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ORIGINAL ARTICLE

The Cressey hypothesis (1953) and an investigation into the occurrence of corporate fraud: an empirical analysis conducted in Brazilian banking institutions

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ABSTRACT

This article fills a technical-scientific gap that currently exists in the Brazilian literature on corporative fraud, by combining the theoretical framework of agency theory, of criminology, and of the economics of crime. In addition, it focuses on a sector that is usually excluded from analyses due to its specific characteristics and shows the application of multinomial logit panel data regression with random effects, which is rarely used in studies in the area of accounting. The aim of this study is to investigate the occurrence of corporative fraud, as well as cases of fraud in Brazilian banking institutions, by using detection variables related to the Cressey fraud triangle. Research into fraud and methods of detecting fraud has grown in management literature, especially after the occurrence of various corporative scandals in the 1990s. Although regulatory agencies have increased their investments in monitoring and control, fraud investigations and convictions are still common in the day-to-day administration of banks, as can be seen in the Brazilian Central Bank and the National Financial System Resource Council's databases of punitive proceedings. We believe that this article will have a positive impact in the area of accounting sciences, since it involves corporative fraud in a multidisciplinary form and because it provides the incentive to use a quantitative tool that can help increase the development of similar studies in the area. This study tested the theory that the dimensions of the fraud triangle condition the occurrence of corporative fraud in Brazilian banking institutions. Thirty-two representative variables of corporative fraud were identified in the theoretical-empirical review, which were reduced to seven latent variables by the principal component analysis. Finally, the seven factors formed the independent variables in the multinomial logit models used in the hypothesis tests, which presented promising results.

Keywords: corporative fraud, banking institutions, fraud triangle.

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1. INTRODUCTION

The number of studies on fraud and fraud detection methods has grown in management literature, especially since the occurrence of corporate scandals in the 1990s (Wang, Winton, & Yu, 2010). These studies include those that investigate the probability of occurrence of accounting and corporate fraud, such as those by Beasley (1996), Brazel, Jones, and Zimbelman (2009), Crutcheley, Jensen and Marshall (2007), Erickson, Halon and Maydew (2006), Lou and Wang (2009), Troy, Smith, and Domino (2011), and Wang et al. (2010).

In the studies mentioned, one point of interest can be verified: banking institutions have not been analyzed in isolation. Because of the importance of these institutions for the economic context, it is clear that the losses from a fraud in a large bank will be felt by the economy in general, since these institutions act as financial intermediaries and providers of external capital for other economic activities. Therefore, understanding and finding ways of preventing and detecting corporate fraud in banking institutions is crucial for society as a whole.

In light of this, the hypothesis created by Cressey (1953) stands out, enabling fraudulent behavior by managers in corporations to be examined using an analysis with three dimensions: pressure, opportunity, and rationalization. This hypothesis reports that individuals who occupy positions of trust in the financial area (financial trust) can violate this trust if they have some particular financial problem that cannot be shared. These individuals, in their capacity as agents of the corporation, believe that this particular problem can be resolved secretly, even if for this they have to violate the trust placed in them. By justifying the breaking of trust as a means of resolving their financial problems, these individuals may use financial resources to their own benefit, even if they self-sustain a false feeling of seriousness in their actions (Cressey, 1953).

Cressey's hypothesis (1953), which is also known as the fraud triangle, considers three dimensions of fraudulent behavior: pressure, opportunity, and rationalization. Pressure, also known as motivation, requires the existence of financial problems that cannot be shared; opportunity would be to secretly resolve these problems by violating financial trust; and rationalization of the fraudulent act would be viewing it as necessary and justifiable for resolving the financial problems. Cressey's fraud triangle (1953) has been used both by the literature and in accounts auditing practice to investigate the occurrence of accounting and corporate fraud. In the literature, the studies by Brazel et al. (2009), Lou and Wang (2009), and Troy et al. (2011) stand out, which manage to elaborate econometric models based on Cressey's triangle (1953) to detect fraud. In practical terms, Cressey's hypothesis (1953) has been used by standardizing organizations as a tool for detecting fraud (Higson & Kassem, 2013), as can be observed in the rules of the American Institute of Certified Public Accountants (AICPA, 2002) – Statement on Auditing Standards n. 99 (SAS n. 99) –, of the Federal Accounting Council (CFC, 2009) – Resolution n. 1.207 of 2009 –, and of the International Accounting Standards Board (IASB) – ISA 240 of 2009.

It bears mentioning that Brazilian studies on corporate fraud are still in their infancy (Murcia & Borba, 2005; Silva, 2007). Most of the Brazilian studies have different scopes from that of this paper, concentrating on analyzing red flags, whether via auditor perception or via the creation of new structures (Murcia & Borba, 2007; Murcia, Borba, & Schiehll, 2008), using data on international companies to calculate the probability of fraud (Wuerges & Borba, 2014) or mapping patterns of corporate fraud (Imoniana & Murcia, 2016). Therefore, carrying out studies to calculate the probability of corporate fraud occurring in the Brazilian context is of academic relevance.

In light of this theoretical gap and of the importance of the Cressey fraud triangle in the theoretical and empirical contexts, the general aim of this study is established, which is to investigate the occurrence of corporate fraud, as well as indications of fraud, in Brazilian banking institutions, by using detection variables from agency theory, criminology, and the economics of crime.

2. THEORETICAL BACKGROUND

2.1. Agency Theory

The agency relationship is one of the oldest and most common forms of codified social interactions (Ross, 1973) and is present in complex societies. Examples of agency relationships include: boss-worker, doctor-patient, adviser-administrator, and relationships between parents and children. Functional dependency, among other reasons, determines that agency relationships are extremely common (Mitnick, 1975). These relationships include those of the owners and managers of corporations, derived from the separation between ownership and control, which is the object of study of agency theory.

According to Demsetz (1983) and Veblen (2001/1921), the separation between ownership and control sought greater management efficiency. The delegation of decision-making authority, according to Barnea, Haugen, and Senbet (1985), is an essential characteristic of modern corporations, in which shareholders delegate their authority to a professional who has managerial skills. However, as Berle and Means (1932) and Demsetz (1983) observe, one of the main problems with regards to the relationship derived from the separation between ownership and control is that of ensuring that managers in fact work towards the aim of achieving the owners' objectives, since their interests are not always convergent.

Agency theory seeks to analyze the relationship between agents and principals. For this, a contract metaphor is used, in which the relationship between agents and principals is formalized in contractual terms (Jensen & Meckling, 1976) that can contain clauses to outline the agent's behavior, with the intention that he/she acts to fulfill the principals' expectations. The differences between the parties' aims give rise to the conflicts known as agency problems. Clearly, agency problems emerge when the conflicts of interest between agents and principals, or between the principals themselves, affect the operation of the company's businesses (Barnea et al., 1985).

These agency problems, whatever the relationship, can damage the efficient functioning of a company. In order to minimize these problems, the owners incur agency costs, which can be subdivided into manager monitoring costs, spending on contractual guarantees from the agent, and residual losses (Jensen & Meckling, 1976; John & Senbet, 1998).

Monitoring costs consist of limiting divergences from the principal, via the creation of appropriate incentives for the agent, which will limit any abnormal activities. These costs can be subdivided into mechanisms for incentivizing and monitoring agents' actions.

Incentive costs involve the agents' remuneration structure and system of financial incentives, while monitoring mechanisms are related to the corporate governance system, including the use of internal and external audits and formal systems of controls (Jensen & Meckling, 1976).

Commitment expenses are resources that agents will receive in the form of a guarantee that they will not make decisions that damage the principal, as well as for guaranteeing that the principal will be compensated if the agent makes such decisions (Jensen & Meckling, 1976).

The residual cost/loss is the monetary value resulting from the reduction in the principal's well-being which occurs in situations in which of the agent's decisions present divergences with regards to the decisions that would maximize the principal's well-being. This loss occurs when the cost of the total execution of a contract exceeds its benefits (Fama & Jensen, 1983).

However, even with the occurrence of the agency costs described above, and with the creation of contracts with restriction clauses and incentives for managers' actions, monitoring of managers' behavior is imperfect, due to the fact that managerial actions are not observable (Denis, Denis, & Sarin, 1999). Like Denis et al. (1999), Jensen and Meckling (1976) observed that the management literature indicates the existence of imperfect monitoring in the agency relationship, resulting from the failure of monitoring costs to resolve agency problems. Thus, even with monitoring mechanisms, agents may not work in favor of the principals' interests.

