as contribuições dos *red flags* obtidos de relatórios financeiros na detecção de fraudes corporativas. Foram selecionadas 277 companhias abertas não financeiras listadas na B3 (Brasil Bolsa Balcão) com dados do período de 2006 a 2018. Os dados e informações foram coletados nas notas explicativas das empresas, na base Refinitiv®, no site da Comissão de Valores Monetários (CVM) e da Polícia Federal. Com base na Regressão Logística para dados em painel, foram analisadas as variáveis firma de auditoria, crescimento dos estoques, representatividade dos passivos, rentabilidade e perdas operacionais. As variáveis foram selecionadas tendo em vista sua relevância identificada na literatura como detentoras de potencial para identificar riscos de fraudes. Os resultados demonstraram que os *red flags* firma de auditoria e o endividamento mensurado pela ponderação dos passivos pelos ativos totais contribuem para a identificação do risco de fraudes corporativas. O estudo contribui para analistas, credores e investidores identificarem, com base nos *red flags*, empresas com risco de fraudes corporativas. A fraude corporativa é um crime que afeta todas as empresas e o estudo de *red flags* é relevante para investidores e analistas

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identificarem empresas com indícios de fraudes ou no caso de a gestão identificar estas no seu estágio inicial. Os resultados do estudo podem influenciar o trabalho de auditores internos e externos, organismos fiscalizadores, investidores, analistas, agências de classificação de crédito e sistema bancário.

Palavras-Chave: Fraudes Corporativas. *Red Flags*. Prevenção.

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1 Introduction

Corporate frauds expose the accounting report fragility and the need to increase control and surveillance so as not to harm the user confidence. Frauds occur mainly with the accounting misuse and by manipulating information (Wells, 2008). In addition to causing losses, frauds become financial scandals and harm the accounting information quality, generating suspicion from investors, creditors and clients (Hung & Cheng, 2018, Munawer, Yahya, & Siti-Nabiha, 2012).

The major challenge that corporate frauds impose is their prevention before they occur or their identification during their occurrence. Nonetheless, several times they happen with the participation of the managers and thus they remain hidden from the internal and external control bodies and from other interested parties, generating suspicion and uncertainties in the market. To contribute to the reduction of such uncertainties is part of the Accounting assignments and responsibilities, as a way to guarantee the safeguarding of the assets and reliability of the information provided to their users via financial statements (Barkemeyer et al., 2015).

As a way of overcoming the challenge of preventing the corporate frauds, the use of early warning signs, known as red flags, which work as warning signs that something irregular may be occurring, is worth being highlighted. (Baader & Krcmar, 2018; Gullkvist & Jokipii, 2013). In the literature on fraud red flags, discussions regarding behavioral, moral, ethical issues (Albrecht et al., 1980; Coenen, 2008; Horwath, 2011; Hackenbrack, 1993; Yusof, 2016; Romney, Albrecht & Cherrington, 1980;

Sandhu, 2016; Vance, 1983), structural aspects and corporate governance predominate (Apostolou and Hassell, 1993; Dharan and Bufkins, 2008; Lim, Lim Xiu Yun, Liu and Jiang, 2012).

Authors such as Kaplan and Reckers (1995), Robertson (1997), Dichev, Graham, Harvey and Rajgopal (2016) show susceptible indicators to be used that together can be useful to predict fraudulent situations that are camouflaged by altering financial statements. Among the indicators suggested by the authors, profit sustainability, non-recurrent items absence and the linking between the profits and the cash flows can be highlighted.

On the other hand, authors such as Lim, Lim, Liu and Jiang (2012), Baader & Krcmar (2018), Botitz and Timoshenko (2014), Brazel, Jones, Thayer and Warne (2015), Dal Magro and Cunha (2017), Dichev et al. (2016) and Moyes, Young and Din (2013) demonstrated the capacity of some red flags to individually predict fraud risks. Among the red flags highlighted by the authors, it is verified that there are the ones related to operational activities, oriented culture for the obsessive remuneration, lack of governance and absence of internal controls, agreement with small and unknown auditing firms, political connections suggesting that these can identify the potential of Chinese companies to commit frauds and to distort the financial statements.

However, in terms of the adoption of complex accounting and surveillance systems, the cases of fraud do not decrease and they are still frequent (Dalla Vecchia et al., 2018; Dal Magro & Cunha, 2017). The constant market changes, added to the creative accounting practices and the sophistication of fraudulent practices (PWC, 2018) can hinder the follow-up and the control of organization processes and make the task of corporate fraud identification more complex (Hegazy & Kassem, 2010).

