A model to detect financial statement fraud in portuguese companies by the auditor

Un modelo para que el auditor detecte el fraude de estados contables en empresas portuguesas

Paulo Sérgio Gomes Macedo[1][*], Helena Coelho Inácio[2],
Elisabete S. Vieira[2]

[1]Polytechnic Institute of Cávado and Ave, Portugal
[2]University of Aveiro, Portugal

Abstract

This study developed a model that can be used to differentiate between fraudulent and non-fraudulent reports and helps the auditor to identify and assess material misstatement risk due to fraud. This model was based on the three stages of the fraud triangle, as well as on the agency theory and stakeholder theory. To develop the model, we used a sample that consists on a group of Portuguese companies that show evidence of fraud and another group of companies without evidence of fraud. Logistic regression results showed a positive relation between fraudulent financial statements and: companies need of higher financing, that represented the pressure to commit fraud; operations ineffectiveness, when the relative weight of accounts receivable is greater when compared to assets, which constituted the opportunity to commit fraud; and higher management turnover, which was characterised by managers who showed predisposition to commit fraud (rationalisation).

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[*]Corresponding author.
E-mail address: paulomacedo76@gmail.com (P. S. Gomes Macedo).
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Resumen

Este estudio establece un modelo para determinar qué distingue a los informes fraudulentos de los no fraudulentos y ayuda al auditor a identificar y evaluar el riesgo de falseamiento material, basándose en los tres componentes del triángulo del fraude, las teorías de la agencia y de las partes interesadas.
Para este fin, se construyó una muestra de empresas portuguesas cuyos estados contables muestran indicios de fraude. A partir de los resultados, de las regresiones logísticas obtenidas, se destaca la existencia de una relación positiva entre estados contables fraudulentos con mayores necesidades de financiamiento de las empresas, las cuales representan un incentivo al fraude, como también con ineficiencia de operaciones representada en las cuentas por cobrar más elevadas respecto a los activos, que posibilitan una circunstancia de fraude, y por último, con una mayor rotación de gestión que caracterizan el comportamiento del gestor con predisposición a cometer fraude (racionalización)

Código JEL: M41, M42
Palabras clave: estados contables; fraude; auditor; Portugal

Introduction

Financial statements (FS) should group the transactions that a company carries out, so they are very useful tools for decision-making, particularly for investors and financiers (Rahmawati and Kassim, 2020). However, their importance is under threat (Chen, Liou, Chen and Wu, 2019). One of the biggest challenges to the modern world is FS fraud. While the costs of fraud could be reduced by increasing financial literacy, this depends on the will of governments (Engels, Kumar, and Philip, 2020). Thus, FS fraud detection is of extreme importance (Kopun, 2018; Maka, Pazhanirajan, and Mallapur, 2020). Nonetheless, the literature usually considers fraud to be less serious than other crimes, despite the substantially higher costs to society (Baird, Zelin II and Olson, 2016; Azmi, Yusoff and Ismail, 2020).

A broader vision should be adopted when addressing fraud detection in order to minimise these costs. This vision should consider that research has been focusing on the isolated analysis of fraud risk indicators, the so-called red flags (Gullkvist and Jokipii, 2013). Committing fraud requires three components (pressure, opportunity and rationalization), known by the fraud triangle, which is usually considered the grounds for the fraud theory (Huber, 2017).

Pressure relates to financial or non-financial motivations or needs to commit fraud. Opportunity concerns the circumstances that can lead one to commit fraud and derives from ineffective or absent controls. Rationalisation represents the predisposition or willingness to commit fraud (Hogan, Rezaee, Riley and Velury, 2008).

Favere-Marchesi (2013) argued that it is preferable to decompose this risk into each of the above components for global fraud risk assessment. Mansor (2015) also stated that the key elements that contribute to fraud were based on this fraud triangle.