2.2 Economics of Crime

The first indications of the application of economic concepts in the area of criminology were observed in the studies by Cesare Beccaria (1819/1764) and Jeremy Bentham (2000/1781), which were forgotten until the 1960s. Gary Becker (1968), a Nobel Prize laureate in 1992, reignited the discussion on the theory of crime via the economic prism and emphasized that his effort in determining an economic structure for criminal behavior can be seen as a resurrection and modernization of the pioneering studies.

Becker (1968) revitalized the main idea from Bentham (2000/1781) by suggesting that a useful theory on criminal

behavior can dispense with special anomie theories, psychological inadequacies, or the inheritance of special characteristics, and he extended the usual choice analysis of economists. For the author, criminals are like any other person and behave as rational utility maximizers. Thus, a person becomes "criminal" when the function between cost and benefit of illicit activities is greater than other activities involving legal alternatives (Becker, 1968).

Based on the work of Becker (1968), economists have invaded the field of criminology, using the comprehensive individual rational behavior model. This model, assuming that individual preferences are constant, can be used to predict how alterations in the probability of the severity of sanctions and socioeconomic factors can affect the amount of crime (Eide, Rubin, & Sheperd, 2006).

In the literature on the economics of crime, studies are observed that analyze the relationship between previous performances and corporate crimes (Alexander & Cohen, 1996), the effect of gender on corporate crimes (Steffensmeier, Schwartz, & Roche, 2013), and a verification of the impact of psychological variables on white collar crime, using individuals who have not committed crimes as a control sample in their experiment (Blickle, Schlegel, Fassbender, & Klein, 2006). These studies, and others related to corporate fraud and agency theory, will enable variables to be identified to measure the probability of corporate fraud.

2.3 Corporate Fraud

Fraud, in its wider sense, can cover any gains obtained through crime, which uses error as its main *modus operandi* (Wells, 2011). However, although all fraud involves some type of error, not all errors are necessarily frauds.

Coenen (2008) observed that the legal definition of fraud is generally presented as false intentional representation regarding a material point and which causes a loss to a victim.

Corporate fraud is related to the corporate environment and can be conceptualized as fraud committed by or against a corporation (Singleton & Singleton, 2010). Costa and Wood Jr. (2012, p. 465) conceptualize corporate fraud as

> a series of illicit actions and conducts carried out in a conscious and premeditated manner by members of an organization's senior management, which take place in a process, aiming to serve own interests and with the intention of harming third-parties.

The United States Justice Department defines corporate fraud in three main areas: accounting fraud or financial fraud, insider trading, and obstructive conduct (American Institute of Certified Public Accountants, 2006, cited by Rezaee & Riley, 2010).

Fraud in financial statements can be conceptualized as the deliberate misrepresentation of a company's financial conditions, carried out by distorting or intentionally omitting values or disclosure in the accounting statements in order to mislead the users of this information (Association of Certified Fraud Examiners, 2008, cited by Singleton & Singleton, 2010). With regards to corporate insider trading, this is mainly related to the improper appropriation of corporate assets by senior executives. As for obstruction of justice conduct, this refers to criminal convictions for giving a false testimony at the Securities and Exchange Commission (SEC) and influencing or threatening other witnesses.

In this study, the type of fraud addressed is corporate, whose areas are related to financial fraud and insider trading. Coenen (2008) argues that fraud constitutes the intentional neglect of a system and a deliberate attempt to violate this system to make personal gains, and that most company systems are not created to detect and prevent fraud. Thus, in an attempt to contribute by showing ways to detect corporate fraud, the Cressey fraud triangle (1953) will be used, which is detailed in the next item.

2.3.1 Cressey's fraud triangle.

One of the most brilliant students of Sutherland, Donald R. Cressey studied at the University of Indiana during the 1940s (Wells, 2011). At this teaching institution he took a doctorate in criminology and became interested in the behavior of fraudsters. This interest led him to write his doctoral thesis, for which he used interviews carried out with 200 prisoners convicted of fraud. With the results of the research, Cressey (1953, p. 30) formulated a final hypothesis, known today as the fraud triangle. This hypothesis assumes that:

> Trusted persons become trust violators when they conceive of themselves as having a financial problem that is non-shareable and are aware this problem can be secretly resolved by violation of the position of financial trust, and are able to apply to their own conduct in that situation verbalizations which enable them to adjust their conceptions of themselves as users of the entrusted funds and properties.

The elements of this triangle are shown in Figure 1.

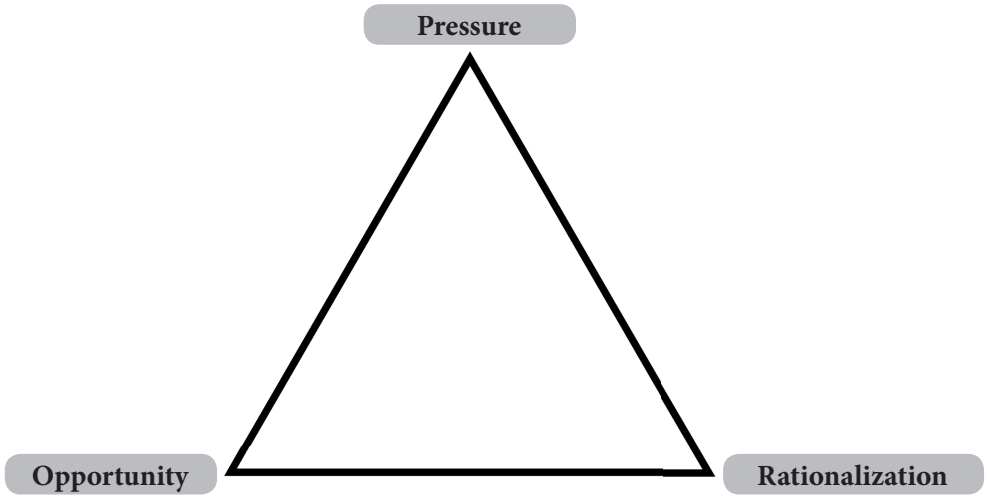

Figure 1 *The Cressey fraud triangle*
Source: *Adapted from Coenen (2008, p. 10) and Wells (2011, p. 8).*

Pressure, also known as incentive or motivation, refers to something that happens in the personal life of the fraudster and that creates a stressful need, thus motivating the fraudster (Coenen, 2008; Singleton & Singleton, 2010). Cressey (1953) showed that in all of the cases found in the interviews, non-shareable problems precede the criminal violation of financial trust. For the author, the violator considers various different situations to produce problems that are structured as non-shareable. These problems are related with the status required by the offender or with maintaining his/her status.

The analysis carried out by Cressey (1953) is consistent with the literature on fraud by indicating that the conditions related to immorality, emergencies, increased needs, reversals in the business environment, and a high standard of living are important for violations of trust. However, relevance only verifies whether these conditions produce non-shareable problems for people that occupy a position of trust. This situation will only have the effect of creating, in the person of trust, the desire for specific results – the pressure -, related with the solution to the problem, and which can be produced by the criminal violation of financial trust (Cressey, 1953).

Opportunity presupposes that fraudsters have the knowledge and chance to commit fraud. The logic is that the individual will commit fraud as soon as he/she holds a position of trust, knows the weaknesses in the internal controls, and obtains sufficient knowledge regarding how to successfully commit the crime (Singleton & Singleton, 2010).

For Cressey (1953), technical knowledge is acquired before the existence of the non-shareable problems and, consequently, the individual's ability to perceive that the non-shareable problem can be resolved by violating the position of trust involves the application of general information to specific situations. Thus, when pressure, which is the existence of non-shareable problems, is added to such opportunities derived from the individual's knowledge, the potential for fraud is greater (Singleton & Singleton, 2010).

Rationalization is a cognitive process of self-justification (Markin, 1979; Rahn, Krosnick, & Breuning, 1994; Scheufele, 2000). This concept is widely discussed by sociologists, psychologists, and psychiatrists. In his hypothesis, Cressey (1953) perceived that fraudsters rationalize their trust-violating conduct as acceptable and justifiable behavior by the intention to resolve a given problem classified as non-shareable. So, rationalization is the process in which an employee mentally determines that fraudulent behavior is the correct attitude, considering that the company can absorb the consequences of this act or that no shareholder or stakeholder will be materially affected by the execution of the fraud (Coenen, 2008; Singleton & Singleton, 2010). According to Cressey (1953), the rationalization used by violators is necessary and essential for the criminal violation of financial trust, as it is by way of this that the individuals find pertinent and real reasons to act; that is, they convince themselves that carrying out the violation of financial trust is a justifiable and acceptable act.