Such complexity makes the indicator and technique development that can help fight this type of crime relevant, especially in the prevention or identification in the early stage. The analysis of indicators from the financial reports that can contribute to precociously detect fraud risk signs

is among these techniques. Hence, it is appropriate to study the subject-matter and to explore the potential economic-financial indicators as to become red flags, which signals corporate fraud risks.

In Brazil, the Lava Jato Operation, triggered in 2014 by the Federal Court, revealed that 39 publiclyheld and private companies from a wide range of sectors were involved in acts of corruption, whose fraudulent operations were hidden in the accounting. As to the objections of the judge *modus operandis* which are not commendable concerning a plot with the prosecution, demonstrating his partialty for the imprisonment of preselected defendants, the operation shows that the frauds occurred with the participation of the managers' summit and significantly affected the companies, leading some to bankruptcy or to judicial reorganization. Furthermore, other operations, such as Zelotes Operation (2015), Xepa Operation (2016) and Carne Fraca Operation (2017) also placed the managers from the senior management of companies, whose facts affected the accounting after the arrests made by the Federal Police, in the dock.

In this regard, the current study has the following research guiding question: What red flags can contribute to identify corporate fraud risks? In order to answer the research problem, the current study aims to assess red flags that can contribute to identify corporate fraud risks.

In order to achieve the goal, the current research analyzed a sample of 277 companies with data regarding the period from 2006 to 2018, segregating those companies that effectively involved themselves in frauds. In order to perform the segregation, the proceedings of the Brazilian Securities and Exchange Commission (CVM) and the operations triggered by the Federal Police (FP) in the research period were taken into account. The financial indicators of liability increase, inventory increase, profitability, operational losses and the type of auditing such as red flags were selected, which are identified in the literature with potential to identify fraud risks.

The results confirmed the positive association between the auditing firm and the liability increase, demonstrating that such red flags can contribute to identify corporate fraud risks. For the other red flags addressed, significant statistics that inferred some potential to identify fraud risks were not found. From the point of view that the red flags together enlarge the identification potential of fraud risk, the used data were insufficient to identify this synergy among the indicators.

Nonetheless, it was verified if the results based on real and known fraud situations contribute to confirm that some red flags have the capacity to identify fraud risks. It was verified that the liability increase in an unbalanced way and the auditing firm can be individually used by the accounting users to identify the fraud risks. Such indicators can also be used to ensure greater robustness to the auditing tests, as they presented statistical significance, inferring association with the frauds used as the basis for the study.

For the analysts, the evidences based on the red flags may suggest the need for adjustment in the indicators used for investment analysis and recommendations. From the investors' part, the signs suggested by the red flags may mean the choice of companies with lower risks and higher quality in the indicators or the replacement of investments in previous moments to the discovery of frauds that may lead to losses. From the creditors' part, the red flag use can lead to a more effective follow-up of the ability of interest and principal payments, enabling early actions for eventual protections regarding the discovery of fraud events. In general, the use of the red flags enables users to infer greater reliability and predictability by receiving the information disclosed by the companies, identifying those with potential fraud risks.

From a theoretical point of view, the study contributes to inventory and to test a set of red flags mentioned in the literature as fraud risk signs. Thus, the present study suggests that although there are elements to theoretically infer that the greater the number of red flags, the better would

the prediction and the identification of fraud risk be, it could not be confirmed by the data analysis. Nonetheless, the absence of synergy among the red flags does not invalidate the indicator individual contributions. These results can boost future studies to enhance the debate on fraud risks, their socioeconomic effects and the need for preparing the professionals for the use and the study of more effective indicators in fraud prediction and prevention.

2 Theoretical Review

2.1 *Motivating factors of Corporate Frauds*

Corporate frauds are illicit actions and conducts consciously and deliberately accomplished by employees, managers, executives, senior management members or organization owners. They happen in a process by aiming to suit one's own interests and with the intention of jeopardizing third parties or of obtaining advantages (ACFE,2018; Costa & Wood Jr., 2012).

Part of the understanding of the reasons why the agents commit frauds is based on the Fraud Triangle (Dorminey, Fleming, Kranacher, & Riley, 2010). This term was developed by the American sociologist and criminologist, Cressey, who focused his researches on the circumstances that lead individuals to involve in fraudulent and unethical activities. It is worth stressing that Sutherland (1949) conceived the motivating elements that Cressey (1953) would call Fraud Triangle (Yusof, 2016) later on in his seminal study.