The agency theory contributes to a deeper knowledge of these fraudulent acts, when the economic setting is characterised by conflicts of interest between managers and owners (Almeida, 2014; Gerard and Weber, 2014). Concurrently, the stakeholder theory suggests the existence of additional conflicts of interest, because there are more parties interested in information besides the owners (Freeman, 1994).

The goal of this study is to use logistic regressions to develop a model to differentiate between FS with more risk of fraud from the others companies. As stated by Mohammadi, Khanmohammadi and Maham (2020) the development of fraudulent FS prediction models is important to minimise the high costs of fraud. For this purpose, we use a sample composed by two groups of FS: One that included Portuguese companies whose FS showed fraud signs, and one that included Portuguese companies whose FS did not show fraud signs.

Literature review and hypotheses

FS fraud derives from deliberate actions performed by managers to obtain individual benefits, and unfair or illegal advantages, or to deceive or mislead interested parties, by not using accounting benchmarks and spreading misinformation (e.g. distortion of company performance and financial situation) (Wells, 2013; Mohamed and Handley, 2014).

Auditing plays an important role in the mitigation of conflicts between managers and stakeholders (Fathi, 2013; Soltani, 2014). But auditors should not limit fraud detection to red flag analysis (Hammersley, Johnstone and Kadous, 2011). In contrast, aggregating fraud risk indicators allows the identification of the behaviour patterns that auditors may see as signs that something is wrong and that can be used to prevent fraud from happening (Brazel, Jones and Zimbelman, 2009).

Although the literature presents several variables with large fluctuations in results, further research is needed to understand fraudulent FSs (Maka et al., 2002).

The literature review reinforced the belief that company characteristics pressure managers into reporting fraud FS and into misleading stakeholders. It also showed that managers report FS that show fraud signs to mislead stakeholders depending on the opportunities given by governance and control mechanisms. Manager and environment characteristics may also influence managers rationalisation in regard to reporting FS that show fraud signs.

Company characteristics

Pressure to commit fraud is usually analysed in the literature as something that is inherent to the fraud author. However, Dorminey, Fleming, Kranacher and Riley (2012) stated that fraud authors did not share their problems, due to the social stigma associated to fraud, and also due to their egos or pride. This way, it is necessary to check if this pressure to commit fraud also derives from company characteristics, because these features can be observed directly.

The literature presents fraud indicators that can be grouped to identify the characteristics of fraudulent companies. Bell and Carcello (2000), Skousen, Smith and Wright (2009), Wang (2013) and Wyrobek (2020), among others, concluded that financial difficulties might enable fraud. Persons (2011) and Maka et al. (2020)   verified that fraudulent FS presented higher bankruptcy risks after observing that companies with lower Z-scores, according to the Altman (1968), showed more fraudulent reports. The Z-score is a model used to predict the likelihood of a company moving into bankruptcy within a period of two years, with approximately 70% of confidence. In this scope, the International Standards on Auditing (ISA) 570 refers that bankruptcy risk can be measured by the negative operational cash flows.

It is important to note that the literature also describes other fraud indicators, like decreased capacity to generate earnings. In this regard, Summers and Sweeney (1998) showed that companies with fraudulent FS presented lower return on assets ratios than other companies. Spathis, Doumpos and Zopounidis (2002) observed that sales profitability ratios presented the same behaviour. Dechow, Ge and Schrand (2010) also verified a negative relation between company size and fraud, for fraudulent companies.

This higher number of breaches of internal control systems may be connected to the less developed control systems of younger companies (Lennox, Lisowsky and Pittman, 2013).

Based on this evidence, we formulate the following hypotheses:

$H_{1.1.}$ Debt is positively related to the probability of fraud signs in FS.

$H_{1.2.}$ Bankruptcy probability is positively related to the probability of fraud signs in FS.

$H_{1.3.}$ Profitability is negatively related to the probability of fraud signs in FS.

$H_{1.4.}$ Company age is negatively related to the probability of fraud signs in FS.