Thus, according to Cressey (1953), the occurrence of fraud is conditioned by the joint existence of three dimensions: pressure, opportunity, and rationalization. In accordance with that assumption, this study used Cressey's hypothesis (1953) to elaborate and test hypothesis 1.

H1: the three dimensions of the fraud triangle together condition the occurrence of corporate fraud in Brazilian banking institutions.

3. EMPIRICAL ANALYSIS METHODOLOGY

The study is classified as empirical with a quantitative approach. To carry out the work, the first step was to identify the banking institutions for which the Brazilian Central Bank (CB) made available data involving quarterly financial information (QFI). Two hundred thirty-one institutions were found with data from January 2001 to December 2012. It bears mentioning that from December 2012 the CB ceased to publish quarterly information on the institutions under its supervision, following Circular letter n. 3,630 of 2013 (Brazilian Central Bank [CB], 2013).

As there was the need to also collect data from the Annual Information Forms (AIFs) and the Reference Forms made available to the market, the decision was made to work with only publicly-held banking institutions with AIFs covering no fewer than three whole years. Due to this limitation, 44 banking institutions composed the research sample. As the data were gathered and organized quarterly, a panel of 2,112 lines of observations was obtained.

In order to identify the existence or not of corporate frauds, the decisions reported by the CB and by the National Financial System Resource Council (NFSRC) were adopted. The former issues first instance decisions while the latter is tasked with judging, in the second and third instance, the punitive administrative proceedings applied by the CB. In the period from 2001 to 2012, 123 punitive proceedings were found, spread over 27 banking institutions and corresponding to 61.36% of the 44 in the sample. The organizations that did not form part of the offenders report formed the control sample for the study, therefore enabling different patterns to be identified between two groups of institutions: with and without corporate frauds.

It is worth mentioning that the choice of punitive administrative proceedings was based on internationally published empirical studies on corporate/accounting frauds, such as those by Beasley (1996), Brazel et al. (2009), Erickson et al. (2006), Lennox and Pittman (2010), Troy et al. (2011), and Wang et al. (2010). In these articles, the authors used the Accounting and Auditing Enforcement Releases, published by the SEC, which contemplate press releases on administrative and/or civil proceedings.

Note that for the classification of the proceedings the concept of corporate fraud was observed, which is fraud committed by or against a corporation (Singleton & Singleton, 2010). This concept enables the analysis of each sentence imposed on the banking institutions analyzed. So, cases were analyzed in which the claim was related with foreign exchange operations, rural credit and debts, investment funds, share repurchases, and the accounting of these institutions.

3.1 Econometric Modeling

The economic modeling developed is based on the empirical analysis procedures proposed in the studies by Beasley (1996), Brazel et al. (2009), Crutchley et al. (2007), Erickson et al. (2006), Lennox and Pittman (2010), and Wang et al. (2010), which were previously cited in this study and are geared towards measuring the probability of occurrence of corporate fraud. The calculation of this probability derives from qualitative choice econometric models, such as logit and probit, in which the dependent variable is binary, with 1 referring to the presence of the attribute and 0 referring to the absence of the attribute, and the attribute being defined by the occurrence of the event, in this case corporate fraud. The logit and probit qualitative choice models can also be extended to multinomial approaches, in which the dependent variable can take one of several attributes in order to cover a greater number of possible occurrences for the studied phenomenon.

This possibility of greater detailing of the dependent variable enables a better adjustment of the data collected in this research to the empirical analysis methodology, since the occurrence of corporate fraud associated with the administrative proceedings of banking institutions is characterized by the existence of intermediary behaviors, given that an institution that is being investigated can be convicted or cleared in the administrative proceeding. In summary, the dependent variable can assume the following behaviors:

- Absence of the attribute: banking institution without administrative proceeding;
- Presence of the attribute: banking institution investigated in an administrative proceeding;
- Presence of the attribute: banking institution cleared in an administrative proceeding;
- Presence of the attribute: banking institution convicted in an administrative proceeding.

Figure 2 clarifies the three different categories of the dependent variable:

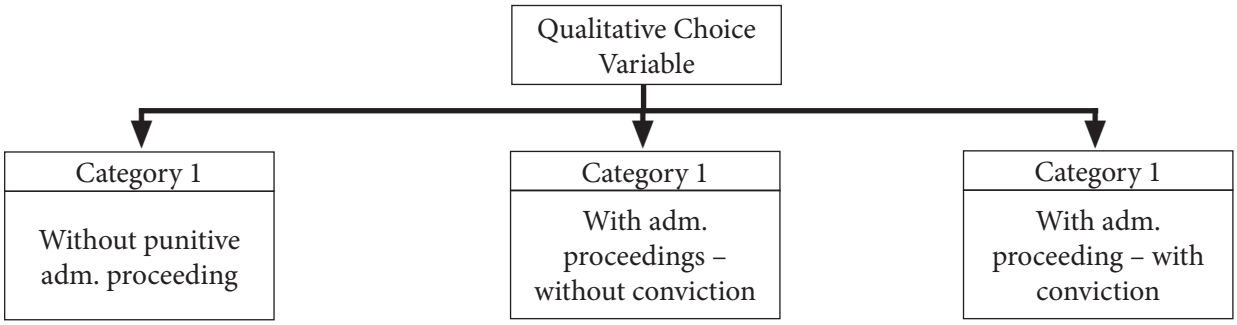

Figure 2 *Characterization of the dependent variable*
Source: *Elaborated by the authors.*

According to Hilbe (2009), the multinomial probability distribution is an extension of the binomial distribution. The multinomial model to test the functional relationship between corporate fraud and the independent variables can be specified as:

$$Ln\Omega_{m\backslash b}(x) = ln\frac{\Pr(y=m\backslash x)}{\Pr(y=b\backslash x)} = x\beta_{m/b}\ , for\ m = 1\ to\ j \qquad (1)$$

in which

$$y = \begin{cases} 0 = without\ administrative\ proceeding \\ 1 = with\ administrative\ proceeding, without\ conviction \\ 2 = with\ administrative\ proceeding, with\ conviction \end{cases}$$

$$x = f\ (pressure, opportunity, rationalization, control\ variables)$$

where the set of variables x will be represented by the elements of the fraud triangle and by the control variables, which will be subsequently described.

Equation 1 presents the relationship between the dependent variable, y, and the independent variables, x. The attribute in reference, which will be compared to the others, is represented by b, while the number of categories is presented as m. To solve the equations j, the following equation is used to calculate the predicted probabilities:

$$PR(y = m\backslash x) = \frac{\exp(x\beta_{m\backslash b})}{\sum_{j=1}^{J}\exp(x\beta_{j\backslash b})} \qquad (2)$$

The collected data present the behaviors of the banking institutions studied over the years, forming transversal and longitudinal cross-sections. These cross-sections can be analyzed by forming a simple pooling, when the estimated parameters are constant for all for all the observation units and for all the periods, or by forming a panel of data, when the estimated parameters are variables for each observation unit over time, which in the multinomial case are estimated by random effects. A study conducted by Karlson (2011) compared the two approaches and found that the simple poolings tend to underestimate the parameter estimates compared to the random effects models. It bears mentioning that in both models the estimation method used is maximum likelihood.

In light of this, in order to test the established hypotheses we opted for the estimation of the two types of multinomial logit models: the simple pooled one and the random effects one, so as to then compare them. In order to provide an overview of how this study was operationalized in terms of econometric modeling, Figure 3 was elaborated.