The fraud triangle consists of three elements: (i) opportunity (ii) pressure and (iii) rationalization. In the first element, the "reliability violator" has the opportunity to commit fraud, usually due to the absent or inefficient trust and controls. In the second element, there is a perceived financial need or pressure that provides motivation to commit frauds. Finally, in the third element, the involved ones have the capacity to

rationalize that the fraudulent act is justified and consistent with their values (Roden, Cox, & Joung, 2016).

Over the years, fraud researchers have enlarged the fraud triangle. Wolfe and Hermanson (2004) added “capacity” as a fourth fraud risk factor. According to the authors, there are personal characteristics and ability that cause the fraudster to identify the opportunity of committing a fraud. Afterwards, Crowe (2011) added two new characteristics to Cressey's model: arrogance and competence, version known as the Fraud Pentagon.

In addition to the fraud pentagon, Murphy and Free (2016) added the organizational atmosphere as an active variable that affects the propensity to commit a fraud. These adaptations to the fraud triangle original idea consider that it occurs in a wide variety of forms that modify as new technologies and new economic and social systems provide new opportunities for fraudulent activities (Nisbet, Miner, & Yale, 2019).

2.2 The role of Red Flags in Corporate Fraud Detection

According to the Association of Certified Fraud Examiners (ACFE, 1996), frauds can be classified into three groups: asset misappropriation, fraudulent financial statements and corruption. According to the ACFE research (2018) with data from 125 countries, the asset misappropriations are the most common fraud groups, occurring in 89% of the cases. However, they are also the least costly, causing an average loss of 114 million dollars, followed by the corruption schemes that represent 38% of the cases and resulted in an average loss of 250 million dollars for the organizations. The least common type and the costliest one is the fraud in financial statements, which occurs in 10% of the cases and it causes an average loss of 800 million dollars (ACFE, 2018).

In an attempt to foresee such situations, red flags that work as predictors of fraudulent situations were developed. The red flags are risk indicators that work as alerts (banners) for possible fraudulent behaviors, suggesting that something irregular may be happening (Baader & Krcmar,

2018; Gullkvist & Jokipii, 2013), considered as “thermometers” in the detection and prevention of frauds (Murcia, Borba, & Schiehl, 2008).

The approach development by indicators took place in the mid-seventies, with the Touche Ross company design, in response to the Accounting Report from the Securities and Exchange Commission n° 153. The company developed a set of alert signs for frauds that involved economic and business structure factors (Sorenson & Sorenson, 1980). From the initial design, other companies created their lists of red flags and they discussed the problem potential indicators.

Although it is considered an efficient technique in fraud detection and it is recommended by the majority of auditing standards, it can not be considered as a perfect one. Its fragility is due to certain alerts which can occur both in non-fraud and in fraud situations (Albrecht et al., 2012; Pincus, 1989). Moreover, there is a series of red flags associated to the human behavior, such as greed, ignorance, determination and attitude that are not always susceptible to be captured (Yusof, 2016). However, the role of the red flags based on indicators is to increase the sensitivity of the controls in face of the occurrence of situations that represent fraud risks even though it is with a certain error margin.

The research carried out by Murcia, Borba and Schiehl (2008) on the relevance of the red flags in assessing fraud risk in the accounting statements, with 33 Brazilian independent auditors, analysed 45 red flags from a total of 267 identified ones in the literature. In order to carry out the research, the authors divided the indicators into 6 clusters consisting of structure and environment, sector/industry, managers, economic-financial situation, accounting reports and external auditing. The results identified that 95,56% of the indicators listed in the questionnaire presented either a fraud “average risk” or a fraud “high risk” in the accounting statements, according to the external auditor perception. Indicating thus the relevance of the red flags in the fraud fighting.

2.3 *Research Hypotheses*

Lim, Lim Xiu Yun, Liu and Jiang (2012) analysed the characteristics of 250 Chinese companies listed in the USA in order to build a model to prevent fraud. The results found characteristics in common such as bad corporate governance, agreement with small and unknown auditing firms, lack of accounting standards and political connections suggesting that these could identify the potential of Chinese companies as to commit frauds and to distort the financial statements.

As to the auditing firm, Lisic et al. (2014) examined the impact of auditors on the accounting fraud incidence. The research results demonstrated that the organizations audited by large auditing companies would be less prone to commit fraud when compared to the others. Hence, the auditing company size can be seen as a substitute for the corporate culture inherent to all the organizations and it can influence the issued opinion.

Thus, it is suggested that larger company auditors hold greater knowledge and commitment when accomplishing auditing services. Furthermore, the large auditing company professionals would probably audit larger companies as well and hence they would be more susceptible to fraud risk (Apostolou & Hassell, 1993; Moyes, 2007). For Carcello and Nagy (2004), auditors have been prone to being associated to frauds of client financial reports for a long time. Therefore, the following research hypothesis has emerged:

H1: Companies audited by non-Big Four firms are associated to greater risk of corporate fraud.