$H_{1.5.}$ Company size is negatively related to the probability of fraud signs in FS.

Governance and control mechanisms

The opportunity to commit FS fraud stems from different interest between company stakeholders and managements. This opportunity depends on governance and control mechanisms that should guarantee effective decisions, company value maximisation and financial information reliability (Soltani, 2014; Azmi et al., 2020; Mohammadi et al. 2020).

The use of external financing is positively associated to fraud, because managers and shareholders risk may end up being transferred to debt holders (Liu, Chan, Kazmi and Fu, 2015). Concurrently, FS fraud may aim at preventing external investors disinterest as well, by making more favourable equity rate indicators against borrowed capital (Jensen and Meckling, 1976).

Some of the fraud literature addresses the board of directors as a governance structure that effectively decreases agency problems (Albrecht, Albrecht and Albrecht, 2004 and Gerard and Weber, 2014) and fraud (Fitri, Syukur and Justisa, 2019). Appointing an auditor contributes to the detection, correction or report FS distortions. Mostly because not disclosing relevant distortions, namely fraud-related distortion, may result in auditors losing their reputation and being involved in litigation, if those distortions are ever revealed (Dechow et al., 2010; Dechow, Ge, Larson and Sloan, 2011). In this sense, Chen, Cumming, Hou and Lee (2013) stated that auditors might discourage less honest managers to commit fraud by checking information reliability.

The empirical literature shows evidence that fraudulent FS that include lower operation effectiveness levels also show larger inventories when compared to non-fraudulent FS, because a higher inventory represents an increase in materials and/or products (Lee, Ingram and Howard, 1999) that results in a decrease in the inventory turnover. In this context, Dechow et al. (2011) and Persons (2011) found that fraudulent FS often presented higher accounts receivable. Indeed, Kirkos, Spathis and Manolopoulos (2007) and Mohammadi, et al. (2020) found signs that fraudulent FS showed lower asset turnover ratios.

Awang, Ismail and Rahman (2017) stated that subjective standards significantly influenced FS fraud intentions. In this respect, paragraph 3 of article 63-C of Portugal's General Tax Law (LGT) establishes a limit for cash payments – that decreased from 10 000 Euro to 1 000 Euro in 2012 - because cash payments are harder to control and more liable to embezzlement. On the other side, the quality and corresponding reliability of financial information in Portugal has been reinforced in 2010 with the adoption of the Accounting Normalization System (SNC), which has a new approach that intends to be close to the IASB's regulatory model adopted by the European Union.

The Portuguese Accounting Plan (POC) was then replaced by the Accounting Normalisation System (SNS).

Considering the above evidence, the hypotheses formulated were:

$H_{2.1.}$ The weight of borrowed capital when compared to equity is positively related to the probability of fraud signs in FS.

$H_{2.2.}$ There is a positive relation between positive equity variation when compared to borrowed capital and the probability of fraud signs in FS.

$H_{2.3.}$ The existence of a board of directors is negatively related to the probability of fraud signs in FS.

$H_{2.4.}$ Not complying with the duty of appointing an auditor is positively related to the probability of fraud signs in FS.

$H_{2.5.}$ The relative weight of inventories when compared to assets is positively related to the probability of fraud signs in FS.

$H_{2.6.}$ The relative weight of accounts receivable when compared to assets is positively related to the probability of fraud signs in FS.

$H_{2.7.}$ Asset turnover is negatively related to the probability of fraud signs in FS.

$H_{2.8.}$ Decreasing cash payments is negatively related to the probability of fraud signs in FS.

$H_{2.9.}$ Changes in accounting regulations is negatively related to the probability of fraud signs in FS.