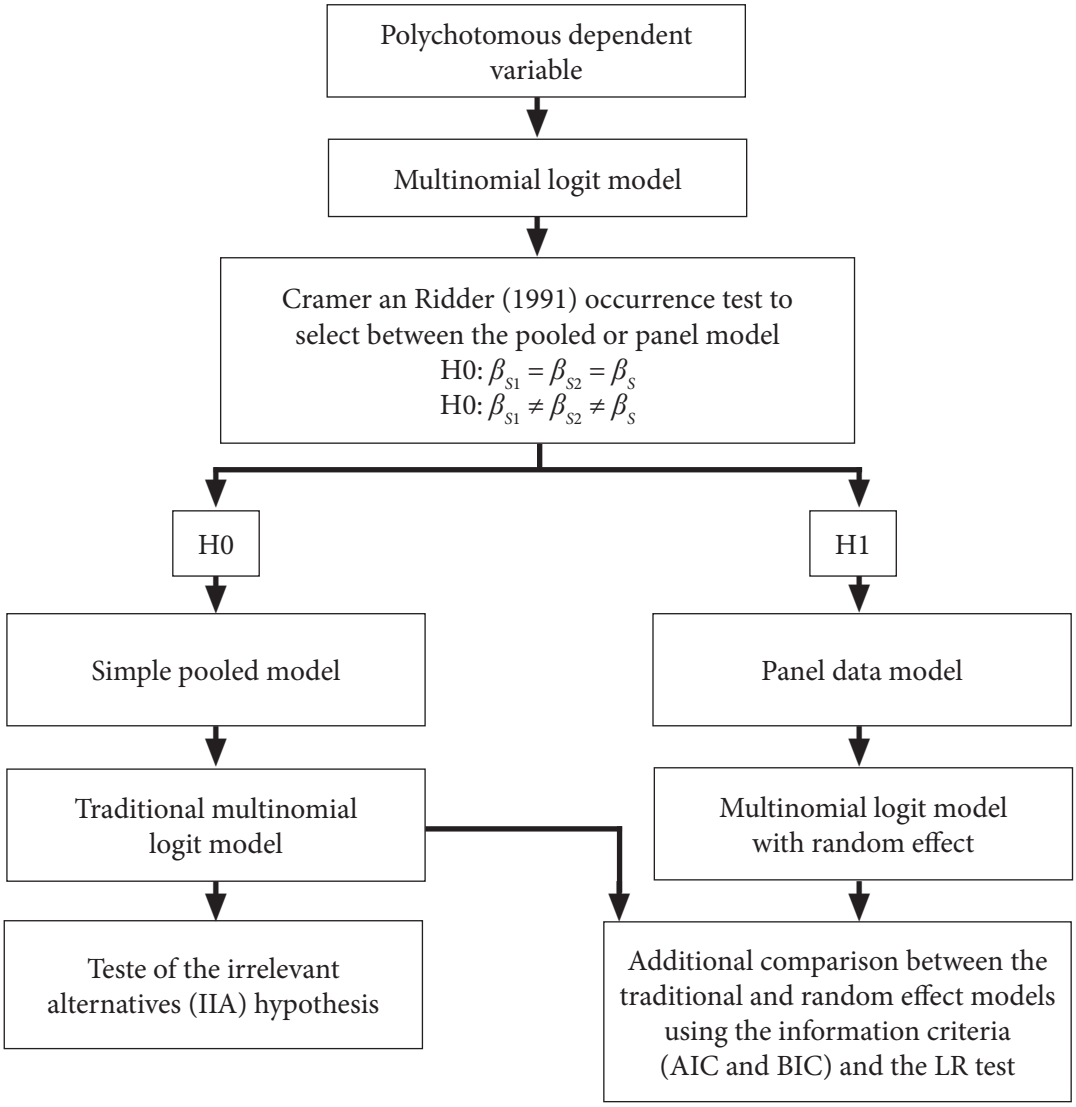

Figure 3 *Flowchart to determine the most appropriate econometric modeling*
Source: *Elaborated by the authors*

As in the flowchart shown in Figure 3, depending on the specificity of the dependent variable and in light of the layout of the research data, the pooling of 44 banking institutions in accordance with their longitudinal data series was considered, in order to verify whether the model should following simple pooling or panel data under random effects.

The first step in applying the methodology was to

calculate the Cramer and Ridder (1991) test, with the aim of verifying whether this model can be used as simple pooling. This test assumes a high multinomial logit with (S +1) states and two pooling candidate states/levels, s_1 and s_2. The null hypothesis assumes that s_1 and s_2 have the same regressor coefficients, except the effect; that is:

$$\beta_{S1} = \beta_{S2} = \beta_S \quad \boxed{3}$$

Thus, for the models in which the Cramer and Ridder (1991) test indicated that the multinomial logit model could be analyzed, the irrelevant alternatives hypothesis was tested. In this hypothesis (IIA), the appropriateness of using the multinomial model is ensured. Thus, the Hausman-MacFadden (1984) test and the Small-Hsiao (1985) test were applied, and alternatively, the suest-base Hausman test to verify the independence of the irrelevant alternatives, and consequently, the assumption of independence between the error terms.

For the models in which the Cramer and Ridder (1991) test indicated that simple pooling was not the best alternative, a multinomial logit model with random effects was used. For this model, the Stata v.13 program was used, which made it possible to measure the multinomial logit models with random effects using the *gsem* command. This command enables models with multilevel data to be adjusted. The adjustment of these models makes it possible to simultaneously treat the level effect in groups, for example by including random effects such as non-observable effects in the group of companies.

An additional comparison between the multinomial logit, traditional, and with random effects models was carried out by analyzing the information criteria – Akaike information criterion (AIC), Schwartz Bayesian information criterion (BIC), and likelihood ratio test (LR) –, with the aim of guaranteeing the choice of that which best adjusts to the data.

It is important to highlight that the multinomial logit model with fixed effects was not considered in the analysis because up to the final date of carrying out this study its integration into the program used – Stata v.13 – had not been concluded, although in 2011 the researcher Klaus Pforr submitted the programming for this insertion. Other statistical software was not studied, with the exception of SPSS and Gretl. So, it cannot be affirmed that the multinomial model with fixed effects has not been implemented in different programs.

3.1.1 Independent variables.

The set of independent variables, $X_{i,t}$, was mostly defined with the help of the literature on agency theory and the economics of crime and empirical studies on fraud and earnings management in banking institutions. The description of these variables, of the data collection and research sources, as well as the control variables used, are presented in tables 1, 2, and 3.

Table 1 shows the independent variables used to measure the pressure dimension of the Cressey (1953) fraud triangle:

Table 1 - *Variables used – pressure dimension*

Dimension of the fraud triangle: pressure			
Nº	**Variable**	**Description and data collection source**	**Authors**
1	FIR_ASS	Financial intermediation revenue divided by total assets. Source: QFI.	Alexander and Cohen (1996), Brazel et al. (2009), Matousek, Rughoo, Sarantis, and George Assaf (2014)
2	VAR_NI	Variation in net income. Source: QFI.	Alexander and Cohen (1996), Crutcheley et al. (2007)
3	SHARE_MARK	The bank's operating income divided by the operating income of the market leader bank. Source: QFI.	Gartner (2010), Sadka (2006), Tymoigne (2009)
4	ROA	Operating income divided by total assets. Source: QFI.	Berger, Clark, Cull, Klapper and Udell (2005), Brazel et al. (2009), Cogneau and Hübner (2015), Troy et al. (2011), Wang et al. (2010), Wu and Shen (2013)
5	ROE	Net income divided by net equity. Source: QFI.	Koutsomanoli-Filippaki and Mamatzakis (2009), Matousek et al. (2014)
6	SHARE_NI	Dummy to indicate whether the directors receive a share in the company's profit. Source: AIFs and RFs.	Crutchley et al. (2007), Erickson et al. (2006), Troy et al. (2011), Wang et al. 2010)
7	QUART_REM	Value of quarterly remuneration divided by total assets. Source: board of directors minutes, AIFs, and RFs.	Crutcheley et al. (2007), Erickson et al. (2006), Troy et al. (2011), Wang et al. (2010)
8	DEV_REM	Deviation in quarterly fixed remuneration. Source: board of directors minutes, AIFs, and RFs.	Crutchley et al. (2007), Erickson et al. (2006), Troy et al. (2011), Wang et al. (2010)
9	D_DEV_REM	Dummy for remuneration received below the average remuneration paid by the market of publicly-traded banks.	Elaborated by the authors.

RFs = Reference Forms; AIFs = Annual Information Forms; QFI = quarterly financial information.
Source: *Elaborated by the authors.*

The auditing rules, Resolution n. 1,207 of 2008 (CFC, 2009), and SAS n. 99 (AICPA, 2002), elaborated in accordance with the Cressey fraud triangle (1953), establish two types of sources of incentive or pressure that produce fraudulent financial information when management is under pressure – external and internal sources – to achieve earnings targets or expected financial results.