If on the one hand the frauds aim at increasing/diminishing the incomes to better/worsen the performance, another way to achieve the same objective is to fictitiously or via accounting choices alter the product costs and consequently the inventory volume. Murcia et al. (2008) identified the abnormal inventory growth among the red flags suggested by auditors. The authors' results demonstrate that this indicator is among the 95,56% of the

indicators listed in the questionnaire that presented either a fraud “average risk” or a fraud “high risk” in the accounting statements, according to the external auditor perception. This red flag is also presented in the studies by Dichev et al. (2016), Golden et al. (2013) and Medrado (2016) with potential to consequently affect the results and the object of fraudster actions.

Hegazy and Kassem (2010) aimed at exploring the highest probability red flags concerning fraud occurrence in financial reports related to the external auditing. According to the authors, company inventory is one of the elements that is easier as to present manipulation in the financial statements representing an auditing risk. The consumed values in the inventories can be allocated to the fixed assets or written-off as expenditures and vice versa. Moreover, lower values can be recorded in the cases of adjustments via cost or market rule.

Hence, it is verified that the inventory abnormal variation can be identified as a fraud red flag. Dichev et al. (2016), Golden et al. (2013) and Medrado (2016) argue that the inventory abnormal increase can be an attempt to conceal losses and damages in which the inventories could disguise the managing inefficiency. In such sense, the following research hypothesis emerges:

H2: The abnormal inventory growth is associated to corporate fraud risk.

Profitability is one of the reporting bases for the investment decisions. Therefore, managers can stimulate their stock prices via changes in profitability (Hegazy & Kassem, 2010; Apostolou & Hassell, 1993; Dichev et al., 2016; Yücel, 2013). In this context, if the profitability presented by the entity does not correspond to the sector average, it suggests fraud risk signs, being considered as a red flag for such (Murcia et al., 2008).

According to Hegazy and Kassem (2010) over half of the frauds in the financial statements involved income, whose main effect is to impact

company profitability. The most common way to fraud income can be by recording fictitious sales, causing the results of the period to be inflated.

According to Medrado (2016), as the operational result of a company is an indicator that provides the investors with information mainly on how its growth is, there is an internal effort by the executives so that the indicators that represent the generation of income are always positive and with an increase trend.

The income recording above the accomplished one can lead to the company result behavior that differs from the others in the sector. In this sense, Golden, Brockett & Wortham (2013) highlight that a way to identify the hidden fraud in the accounting information is to compare the result to the one from the other companies in the same sector of operation, subject to the same conditions of the analyzed company. Based on the identified studies, the research hypothesis is presented as follows

H3: Profitability above the sector average is associated to corporate fraud risk.

Dichev et al. (2016) verified in an interview carried out with 400 CFOs, with special emphasis on the prevalence and detection of distorted profits, that the extent of the profit distortion is close to 30% in the research CFOs' opinion. In addition, over 20% of the companies use some type of discretion of the accounting standards, moving the average distortion of 10% of the reported profits upwards or downwards.

It should be emphasised that Dichev et al. (2016) affirm that their questionnaire made the fraud exclusion events clear. However, the authors highlight the CFOs' concern by considering that most of the result management types begin in situations of low impact and can have the invasion as a consequence for the fraud area.

Studies by Hegazy and Kassem (2010) and Medrado (2016) verified that a way to commit frauds is the recognition of events that would be revenues as liabilities. The liability recognition, or hidden revenues, are easier to be camouflaged than to falsify sales transactions. The counterparts

of omission or excess of revenue recognition by accrual or by liabilities by means of downpayments can be verified in the liability analysis. Thus, the following research hypothesis is elaborated:

H4: The increase of liabilities is associated to corporate fraud risk.

Medrado (2016) analysed the adequacy of red flags in order to identify events that characterize fraud risks or accounting manipulation, in a continuous auditing process. One of the analysed red flags concerns the operational losses. According to the authors, as a company operational result is an indicator for the investors on its growth, there is an internal effort by the executives so that the indicators represent positive results with growth trend as well.

For the Statement on Auditing Standards No. 99 (SAS 99) (AICPA, 2007), the fraud risks are the result from several factors. The SAS 99 guidelines highlight that in environments where the managers are encouraged or pressured to achieve stable or increasing financial profitability goals, one of the ways to identify such behaviors is to verify the existence of operational losses that threatens bankruptcy, foreclosure or hostile takeover. In such situations, the managers seek their position defense and for such they may use fraudulent artifices. The following research hypothesis was built from these assumptions:

H5: The operational losses are associated to corporate fraud risk.