Manager and environment characteristics

Hogan et al. (2008) found that information about manager rationalisation in the literature was scarce, namely because manager rationalisation is not easy to observe, as stated by Lou and Wang (2009). In this sense, Huang, Lin, Chiu and Yen (2017) referred that rationalisation was the fraud triangle component that was less explanatory of fraud. Nonetheless, some manager and environment characteristics influence managers to commit fraud. The agency theory, whose grounds are assumptions like self-interest, risk aversion, and conflicts of interest (Eisenhardt, 1989), states that these
depend on certain manager characteristics. In addition, the stakeholder theory explains manager behaviour in terms of the behaviour of stakeholders that are not shareholders, and refers that this behaviour depends on environment characteristics.

Manager characteristics can be the higher predisposition to take advantage from tax benefits, generating higher effective taxes, and consequently, higher fraud risk (Lennox et al., 2013); the probability of committing crimes being lower for women than men (Steffensmeier and Allan, 1996); and the higher manager turnover when accounting distortions are made public when compared to other companies, given that this turnover is a disciplining mechanism (Dechow et al., 2010).

Lastly, managers more predisposed to use the number "1" as the leading digit when declaring their net earnings (first digit), because this number allows to report earnings in the higher order of magnitude that is closer to zero. This can be verified by applying the Benford's law. This law allows to identify fraud potential by comparing the actual number (digit) position frequency with its expected frequency, and investigate potential embezzlements (Hogan et al., 2008). In this sense, Bernardino, Pedrosa and Laureano (2018) referred that the Benford's law helped identifying frauds like data system manipulation and other irregularities. Durtschi, Hillison and Pacini (2004), and Nunes, Inácio and Marques (2019) added that given the above, auditors could use this law to assist in fraud signs identification.

As environment characteristics, Dechow et al. (2011) described that more fraud cases were found for companies in the industrial sector. Dorminey et al. (2012) also stated that fraud could be deterred by increasing the perception that detection and punishment are likely to occur, which would decrease effective conversion chances. Article 103 of the Portuguese General Regime on Tax Infractions (RGIT) establishes a limit for fraud punishment that was changed in 2006 from 7 500 Euro to 15 000 Euro. This may seem less harsh but the purpose here was to control infractions more effectively.

In this context, we formulate the last hypotheses as follows:

$H_{3.1.}$ Taking advantage of the possibilities given by tax law is negatively related to the probability of fraud signs in FS.

$H_{3.2.}$ Women in management positions is negatively related to the probability of fraud signs in FS.

$H_{3.3.}$ Higher manager turnover is positively related to the probability of fraud signs in FS.

$H_{3.4.}$ Number "1" as the first digit of income reports is positively related to the probability of fraud signs in FS.

$H_{3.5.}$ Industrial sector operations present a higher probability of fraud signs in FS than other sectors.

$H_{3.6.}$ The increase in fraud punishment limit is positively related to the probability of fraud signs in FS.

Methodology and sample

Methodology

This study used a quantitative research method, resorting to logistic regressions, which were made using the Statistical Package for the Social Sciences (SPSS).

The first stage involved the creation of a specific model for each fraud triangle component. The second stage included the development of a global model based on the significant variables obtained using the aforementioned specific models.

Following Lou and Wang (2009) and Skousen et al. (2009), fraud indicators for all fraud triangle components were analysed according to one model to increase the probability of identifying fraud signs.

Sample

This study focused on unlisted Portuguese companies. Portuguese companies have different characteristics from most companies studied in fraud literature, as referred by Lopes e Rodrigues (2007) and Marques, Rodrigues e Craig (2011). They are smaller, they have a more concentrated property structure, lower dispersion levels in the stock market and, consequently, financing is mostly provided by banks and providers. The importance of taxation in management is also a differentiating factor for Portuguese companies, as taxation laws do not accept certain accounting standards and management uses taxation laws instead of accounting standards to avoid having to make tax adjustments. However, these companies have not been studied in the scope of fraud literature, so this study intends to validate the presented hypotheses based on a sample of Portuguese companies.