As internal and external sources of pressure, two items stand out that can serve as indicators of the pressure dimension: the performance to be achieved by the agents and perceived remuneration, which influences the standard of living of these agents. As internal sources of pressure, the studies by Alexander and Cohen (1996) and Macey (1991) are used, which originate from the area of criminology and the economics of crime. According to Macey (1991), self-interested managers become involved in criminal conduct in the name of their organizations not to benefit the shareholders but to maintain their positions. Also according to the author, the threat of a lower than ideal performance can lead to managers preferring a higher level of risk in order to increase the company's performance. This can lead the manager to manipulate the financial statements with the aim of increasing the institution's performance, thus achieving the performance targets set by the owners and resulting in them maintaining their current position. Thus, in order to measure the institutions' performance, the financial intermediation revenue was used, as well as the variation in the institution's net income, the return on assets and on investments, and the level of market share in relation to the leading banking institution. For these variables, a positive and significant behavior is expected in relation to the probability of fraud; the higher its value, the greater the possibility of fraud occurring. As external sources of pressure, variables related to the structure of the managers' remuneration were used, since this is interconnected with their personal standard of living.

The managers' remuneration structure, or compensation policies, according to agency theory, aims to give incentives for the agent to select and plan actions that increase the wealth of shareholders (Jensen & Murphy, 1990). Thus, using articles on this theory, the following variables were outlined: fixed remuneration, profit share, and an indicator of remuneration perceived below the market average. Fixed remuneration and profit share, as well as remuneration policies, could indicate an inverse relationship with the probability of fraud.

As remuneration perceived below the market average, a positive relationship with the probability of fraud is expected, given that managers can use fraudulent means to "correct" perceived economic inequality. It bears mentioning that as a pressure point Cressey (1953) highlighted the relationship between employees and employers, in which the former can feel undervalued in relation to their status in the organization. This feeling can derive from perceived economic inequalities, such as payment and a feeling of being overloaded with tasks or being undervalued (Wells, 2011).

Table 2 presents the independent variables used to measure the opportunity dimension.

Table 2 *Variables used – opportunity dimension*

Fraud triangle dimension: opportunity			
Nº	**Variable**	**Description and data collection source**	**Authors**
10	IBM2	Number of independent board of director members squared. Source: AIFs and RFs.	Beasley (1996), Yermack (1996), Crutchley et al. (2007), Troy et al. (2011)
11	TBD2	Number of board of director members squared. Source: AIFs and RFs.	Crutchley et al. (2007), Troy et al. (2011), Yermack (1996)
12	TFC2	Number of fiscal council members squared. Source: AIFs and RFs.	Trapp (2009)
13	SIZE_DIR	Number of company directors.	Elaborated by the authors.
14	SEAL_GOV	Dummy for companies that are listed in the corporate governance segments of the BM&FBOVESPA. Source: BM&FBOVESPA Daily Bulletin.	São Paulo Stock, Commodities, and Futures Exchange (2014)
15	BIG_FIVE	Dummy to indicate whether the auditing company is one of the Big Five or not. Source: CB auditing reports.	Brazel et al. (2009), Lennox and Pittman (2010)
16	ADA_EXP	Allowance for doubtful accounts. Source: QFI.	Anandarajan, Hasan e Maccarthy (2007), DeBoskey and Jiang (2012)
17	TTOT_ASS	Value of total assets. Source: QFI.	Brazel et al. (2009), Troy et al. (2011)

CB = Brazilian Central Bank; RFs = Reference Forms; AIFs = Annual Information Forms; QFI = quarterly financial information.
Source: *Elaborated by the authors.*

The opportunity dimension includes weak corporate governance structure as well as other working conditions that enable the manager to commit fraud (Brazel et al., 2009).

Corporate governance mechanisms enable the owners of a corporation to exercise control over the activities of insiders and managers, so that their objectives are protected (John & Senbet, 1998). Thus, if these mechanisms are not adequate and present fragilities, the possibilities of corporate fraud occurring is increased. To measure such mechanisms, the number of independent board members was used, as well as the size of the fiscal council, the size of the board of directors, the auditing firms considered as Big Five, company seals of corporate governance issued by the São Paulo Stock, Commodities, and Futures Exchange (BM&FBOVESPA), and the size of the institution's executive board.

It bears mentioning that Arthur Andersen, Deloitte, Ernst & Young, KPMG, and Price were considered as the Big Five. Currently the auditing companies are called the Big Four, as a result of the demise of Arthur Andersen in 2002. As the period of this study covers that year, the decision was made to follow the same treatment given by Lennox and Pittman (2010), by including this company and using the original denomination – *Big Five*.

Note that the independent members, board of directors size, and fiscal council size variables were squared to capture the fact that coordination, communication, and decision-making problems make the board's performance difficult when the number of directors increases (Yermack, 1996). Thus, the size of the board of directors and the number of independent members help in the effectiveness of the corporate governance up to a certain point, since as the board grows the incremental cost of adding members will be greater than the monitoring benefit, thus constituting a convex function.

Also, as independent variables, the allocation for doubtful accounts and company size were included. Lou and Wang (2009) found that complex transactions are accompanied by a high inherent risk due to the involvement of a high degree of management judgment and subjectivity.

The allowance for doubtful accounts will identify earnings management opportunities for the manager, given the use of subjective criteria in its accounting. This variable is used to detect earnings management in banking institutions (Deboskey & Jiang, 2012), precisely because

of the discretion and subjectivity that managers have to estimate it and the difficulty involved in the auditing of this variable (Deboskey & Jiang, 2012).

When the size of the organization increases, managers have a greater amount of resources at their disposal, as well as there being an increase in the complexity of operations and in the agency conflicts between owners and managers (Ryan & Wiggins, 2001). Thus, when the size of the company increases together with the complexity of its operations and the conflicts derived from the agency relationship, managers can use this environment to execute corporate fraud.

Table 3 shows the independent variables used to measure the rationalization dimension of the Cressey fraud triangle (1953) and also those used as control variables.

Table 3 *Variables used – rationalization dimension*

Fraud triangle dimension: rationalization			
Nº	**Variable**	**Description and data collection source**	**Authors**
18	AGE	CEO age. Source: AIFs and RFs.	Kelley, Ferrel and Skinner (1990), Troy et al. (2011), Zahra, Priem and Rasheed (2007)
19	DEGREE_MAN	Dummy for CEO with degree. Source: AIFs and RFs.	Hambrick and Mason (1984), Rest and Thoma (1985), Troy et al. (2011)
20	SP_MAN	Dummy for CEO with specialization. Source: AIFs and RFs.	Hambrick and Mason (1984), Rest and Thoma (1985), Troy et al. (2011)
21	STRICTU_MAN	Dummy for CEO with *strict sensu* post-graduation. Source: AIFs and RFs.	Hambrick and Mason (1984), Rest and Thoma (1985), Troy et al. (2011)
22	CDAB	Dummy for CEO with degree in the business area. Source: AIFs and RFs.	Daboub et al. (1995), Kelley et al. (1990), Troy et al. (2011)
23	CLSPAB	Dummy for CEO with *lato sensu* post-graduation in the business area. Source: AIFs and RFs.	Daboub et al. (1995), Kelley et al. (1990), Troy et al. (2011)
24	CSSPAB	Dummy for CEO with *strict sensu* post-graduation in the business area. Source: AIFs and RFs.	Daboub et al. (1995), Kelley et al. (1990), Troy et al. (2011)
25	PERC_WOM_FC	Percentage of the number of female directors over the total number of members of the fiscal council. Source: AIFs and RFs.	Kelley et al. (1990), Reynolds (2006), Steffensmeier et al. (2013), Zahra, Priem, and Rasheed (2007)
26	PERC_WOM_BD	Percentage of the number of female directors over the total number of members of the board of directors. Source: AIFs and RFs.	Kelley et al. (1990), Reynolds (2006), Steffensmeier et al. (2013), Zhara et al. (2007)
27	PERC_WOM_EB	Percentage of the number of female directors over the total number of members of the executive board. Source: AIFs and RFs.	Kelley et al. (1990), Reynolds (2006), Steffensmeier et al. (2013), Zhara et al. (2007)
28	PUNI	Dummy to indicate alterations in the legislation with the aim of increasing the punishment for financial crimes. Law n. 12,683 of 2012 (Brazil, 2012).	Becker (1968), Block e Lind (1975), Dau-Schmidt (1990), Eide et al. (2006), Garoupa (2003), Murphy (2012), Wright Caspi, Moffitt, and Paternoster (2004)
		Control variables	
29	TYP_BK	Dummy for multiple and commercial banks. Source: CB registration data.	Elaborated by the authors.
30	CONVERG	Dummy for the international accounting standards convergence period.	Elaborated based on Resolution n. 3,786/2009 (CB, 2009).
31	STATE	Dummy for state controlled banks (federal, state, and municipal government). Source: AIFs and RFs	Elaboration based on the studies by Berger et al. (2005) and Silva (2004).
32	CRISIS	Dummy to indicate the subprime crisis period (July 2007 to April 2009)	Maciel, Silveira, Luna, and Ballini (2012)

CB = Brazilian Central Bank; CEO = chief executive officer; RFs = Reference Forms; AIFs = Annual Information Forms.
Source: *Elaborated by the authors.*

In an attempt to measure the rationalization dimension, the demographic characteristics of the executives were used. These characteristics, although considered incomplete and imprecise proxies of the executives' cognitive structures, are taken as valid because of the difficulty in obtaining conventional psychometric data on senior executives (Hambrick, 2007). For this, the following demographic variables were used: age of the chief executive officer (CEO), his/her training in any area, his/her training on courses related to the area of business, the predominance of females on the fiscal council, on the board of directors, and in management, and a punishment factor.