3 Methodology

3.1 Sample Selection and Data Collection

In order to achieve the objective of assessing the red flags that contribute to identify corporate fraud risk, the non-financial companies were selected, with stocks negotiated on the Brazilian Stock Exchange, called Brazil, Stock Exchange (Bolsa), Over-the-Counter market (Balcão) (B3) totaling 303 companies. For the database construction, present information from the Eikon Refinitiv® base, from the Securities Exchange Commission (SEC) website and from the Federal Police (FP) one were considered. Two

distinct periods were considered for the analyses. For the company selection, the analysis includes the years from 2008 to 2020. As to the variable selection, the period was from 2006 to 2020, so that the data collecting of at least two previous periods to the fraud discovery that occurred in 2008 were feasible.

In Brazilian SEC (CVM), the Sanctioning Administrative Proceedings (SAP) were analyzed, the selection was via the CVM > Proceedings > Advanced search website. The field “Term”, blank, “period” from 01/01/2008 to 31/12/2020 and in the field “Type” “judged sanctioning proceedings”. In the analysis of the proceedings, 669 proceedings were identified, considering that one proceeding can address more than one company or this company can be in more than one proceeding. After reading the proceedings, those companies that were effectively condemned in some of the corporate fraud categories, such as interest conflict, violations related to financial statements, Responsibility of management board members, managers' fiduciary duties, among others were selected.

As to the Federal Police Operations, the ones that cited companies with stocks negotiated on B3 whose proceedings were fully judged were selected. The search was on the FP website > Press > Large Operations, reaching the following results: Lava Jato Operation (2014), Zelotes Operation (2015), Xepa Operation (2016) and Carne Fraca Operation (2017).

From the collected information, the data were segregated in two samples: (i) companies that were condemned by frauds (32); (ii) companies that were not condemned by fraud (271). Hence, it has been adopted for the current research that a fraudulent company is the one that has been involved in at least one fraud case during the study period. The justification for this criterion is that in longitudinal researches in the fraud area, it is hardly possible to precisely identify the start and the end dates of the unlawful practice, by considering that when such practice occurs, it occurs longer than one period (Beneish, Lee & Nichols, 2013; Barkemeyer, Preuss, & Lee, 2015).

By using this form of measuring corporate fraud from real cases, measurement errors are avoided, according to Im and Nam (2019), considering that other types of measurements have higher error probability as the answers obtained by them can not be true, considering that the fraudsters would probably hide conduct evidence against themselves.

3.2 *Econometric Procedures*

In the literature on fraud prediction, it was possible to observe that a significant part of the studies is grounded on statistical model use, for instance multiple linear regression technique, logistic regression, discriminant analysis and computing methods, such as the neural networks (Kirkos, Spathis, & Manolopoulos, 2007; Medrado, 2016).

By considering that this study objective is to verify the red flag contribution in the corporate fraud detection based on the indicator predictive capacity, the Logistic Regression technique for panel data was chosen. The model is described in Equation 1.

$$FRAUD(z) = \beta_0 + \beta_1 AUDT + \beta_2 INV_{it} + \beta_3 ROA_{it} + \beta_4 INDEBT_{it} + \beta_5 OP_L_{it} + \varepsilon_{it} \quad (1)$$

Where: *FRAUD*: dummy variable that assumes value 1 when the company was involved in fraud in at least one year and 0 if it had not involved in fraud in none of the years; *AUDT*: dummy variable that assumes value 1 when the auditing company is a Big Four and 0 when it is not, of company i, at moment t; *INV*: measures the inventory variation in the period weighted by the total assets of the period t-1 as the basis; *ROA*: at moment t; *INDEBT*: company i indebtedness, at moment t weighted by the total assets; *OP_L*: dummy variable that assumes value 1 when the company i has negative ROE and 0 when the company i has positive ROE, at moment t.

All the study period is considered regarding the *FRAUD* dependent variable as the objective is to verify if the used indicators contribute as red flags to signal company fraud risk. Thus, the year when the fraud was identified in the company was not considered, either by the administrative proceeding or by the federal police operations, as it refers only to the year in which the fraud was discovered, but not to the period in which it occurred or in which it started.

Such classification was chosen due to the fact that it was impossible to establish the year in which the fraud started or if the fraud repeated for several periods that preceded its discovery.

Concerning the *AUDT*, it represents the size of the auditing company measured by its classification as one of the four big auditing companies (big four) and by other auditing companies. The hypothesis to be analyzed is that there is an inverse association of this variable with the fraud risk (Apostolou & Hassell, 1993; Dichev et al., 2016; Lim et al., 2012; Lisic, Silveri, Song, & Wang, 2015; Medrado, 2016; Moyes, 2007).