The sample of companies with evidence of fraud was constructed by combining information from various sources for the period between 2006 and 2012. Study period was limited by the last available information from all different sources. It must be noted that the sample aims to find the most important factors for the identification of fraud evidence. Thus, the sample most relevant factor is the way it is constructed, guaranteeing a degree of certainty that it incorporates financial statements that are proven fraudulent and others that are not. For this fact, it is necessary to elapse some time.

The sample was only used for model development purposes, and that the period to which it refers is not relevant, but rather the way it was constructed.

The sample of FS with evidence of fraud was constructed from the following information:

• Auditor reports with adverse or disclaimer opinions, provided by Informa D&D, Lda.;

●Newspaper articles found on the internet that identify the company involved in fraud investigations;

●Excerpts from tax auditors' reports reproduced in decisions of the Portuguese Supreme Administrative Court.

These sources led to 530 observations of FS fraud signs, 116 observations that were not available in the Amadeus database were removed from the initial sample. Then, based on the expressions of fraud indications referred in ISA 240, a content analysis was carried out. Table 1 shows the most frequent expressions published in source documents that allow to identify fraud signs pursuant to ISA 240. This content analysis excluded 251 FS, resulting in a final sample with 163 observations (30.75% of 530) of FS that showed fraud signs. A total of 325 expressions that revealed facts that indicate fraud, according to ISA 240, were identified from those 163 FS that showed fraud signs.

Table 1
Most frequent expressions mentioned in source documents

Expressions mentioned in source documents	Frequency
"Capital flight in suitcases loaded with cash"	31
"Capital hidden abroad kept in tax havens"	31
"They were entering fake invoices as costs in their accounting"	30
"Use of fake invoices"	28
"Creation of fake companies setting up several operations"	28
"Directors in the possession of high financial resources without any justification"	11
"Omission of directors incomes"	11
"Documents were not provided"	9
"We didn't get enough information"	8
"Impairment wasn't recognised despite impairment indicators"	7
"Omission of substantial incomes"	6
"Fake transactions"	6
"Transfers to societies registered in tax havens"	6
"Offshore in tax haven for money laundering, identity omission"	6
"Cheque withdrawal in cash without recalling where the money went"	6
"Bearer cheques and bank transfers to private accounts"	6
"It wasn't possible to obtain documentation that allowed to conclude"	5
Expressions with frequency below 5	90
TOTAL	325

The FS that showed fraud signs were compared with control sample including FS that showed no signs of fraud in a one-to-three ratio. Selection criteria were year, activity sector and equivalent asset,

as in Bell and Carcello (2000). Global sample was divided into sub-samples according to activity sectors, as showed in Table 2.

Table 2
Global sample sub-samples

Sample sub-divisions	FS that showed Fraud signs	FS that showed no Fraud signs
Industrial activity sub-sample	37	111
Commercial activity sub-sample	54	162
Services activity sub-sample	72	216
Total	163	489

Models and variables

Control variables were considered in the model in order to explain other fraud determinants that are not related to any of the above theories, like company location, auditor type or gross domestic product (GDP).

Model to determine pressure to commit fraud

Taking into account that pressure to commit fraud relates to company characteristics, hypotheses $H_{1.1}$ to $H_{1.5}$ presented in section 2.1 were tested using the logistic regression model below and according to the following relation:

$$\text{FS that showed fraud signs}= f\,[\text{DEB-LI, DEB-WC, BAN-Z, BAN-CF, PRO-AT , PRO-TU, AGE, SIZ-AT , SIZ-TU, LOC, BIG e GDP}]$$

(1)

The dependent variable "FS that showed fraud signs" is a dummy variable that assumed the value "1" whenever FS showed fraud signs and the value "0" in the opposite situation. Independent variables are described in Table 3.