For Troy et al. (2011), younger managers are more likely to rationalize accounting fraud as an acceptable decision. Thus, Zahara et al. (2007) emphasize that younger managers tend to take risks as a way of more quickly achieving career progression. As for older ones, they tend to be more analytical in their decision making, executing decisions with more care, seeking more information, and carrying out a more precise diagnosis of the information gathered. Therefore, age appears to be an indicator of an individual/manager's moral development.

With regards to educational training, studies such as those by Gioia (2002), Hambrick and Mason (1984), and Rest and Thoma (1985) recognize the role of education in the ethical behavior of managers, as well as empirically proving this relationship has a positive association with moral development (Rest & Thoma, 1985). Also, Troy et al. (2011) affirm that managers without knowledge in the area of business will tend to rationalize fraud as an acceptable decision, unlike those trained in the area of business, who will be more aware of potential repercussions and penalties of unethical behavior. In light of the claims of the various authors, it is perceived that managers' educational training can be directly associated with the act of committing fraud.

To analyze managers' gender, support was sought from the studies by Kelley et al. (1990), Reynolds (2006), and Zahra et al. (2007), which indicate that male managers are more likely to accept unethical behavior to achieve their objectives. Moreover, Steffensmeier et al. (2013) determined that female executives can be more ethical in their decision making. Therefore, it can be inferred that a female predominance can negatively influence in the probability of corporate fraud occurring.

The use of a punitive factor was derived from the studies by Cressey (1953) and Becker (1968). In his model, the latter pondered that criminal individuals consider the effect of punishment in their decision to commit a crime or not. Thus, the effect of an increase in punishment is expected to negatively impact the probability of corporate fraud.

In order to measure the effect of punishment on the probability of corporate fraud occurring, the decision was made to use the normative alterations that increased the punishments applied to crimes against the National Financial System (NFS). The alterations in the legislation were qualified by a dummy. It bears mentioning that the legal instruments that discipline crimes against the NFS were researched and of these only Law n. 9,613 of 1998 (Brazil, 1998) against crimes of money and illicit laundering in the financial system was altered. The alteration occurred via Law n. 12,683 of July 2012 (Brazil, 2012), which raised the penalties applied to institutions involved in crimes and their representatives.

For the model, four control variables were also defined: type of bank, convergence with the international accounting rules, state control, and subprime crisis. The first variable was used to identify the type of bank classified by the CB according to their activities – multiple or commercial bank.

The second variable was employed with the aim of distinguishing the period in which the conversion to the international accounting rules came into effect, in accordance with Resolution n. 3,786 of 2009 (CB, 2009). It bears mentioning that, according to CB information, the accounting norms established by the National Monetary Council and by the CB, embodied in the Accounting Plan for Institutions of the National Financial System (COSIF), present divergences in relation to the international accounting rules issued by the IASB, representing partial convergence with the international accounting rules.

In order to moderate the effect of the control and ownership of the banking institutions, the inclusion of variables that identify whether the control is state or foreign was considered. These two types of categories have different characteristics from the other banking institutions. Foreign banks need to deal with different environments and regulations: regulations in their country of origin and those of the foreign institution. State banks can operate with government subsidies, besides having a more complex governance due to the presence of one more agent: the politician (Silva, 2004). However, in this study foreign control was not differentiated, given that for the banking sector, 87.38% of total assets in 2012 are of banks with Brazilian capital, besides the limited number of banking institutions with foreign control, corresponding to six of the 44 institutions analyzed.

The fourth control variable was included to analyze the effect of the subprime crisis. Thus, the variable will indicate the crisis period occurring from mid-2007 to April of 2009 (Maciel et al., 2012).

It is worth noting that in light of the research period, January 2001 to December 2012, the variables derived from the financial statements and the fixed remuneration of management were monetarily corrected. For this, the monetary correction index was used, as well as the general index of prices-internal availability (IGP-DI), calculated monthly by the Getúlio Vargas Foundation. This procedure enabled an analysis of the impact of these variables in a space of time without the influence of inflation.

It is perceived that the number of independent variables presented in tables 1, 2, and 3 is too high, totaling 32, and this number of variables may have an impact on the accuracy of the model to be estimated for hypothesis 1, due to the problems derived from the multicollinearity of the independent variables. One option for minimizing this problem is the application of data reduction techniques, such as factor analysis.

Factor analysis is a multivariate technique that provides tools for examining the structure of the inter-relationships in a large number of variables, defining sets of strongly inter-related variables, known as factors (Hair Jr., Black, Robin, Anderson, & Tatham, 2009). To apply this technique, first the following tests were carried out: (i) Bartlett sphericity, to analyze whether the variables are intercorrelated, and (ii) Kaiser-Meyer-Olkin (KMO), to measure the adequacy of the sample. For Hair Jr. et al. (2009), the closer to 1 the KMO value is, the better the sample will fit the factor analysis. The author states that the researcher should consider a general value above 0.50 to apply the factor analysis.

The technique applied enabled the generation of components, called factors, which were rotated by the orthogonal varimax method to simplify their analysis. These factors were allocated instead of the 32 variables reported in tables 1, 2, and 3 and used to test hypothesis 1 of this study, via the application of the multinomial logit model.

It is important to mention that the logit model to be estimated can lose its predictive character due to the application of the factor analysis technique. The inclusion of new observations in the database will imply the need to employ the technique again, whose action can alter the parameters estimated in this study. However, it is worth highlighting that the results of the study enable important variables to be identified to calculate the probability of fraud occurring. These variables can be used both in new academic studies and by market professionals, such as regulators, auditors, and investors.

4. EMPIRICAL ANALYSIS

The use of factor analysis to reduce the data resulted in the data in Table 4.

Table 4 *Factor analysis: hypothesis 1*

Variable	Factor 1 (A)	Factor 2 (B)	Factor 3 (C)	Factor 4 (D)	Factor 5 (E)	Factor 6 (F)	Factor 7 (G)
Fir_ass	-0.3498	-0.0238	0.3552	-0.6204	-0.1646	0.0483	0.0524
Var_ni	-0.0274	0.0517	0.0090	0.4302	-0.1053	-0.1139	-0.0525
ROE	0.0329	0.0056	-0.0188	0.1069	-0.0155	-0.0738	0.8883
ROA	-0.0925	-0.0815	0.0199	0.7099	-0.1737	-0.1369	0.4639
Share_mark	0.8881	0.2349	-0.1232	-0.1438	0.0603	-0.0693	0.0671
D_dev_rem	-0.6666	0.3415	-0.0477	-0.4673	0.0790	0.0413	0.0050
Dev_remun	0.8520	-0.3153	0.0226	0.1924	-0.1180	0.0690	-0.0053
Share_ni	0.2543	-0.1784	-0.3811	0.2995	0.3553	0.2087	0.1381
Rem_quart	0.8563	-0.3092	0.0400	0.1968	-0.0459	0.0709	-0.0112
Ibm2	0.0422	0.0390	-0.1471	-0.0597	0.6427	-0.1982	-0.1191
Tfc2	-0.0509	0.8447	-0.1536	0.0529	-0.0603	0.3686	-0.0073
Tbd2	-0.0031	0.0181	0.0217	0.6630	0.2170	0.3311	-0.0744
Big_five	0.2506	-0.1808	-0.4046	0.2085	0.4768	0.1624	-0.0056
Seal_gov	0.6166	-0.1911	0.0940	0.3660	0.2821	-0.0990	-0.0889
Siz_dir	0.8655	-0.1869	-0.0417	-0.0104	-0.0305	0.0281	-0.0001
Tot_ass	0.8580	0.3031	-0.0740	-0.0932	0.1387	-0.0393	0.0427
Ada_exp	0.8387	0.2888	-0.0993	-0.1332	0.1785	-0.0456	-0.0047
Age	-0.0434	-0.0443	0.1473	-0.0604	-0.0257	0.8755	-0.0386
Degree_man	0.1016	-0.0633	0.9005	-0.0531	-0.0414	-0.0969	0.0436
Sp_man	0.0620	0.1057	-0.8239	0.0982	-0.1024	-0.3512	0.0664
Cdab	-0.2396	0.1650	0.7586	-0.0402	0.0064	-0.1869	0.0427
Clspab	0.0295	0.2628	-0.7281	-0.2482	-0.0579	-0.3254	0.0636