The *INV* variable that measures the inventory growth in the period has the inventory variation in the period weighted by the total assets of the period t-1 as the basis. The hypothesis to be confirmed with this variable is that there is a positive growth relation of inventories with the fraud risk (Dichev et al., 2016; Golden et al., 2013; Medrado, 2016; Murcia & Borba, 2007).

The *ROA* variable was obtained by having the period net profit divided by the asset volume as the basis. The hypothesis to be verified is that a divergent profitability of the sector can be related to fraud risk (Medrado, 2016; Murcia & Borba, 2007). The *INDEBT* variable was obtained by the weighting of the total liabilities with the total assets of the period t-1 (Dichev et al., 2016). This variable was Winsorized at 1% and 99% levels in order to avoid possible unwanted effects in the statistical analysis of the sample existing outliers. At last, the *OP_L* variable was estimated by

having the recording of operational losses in the income statement for the fiscal year as the basis (Medrado, 2016).

4 Result Analysis

4.1 Descriptive Statistics

In order to analyze the behavior of variables used as red flags of corporate fraud risk, those with continuous characteristics of categorical variables were segregated. Table 1 summarizes the descriptive analysis for these variables.

Table 1. Descriptive statistics according to fraud and non-fraud occurrence

Variable	Without fraud event						With fraud event						P-Value
	N	min	max.	avg.	p50	sd.	N	min	max.	avg.	p50	sd.	
INDEBT	2729	0.01	20.48	1.05	0.65	2.33	397	0.12	20.48	0.76	0.76	1.7	0
INV	2306	-1	109.8	0.27	0.06	2.76	376	-1	29.39	0.19	0.03	1.61	0.15
Categorical variables													
AUDT	Outsers			<i>Big4</i>			Outsers			<i>Big4</i>			0.00
<i>N</i>	1065			2118			208			208			
<i>%</i>	33.46			66.54			50.00			50.00			
OP_L	Without Loss			With Loss			Without Loss			With Loss			0.83
<i>N</i>	3082			103			406			10			
<i>%</i>	96.77			3.23			97.60			2.40			
ROA	Below Average			Above Average			Below Average			Above Average			0.05
<i>N</i>	945			1844			130			247			
<i>%</i>	33.88			66.12			34.48			65.52			

Source: Based on the information from the Thomson Reuters database.

Notes: N represents the observation number; p50 represents the median; sd represents the standard deviation. P value indicates the values associated to the Mann-Whitney test.

Regarding the *INDEBT* variable, one can notice that the group composed by the companies with identified frauds have proportional liabilities to the assets in higher mean values (0,76) when compared to the group considered as non-fraudulent (0,65). The Mann-Whitney test result confirms the differences in the samples (with fraud and without fraud) to a significance level of 1% rejecting the null hypothesis of equality of medians. Therefore, it is verified that the variable behavior differs between the two research samples (fraud and without fraud) that suggests that companies

involved in frauds have higher levels of liabilities recognized in their financial statements.

The second continuous variable described in the Table (*INV*) has, in average, higher values in non-fraudulent companies. Nonetheless, when performing the Mann-Whitney test, it was verified that the test null hypothesis regarding the fact that the sample medians are different is not rejected. It means that it is not possible to affirm that there are significant differences in the inventory variable between the group of companies in which frauds were identified and the others.

With regard to the *AUDT* variable, Table 1 demonstrates that in the companies classified as non-fraudulent ones, 66.54% of the companies were audited by a Big4. However, with regard to the group of fraudulent companies, there were no differences among the auditing companies. According to the proportion test result to analyze if there is any difference between the audited ones by Big4 or Others (p-value 0.00), it is possible to verify that difference in the fraud involvement by companies audited by a Big4 is found when they are compared to those audited by another kind of firm.

For the *OP_L* variable, the results are visible regardless of more robust tests and they demonstrate that the differences between the companies with and without fraud are significant. This result is confirmed by the proportion test (p-value 0.83), demonstrating that there are no differences of operational losses between the two groups of companies. As to the ROA variable, at a 5% significance level, it is observed that there are statistical differences between the companies involved in frauds and the others. This may suggest that the companies in the fraud group have significant changes in the operational results, maybe related to fraudulent actions.

The analysis results of the variable descriptive statistic individually suggest that the *INDEBT*, *AUDT* and *ROA* variables contribute to the fraud risk indication in the analyzed companies. These results suggest that the

red flags individually contribute to identify corporate fraud risks. However, these results can be considered as preliminary ones. In order to analyze the capacity of the variables together, it is necessary to use tests that consider the effects of combined variables. For such purpose, the combination of the variables by the logistic regression model was analyzed, being presented as follows.