Table 3
Independent variables used with the company characteristics model

Independent variables	Designation	Measure
Debt Level	DEB-LI	Liabilities$_t$
		Assets$_t$
	DEB-WC	Working Capital t
		Assets $_t$
Bankruptcy risk	BAN-Z	Altman Z-Score[1]
	BAN-CF	Dummy variable if operational cash flow was negative (1), otherwise (0)
Profitability	PRO-AT	Net earnings t
		Assets $_t$
	PRO-TU	Net earnings t
		Turnover t
Company Age	AGE	Natural logarithm of number of years from company incorporation until fraud detection = Fraud year (t) – Operation start year
Company Size	SIZ-AT	Natural logarithm of assets t
	SIZ-TU	Natural logarithm of turnover t
Location	LOC	Dummy variable if located in the district of Lisbon (1)
		District with higher number of companies in Portugal, otherwise (0)
AuditorBIG20	BIG	Dummy variable if AuditorBIG20 (1), otherwise (0)
Positive GDP variation	GDP	Dummy variable if GDP variation compared with last year's is positive (1), otherwise (0)

Given that Portuguese companies have smaller dimensions and are less likely to have a BIG auditor, for the BIG[2] variable to be representative it must include the 20 largest auditing companies according to the BIG4 Accounting Companies for purposes of comparison with FS that are not audited or with FS that are audited but whose auditor is not BIG.

Model to determine opportunities to commit fraud

Hypotheses $H_{2.1}$ to $H_{2.9}$ presented in section 2.2 were tested, considering that the opportunity to commit fraud relates to governance and control mechanisms.

To this end, our logistic regression model was based on the following variables:

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[1] Fernandes, Peguinho, Vieira and Neiva (2016) calculated the Altman Z-core for unlisted companies by using the formula below: Z = 1.72Working Fund/Assets + 0.85Retained Earnings/Assets + 3.1EBIT/Assets + 0.42Equity/Liabilities+ 1Sales/Assets. The lower the Altman Z-score, the higher the bankruptcy risk.

[2] http://www.big4accountingcompanies.org/the-top-accounting-companies-in-the-world/.

FS that showed fraud signs= f [DISP-FIN, INC-FIN, BD, AAUD, INV, ACC-REC, TUR-AT, CAS, SNC, LOC, BIG e GDP]

(2)

Control variables were the same (LOC, BIG and GDP). Independent variables are presented in Table 4.

Table 4
Independent variables used with the governance and control mechanisms model

Independent variables	Designation	Measure
Dispersion in Financing	DISP-FIN	Liabilities t / Equity t
Incentive to external financing	INC-FIN	Positive Equity variation against Liabilities
Governance structure	BD	Value "1" allocated to dummy variable whenever there is a board of directors and "0" otherwise
Appointment of auditor	AAUD	Value "1" allocated to dummy variable whenever company did not comply with the obligation of appointing an auditor and value "0" otherwise
Inventory operation effectiveness	INV	Inventory t / Assets t
Accounts receivable operation effectiveness	ACC-REC	Accounts Receivable t / Assets t
Asset turnover operation effectiveness	TUR-AT	Turnover t / Assets t
Reduction of cash as payment method	CAS	Value "1" allocated to dummy variable for the year when cash payment amounts were decreased and value "0" allocated otherwise
Accounting regulations	SNC	Value "1" allocated to dummy variable for the years of 2010, 2011 and 2012, and value "0" allocated otherwise

Model to determine the rationalisation of committing fraud

Hypotheses $H_{3.1}$ to $H_{3.6}$ presented in section 2.3 were tested using the logistic regression model below and considering that the rationalisation of committing fraud is related to manager and environment characteristics:

FS that showed fraud signs= f [POSS-TAX, GEN, MAN-TUR, NUM"1", IND-SET, PEN-INC LOC,

BIG e GDP]

(3)

The independent variables are presented in Table 5.