Table 4 *Cont.*

Variable	Factor 1 (A)	Factor 2 (B)	Factor 3 (C)	Factor 4 (D)	Factor 5 (E)	Factor 6 (F)	Factor 7 (G)
Csspab	-0.0302	-0.0055	-0.0028	0.0369	0.0407	-0.0689	-0.8462
Perc_wom_fc	-0.2099	0.7165	0.1940	-0.0082	0.1802	-0.0140	-0.1453
Perc_wom_bd	0.0542	0.4412	-0.0272	0.1270	-0.1299	0.6519	0.0363
Perc_wom_eb	-0.0620	-0.2872	-0.0203	-0.0527	0.5030	-0.2357	0.2195
Puni	0.0422	0.0602	0.1701	0.0402	0.5433	0.0249	0.0289
Typ_bk	-0.2342	-0.7257	0.2055	0.0961	-0.0210	0.2854	-0.0086
Converg	0.0880	0.0250	0.1887	0.0440	0.7468	0.0053	-0.1264
State	-0.0858	0.8412	-0.0061	-0.0989	-0.1055	-0.0781	0.0721
Eigen value	6.31945	3.89325	2.97178	2.28643	2.23501	1.89343	1.37375
% cumulative	0.2106	0.3404	0.4395	0.5157	0.5902	0.6533	0.6991

Bartlett sphericity test		KMO sampling adequacy measure	
$\chi 2$	12,947.614	KMO	0.7180
Degrees of freedom	435		
p-value	0.0000		

Note: *rotated factors – varimax.*
KMO = Kaiser-Meyer-Olkin.
Source: *Elaborated by the authors.*

As the results of Table 4 show, the Bartlett sphericity test indicates that the null hypothesis was rejected at a 1% level of significance, therefore the analyzed variables are correlated. The KMO test statistic, with a value of 0.718, shows that the proportion of the variance in the data can be considered as common to all of the variables, thus validating the use of the factor analysis in this study. Note that the subprime crisis variable was removed from the sample as it did not present a high correlation with any other variable used. The variable for CEO with a *stricto sensu* post-graduation course in any area was also excluded as it presented a correlation of 100% with the variable for CEO with *stricto sensu* post-graduation in the area of business, in order to avoid redundancy. As observed in Table 4, seven factors were extracted as they presented Eigen values above 1.00. These factors, in their totality, are able to explain 69.91% of the cumulative variance.

In Table 4 it is verified that the variables from each dimension – pressure, opportunity, and rationalization –, numbered in tables 1, 2, and 3, were distributed between the factors, except factors 3 and 6, in which variables from the rationalization dimension were grouped. Due to this dispersion of variables, it was decided not to rename them, thus preserving the individual characteristics of the variables with high factor loads, grouped in the different factors. Therefore, factor 1 contemplates variables from the pressure and opportunity dimensions; factor 2 contains variables from the opportunity and rationalization dimensions and control variables; factor 4 contains variables from the pressure and opportunity dimensions; factor 5 contemplates variables from the three dimensions and one control variable; and factor 7 is composed of variables related to the pressure and rationalization dimensions.

The factors presented in Table 4 were used as independent variables to process equations 1 and 2, which were previously described and whose results are available in Table 5. Note that the multinomial logit panel model was operationalized by the Stata v.13 software.

Table 5 *Relationship between corporate factors and frauds: hypothesis 1*

Variables	Multinomial logit simple pooling (A)		Multinomial logit panel with random effects (B)	
	Proceedings without conviction[1] (A1)	Proceedings with conviction[2] (A2)	Proceedings without conviction [1] (B1)	Proceedings with conviction [2] (B2)
	Coefficient	Coefficient	Coefficient	Coefficient
Factor 1	0.6839**	0.3052	0.6850**	0.6923
	(0.2893)	(0.5016)	(0.2901)	(0.7730)
Factor 2	-0.0266	0.9865***	-0.0299	1.4013**
	(0.2944)	(0.3034)	(0.2958)	(0.5728)
Factor 3	-0.7306	-0.9425**	-0.7219	-1.2556*
	(0.4628)	(0.4036)	(0.4589)	(0.6983)
Factor 4	-0.8765	-2.9904***	-0.9177	-2.7746**
	(0.7654)	(0.9495)	(0.7910)	(1.1965)
Factor 5	-0.5154	-1.5692**	-0.5187	-2.3302**
	(0.4652)	(0.6685)	(0.4657)	(0.9733)
Factor 6	0.5571*	0.5730*	0.5571*	0.4427
	(0.3375)	(0.2973)	(0.3384)	(0.5466)
Factor 7	1.11	0.447	1.1466	-0.0137
	(0.8440)	(0.6044)	(0.8549)	(0.5412)
M1[i]			1	-16,797,000
			0	(599,450,000)
Constant	-4.4487***	-5.7638***	-4.4628***	-7.1296***
	(0.5725)	(0.8657)	(0.5830)	(1.4002)
var(M1[i])				
Constant			0.0000	
			0.0000	
Obs.	493		493	
Log likelihood	-104.900		-101.200	
AIC	241.770		236.437	
BIC	308.978		307.846	
LR Test	7.330	Cramer and Ridder Test (1991)		
LR p-value	0.0068	p > χ2 = 01:02 0.0900	p > χ2 = 01:00 0.0000	p > χ2 = 02:00 0.690

Note: *standard errors in brackets.*
1: *proxy for indications of corporate fraud; 2: proxy for occurrence of corporate fraud; AIC = Akaike information criterion; BIC = Bayesian information criterion; LR = likelihood ratio.*
****: p < 0.01; **: p < 0.05; * p < 0.1.*
Source: *Elaborated by the authors.*

From examining the results in Table 5, it is verified that the results of the Cramer and Riddler test (1991) indicate that the groupings among the alternatives cannot be carried out at a 1% level of significance. Thus, the econometric analysis of hypothesis 1 cannot be carried out via simple pooling of the data and it is necessary to treat them as a panel and consider the existence of non-observed heterogeneity between the banking institutions. That is, the banks present peculiar characteristics that differentiate them over time. So, the multinomial logit model with random effects represents the most appropriate model for estimating the parameters of the functional relationships established in the study.

The additional comparison tests also indicate that the logit model with random effects best adjusts to the data. This can be observed in the results of the LR test and via the AIC and BIC information criteria. The LR test shows a p-value of less than 0.05, implying that the constrained model is more adequate. The values of the AIC and BIC information criteria for the multinomial logit model with random effects were lower than those of the traditional logit model, which enables it to be inferred that the model with random effects appear to be more adjusted to the data in the study.

Considering the probability of indications of corporate fraud, in Table 5 (column B1) it is observed that factor 1 presents a positive and significant relationship. In this factor, the variables with the highest factor load are: level of market share, size of the executive board, size of the institution, quarterly remuneration, and deviation from remuneration paid by the market, in that order, and with a factor load above 0.85 (Table 4, column A). It bears mentioning that these variables were characterized as representative of the pressure and opportunity dimensions. The level of market share and the variables interlinked with remuneration represent measures for company performance and compensation structure, which denotes elements of the pressure dimension. As for the size of the

executive board and the size of the institution, these can be considered as explaining the opportunity dimension.

Due to factor 1 having indicated a positive behavior with the probability of indications of fraud, it is perceived that the variables derived from the pressure dimension present a coherent behavior with the findings of Alexander and Cohen (1996) and Macey (1991), both from the area of criminology. In these, below-ideal performance can lead managers to prefer a higher level of risk to increase company performance, such as by manipulating results. With regards to the variables classified as remuneration items, Macey (1991) argues that in order to achieve their objective of satisfying or maintaining a particular level of income, managers can achieve this either through work and ability, or by becoming involved in criminal activities.