4.2 Result Analysis of the Logistic Regression Model

Aiming to analyze the model robustness and to select the logistic regression model in suitable panel for the sample, tests to verify the most adequate estimate were performed (by fixed effects or random effects). Initially, the Chow Test was performed, whose result rejected the null hypothesis, indicating that the panel data modeling is adequate for the research sample. In the sequence, the Breusch-Pagan test was performed, whose result rejected the null hypothesis that the POLS model offers appropriate estimators, that is, there are differences statistically significant (at a 5% level) among companies over time that justify the adoption of panel modeling

Subsequently, the Hausman test was performed to verify which model, between the fixed and the random one, would be more appropriate. The results indicate that the correction model hypothesis is adequate, random effects, was rejected. Thus, the most adequate estimation is through the fixed effect model. Moreover, additional tests to identify autocorrelation and heterocedasticity problems were performed, which were not identified.

With the goal of verifying the red flag predictive capacity, the statistical relevance analysis of the explanatory variables became necessary, indicating the existence of the association of each of them such as the behavior of the dependent variable (Fraud) of the study. For this purpose, the data analysis using the longitudinal logistic regression model was performed to identify the relation between the fraud dependent variable and the other independent variables of the study. Table 2 presents the results.

Table 2. Regression Result – Robust Standard Errors

$$FRAUD(z) = \frac{e^{(\alpha + \beta_1.AUDT_{it} + \beta_2.INV_{it} + \beta_3.ROA_{it} + \beta_4.INDEBT_{it} + \beta_5.OP_L_{it})}}{1 + e^{(\alpha + \beta_1.AUDT_{it} + \beta_2.INV_{it} + \beta_3.ROA_{it} + \beta_4.INDEBT_{it} + \beta_5.OP_L_{it})}}$$

<i>FRAUD</i>	Coefficient	Standard Error	Z
<i>AUDT</i>	-0.466***	0.062	3.95
<i>INV</i>	-0.022	0.033	-0.69
<i>ROA</i>	0.009	0.126	0.07
<i>INDEBT</i>	0.245***	0.062	3.95
<i>OP_L</i>	-0.301	0.476	0.07
<i>Cons.</i>	1.007***	0.136	7.37
<i>Prob > F</i>	0.0207		
<i>Wald chi²</i>	0.020		
<i>Obs</i>	2367		

Source: By the authors.

Notes: ***significant t-statistic at the 0,01 level. **significant t-statistic at the 0,05 level. *significant t-statistic at the 0,1 level. (two-tailed).

According to Table 2 results, it is possible to verify an association between the Auditing Firm variable (*AUDT*) and the fraud risk, consistent with the literature and the descriptive statistic that has already been presented. Authors such as Apostolou and Hassell (1993), Lim et al. (2012), Lisic, Silveri, Song, and Wang (2015), Medrado (2016) and Moyes (2007) affirm that the size of the auditing company can be seen as a substitute for the corporate culture inherent to all organizations and thus it can influence the requirements of the control system used as the ground to issue an opinion.

It is worth emphasizing that the large Brazilian contractors, responsible for the infrastructure of Brazil, and the largest oil and gas company of Brazil were audited by a big four and they were involved in the frauds discovered by the *lava jato* operation. The same is verified regarding the *carne fraca* operation in which the largest company of the meat and processed food sector of Brazil, with frauds identified by the FP, was also audited by a big four.

According to Apostolou & Hassell (1993) and Moyes (2007), auditors from larger auditing companies hold greater knowledge and commitment in the conducting of auditing work and they would be more

susceptible to the fraud risk. Nonetheless, although the sample results present an inverse relation between the auditing firms and the big four ones, the Brazilian reality demonstrates that, although the companies are audited by “good auditing firms”, they are still subject to fraud occurrence.

The *INV* variable has also proved to be a non-significant one, rejecting the hypothesis that the companies with larger growth in the inventory variation present higher fraud risk in the analyzed period. These results contradict the studies carried out by Medrado (2016) and Murcia & Borba (2007).

With regard to the profitability (*ROA*), the findings of this study did not demonstrate statistically significant association of this variable concerning the fraud risk. Hence, it is not possible to affirm that there is an association among the companies that differ from the sector profitability. It should be stressed that the results by Medrado (2016) suggest that companies that operate in a certain sector follow the same dynamic concerning their costs and market of product sales and consequently, in normal situations, their profitability measures should not present significant divergence over time.