For the size of the executive board variable, it is verified that an executive board with a greater number of members can represent a measure of power compared with board of directors (Brazel et al., 2009) and can also imply an increase in monitoring costs and problems for the board of directors to coordinate these directors. As for the size of the institution, this can result in an environment that is more conducive to indications of corporate fraud. According to Alexander and Cohen (1996), what promotes an environment with a greater number of opportunities for committing fraud is the size of the organization. Thus, for the variables that denote measured items of the opportunity dimension in factor 1, it is observed that given that its factor loads are positive and the factor is positively and significantly related with the probability of indications of fraud, the results are consistent with the empirical results of studies on accounting fraud, agency theory, and criminology.

For the probability of corporate fraud occurring, it is verified that factor 2 (Table 5, column B2) shows a positive and significant relationship with the occurrence of corporate fraud. For this factor, it is observed that the variables with the highest factor load, above 0.84 (Table 4, column B), are the size of the fiscal council and companies under state control. With these, the former was considered as an element of the opportunity dimension and the latter as a control variable. The behavior of the size of the fiscal council was expected to be the opposite to that of factor 2. However, given the positive factor load, this was not found. This variable aims to monitor management acts, offer an opinion on particular issues, and express the shareholders' position (Trapp, 2009). It would therefore be a element of monitoring management actions.

As for the factor load for the state control variable, this shows an interesting result. Because it is positive, it is consistent with the relationship between factor 2 and the probability of corporate fraud occurring, which is positive and significant. This result is consistent with the most recent cases of corporate fraud in Brazil, such as those of Petrobrás and Correios (Brito, 2014; Ministério Público Federal, 2014), indicating that these companies provide greater opportunities to execute corporate fraud.

Also for the probability of occurrence of corporate fraud, it is observed that factors 4 and 5 indicate negative and significant behavior in relation to this probability.

As variables with loads higher than 0.62 (Table 5, column D), factor 4 presents the return on the assets of the banking institution and the size of the board of directors. As this factor is negatively related with the probability of fraud occurring, an alignment is perceived between the result obtained with the size of the board of directors, given that it is positively correlated with this factor. This result is consistent with agency theory, in that the composition of the board of directors is a fundamental corporate governance mechanism in market economies, as it exercises control over the executive board (Byrd, Parrino, & Pritsch, 1998; John & Senbet, 1998). As for return on assets, this indicated an unexpected behavior. Classified as a pressure element and especially as a measure of the institution's performance, its influence was expected to be inverse to the probability of fraud, however this did not occur. The financial intermediation revenue variable presented an expected result, consistent with factor 4 and therefore not contributing with its negative relationship to the probability of fraud occurring, which supports the writings of Alexander and Cohen (1996) and Macey (1991).

Finally, factor 5 gathered the following variables of the opportunity and rationalization dimensions of the Cressey fraud triangle (1953), as well as a control variable: independent members, predominance of females on the executive board, punishment, and convergence with the international accounting rules. Factor 5 presented a negative and significant relationship for the probability of occurrence of corporate fraud. In this, the variables with a factor load above 0.50 (Table 4, column E) showed a positive correlation with the factor, therefore contributing to the negative relationship found for the probability of corporate fraud occurring. Note that the results obtained for independent members are consistent with agency theory, given that a greater proportion of independent members – outsiders – on the board of directors reduces the probability of corporate fraud occurring, as seen in Beasley (1996).

As for the predominance of females on the executive board and punishment, these are in accordance with the writings from the area of criminology. The results for

females are similar to those of Steffensmeier et al. (2013) and the claims of Kelley et al. (1990), Reynolds (2006) and Zahra et al. (2007) concerning the behavior of females with regards to fraud. According to these authors, female managers are less susceptible to committing fraudulent acts than male managers. The results for punishment are bolstered by the studies by Becker (1968), Eide et al. (2006), and Murphy (2012) in the area of criminology and the economics of crime. According to these studies, punishment is an important situational factor in the decision-making process with regards to committing a criminal act or not.

As it was observed in the results of the research, variables from the three dimensions of the Cressey fraud triangle (1953), even when grouped in factors, were significant for measuring the probability of corporate fraud. This is consistent with the arguments of Cressey (1953), in which the absence of any one of the dimensions would prevent the violation of financial trust; that is, committing fraud. Therefore, because of the results obtained with factors 2, 4, and 5, hypothesis 1, which states that the three dimensions of the fraud triangle together condition the occurrence of corporate fraud in Brazilian banking institutions, cannot be rejected.

Based on the results put forward in Table 5, which were discussed in the previous paragraphs, an econometric model is presented for measuring the probability of corporate fraud occurring in banking institutions, in its final specification:

$$Pr\left(Y_t = j \middle| X_{i,t}, \alpha_i\right) = \frac{e^{0.6850_j Factor1_{i.t} - 0.0299_j Factor2_{i.t} - 0.7219_j Factor3_{i.t} - 0.9177_j Factor4_{i.t} - 0.5187_j Factor5_{i.t} + 0.5571_j Factor6_{i.t} + 1.1466 Factor7_{i.t} - 4.4628_{ij}}}{1 + \sum_{j=1}^{3} e^{0.6850_j Factor1_{i.t} - 0.0299_j Factor2_{i.t} - 0.7219_j Factor3_{i.t} - 0.9177_j Factor4_{i.t} - 0.5187_j Factor5_{i.t} + 0.5571_j Factor6_{i.t} + 1.1466 Factor7_{i.t} - 4.4628_{ij}}} \quad (4)$$

5. CONCLUSIONS

This article investigated the occurrence of corporate fraud in Brazilian banking institutions in the period between January 2001 and December 2012 using detection variables extracted from agency theory and the economics of crime, grouped according to the dimensions of the Cressey fraud triangle: pressure, opportunity, and rationalization. From agency theory, variables were identified that enabled the measurement of the pressure and opportunity dimensions pertaining to the instruments for monitoring manager actions, such as remuneration incentives and corporate governance. From the economics of crime, technical and empirical studies were used that enabled the identification of variables for measuring the pressure and rationalization dimensions, such as indicators of pressure for company performance and manager demographic characteristics, with age, educational level, training in the area of business, and gender standing out.

The study confirmed the general hypothesis of the Cressey fraud triangle, in which breaking financial trust is conditioned by the simultaneous existence of the three dimensions of the fraud triangle: pressure, opportunity, and rationalization.

This article is relevant in that it fills a gap in the literature in the area by carrying out a differentiated analysis of frauds, contemplating all those that occur in the context of an institution and not being limited to only those of an accounting nature. Likewise, this study enabled the measurement of the probability of occurrence of corporate fraud by dissociating fraudulent banking institutions from those that only showed indications of corporate fraud, this situation not being found in neither the Brazilian or international empirical studies used.

Besides the theoretical relevance presented in the previous paragraph, it is worth highlighting that the variables used in constituting the factors, with statistical significance, can be treated as indicators of possible occurrences of corporate frauds. Moreover, identifying these variables will enable both regulatory bodies and investors to analyze the possibilities of fraud occurring, whether for the regulatory bodies to curb it or for investor decisions with regards to maintaining or carrying out new investments.

This research also contributes with an investigation of new debates and studies in the Brazilian academic field on corporate frauds in the country, since besides being few in number these have different scopes to those of this study.

There were limitations for carrying out the study, especially during the data gathering process, due to the existence of few institutions that presented the totality of their data series for the period analyzed, mainly impacting on the obtainment of information on manager demographic characteristics. Another limitation was the temporal range of the data, covering January 2001 to December 2012, due to the fact that via Circular Letter n. 3,630 of 2013 (CB, 2013) the CB relieved banking institutions of presenting QFI from January 2013 onwards. The decision made obtaining the quarterly data from 2013 onwards unviable. This is added to the limitations of the research from using punitive administrative proceedings as proxies for the occurrence of corporate fraud; in future studies, judicial proceedings could be used for this purpose.

It bears mentioning that the models that use accounting variables can cause the problem of variable endogeneity, which requires specific treatment. In linear panel data models, the endogeneity of the regressors can be controlled using the generalized moments method (GMM) technique. However, controlling the endogeneity of the regressors in non-linear panel data models, especially in multinomial logit and probit cases, is something that is still being developed and is not yet available in the literature. For this reason, this problem was not considered in this article, representing a technical-scientific limitation to be addressed at some point the future.

For future studies, we propose an in-depth analysis of other measures of manager remuneration incentives, such as share bonuses, and their effect on the probability of corporate fraud occurring. We also suggest replicating this study for other activity sectors, such as non-financial publicly-traded companies.

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