It is worth stressing that the absence of statistic significance may derive from the methodology used for the variable construction. Unlike Medrado (2016), the current study used the variable in a categorized way so that the companies that were above the sector average, regardless of the value, were clustered in the same class. This difference in the methodology can justify the lack of statistical significance for the variable and differ from the results by Medrado (2016).

Regarding the liabilities of the companies captured by the *INDEBT* variable, the results suggest the existence of a positive and statistically significant association at a 1% level, suggesting that companies that involved in frauds have higher liabilities. The result corroborates the findings by Dichev et al. (2016) that revealed that high liability in a

company is an indicative that can be used by investors and financial analysts to detect distortions in the accounting information.

The last tested red flag was the one on operational losses. The company managers with recurrent operational losses may feel pressured in order to improve the situation, stimulating the fraud practice. In the current research, the results do not corroborate this hypothesis, as the variable did not prove to be statistically significant (P Value = 0.812), suggesting that the collected data do not allow to establish an association between the operational losses and the fraud risk.

For Burgstahler & Dichev (1997), a plausible explanation for the lack of association lies on the fact that the managers avoid to report losses in view of the loss aversion from the capital market agents. According to the authors, a loss recording can be relevant for the analyst and investor decision-making. Thus, the managers "manage" the results and they do not present significant losses in their accounting reports (Reis, Lamounier, & Bressan, 2015).

5 Final Considerations

The current research aimed at verifying the contribution of the red flags derived from the financial reports in corporate fraud detection. In this sense, the study analyzed the main indicators associated to fraud events in the reviewed literature. Grounded on a sample of 277 companies, five independent variables were analyzed, based on data from 2010 to 2018. To this end, the logistic regression was used to assess if the variables were associated to companies that were involved in findings of fraud events during the period.

The subject-matter is relevant in the accounting environment, as the Accounting holds responsibility for safeguarding the company assets, in addition to guaranteeing that financial statements are reliably presented, influencing the credibility of the accounting information and the provided services. It is highlighted that the red flags theme was developed in the

auditing environment and hence part of the researches regarding the theme has this environment as the basis, mainly exploring methodologies derived from interviews and questionnaires.

Nonetheless, with the increasing cases of corporate frauds and the derived losses, other groups of interest started to explore such indicators, especially investment and credit analysts and government bodies. Such interest reflects on academic researches, which started to consider these groups in order to verify the perceived importance of the red flags.

The chosen red flags in this study (auditing firm, indebtedness, inventory, profitability, liability and operational losses) have already been identified as fraud predictors by other researches. However, the used methodology relied on statistical tests applied to indicators which were obtained from a sample of companies that reportedly involved in frauds.

The results of the current research suggest that only the *AUDT* and *INDEBT* variables have statistically significant association for the selected sample and the adopted methodology. Therefore, the red flags that can contribute to the fraud situation detection were the auditing firm and the indebtedness measured by the weighting of the liabilities by the total assets. The other variables did not present statistical significance and consequently the hypotheses that they have predictive capacity of fraud risks were rejected.

By considering the analyzed companies and red flags, the results suggest that the liability size is associated to fraudulent companies and can be highlighted as the sole standard of economic-financial behavior related to frauds. The other red flags in the current study did not prove to be possible indicators of fraud event risk, having the used sample as the basis.

The divergences of the current research results with the analyzed literature may be derived from the used methodology. The predicting fraud variables listed in the literature with interview approach and in criteria that the research participants believed to be adequate for the fraud

prediction. Nonetheless, such variables can not support empirical tests in a sample with heterogeneous companies, affecting their predictive capacity.

Furthermore, the sample construction of companies involved in fraud, based on the CVM proceedings and on the Federal Public Ministry actions, is empowered to affect the research results. The sample composition based on this format can incur in misclassification, as the companies that are with fraud events in progress have not been discovered or disclosed yet. In this case, such companies may have been misclassified in this study as non-fraudulent ones.

Moreover, fraudulent companies often develop new data manipulation techniques, often with off balance operations, which makes the irregularity detection by using financial statements difficult and with the discovery only possible by making a complaint. All these factors, demonstrate the difficulty to precociously identify a fraud situation. In addition, to make this identification from the red flags based on financial reports that are built by the same managers who are responsible for the frauds becomes a harder task to a greater extent.

As such, the need to address the subject-matter in different ways was verified in the research process. Hence, it is suggested that future researches explore the behavioral and learning characteristics that suggest potential to play an important role in the detection of such kind of event. To carry out experimental researches that use behavioral factors associated to financial indicators can contribute to come closer to a possible model of fraud risk red flags.

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