Table 5
Independent variables used with the manager and environment characteristics model

Independent variables	Designation	Measure
Tax planning	POSS-TAX	Income tax t Earnings before taxes t
Manager Gender	GEN	Female Gender
Management Turnover	MAN-TUR	Sum of number of manager exits and entrances during the year with fraud signs
Benford's Law	NUM"1"	Value "1" allocated to dummy variable when first net earnings digit is "1" and value "0" otherwise
Activity sector	IND-SET	Value "1" allocated to dummy variable when company activity sector was the industrial sector and value "0" otherwise
Penalties	PEN-INC	Value "1" allocated to dummy variable for the years when penalty limit was increased and value "0" otherwise.

Global model

The conceptual model depicted in Figure 1 (suggested model) was based on the fraud triangle components. The pressure element was analyzed in regard to company characteristics, the opportunity element was assessed in terms of governance and control mechanisms, and the rationalization element reflected manager and environment characteristics.
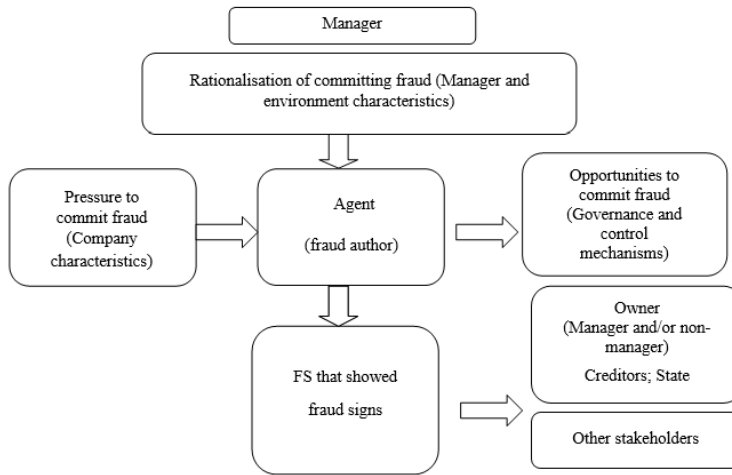
Figure 1. Suggested conceptual model

This way, all fraud triangle component indicators were analysed according to one model.

Results and discussion

Specific models

Model to determine pressure to commit fraud

The hypothesis-testing variables in global sample and sub-samples were selected according to Spearman's rho correlation coefficients to prevent multicollinearity issues and to use more than one independent variable when testing each hypothesis (as indicated by the literature). Table 6 summarises the output of the logistic regression model used with the company characteristics model, according to the "Enter" method used for the global sample and sub-samples, namely the coefficients of hypotheses variables and their significance.

Table 6
Company characteristics model results

Hypotheses	Independent variables	Sign Exp.	Global sample	Industrial activity sub-sample	Commercial activity sub-sample	Services activity sub-sample
			B	B	B	B
	Explanatory					
$H_{1.1.}$	DEB-LI	+		**2.627		-0.22
	DEB-WC	-	***-1.075	*-1.688	***-2.2	*** 2.10
$H_{1.2.}$	BAN-Z	-				-0.063
	BAN-CF	+	*** 0.960	* 1.455	0.27	
$H_{1.3.}$	PRO-AT	-			**-11.3	
	PRO-TU	-	-0.032	1.123		-0.027
$H_{1.4.}$	AGE	-	0.051	0.232	-0.355	**0.520
$H_{1.5.}$	SIZ-TU	-	***0.240	0.014		
	SIZ-AT	-			*0.291	**-0.201
	Control					
	LOC	+	*** 0.850	0.822	-0.074	***1.774
	BIG	?	**-0.891	*-1.37	*-1.728	-0.318
	GDP	?	-0.014	0.217	0.236	0.36
	Constant		-5.165	-3.7	-4.07	-1.38
	R^2		10%	17%	25%	23%
			*p<0.10	**p<0.05	***p<0.01	

It should be noted that when the variable degree of indebtedness is calculated by measuring the weight of the liability in relation to the asset, we expect a positive relationship between this and the probability of evidence of fraud in the FS. In this case, the higher this ratio, the higher the debt and consequently the higher the fraud probability. When calculated by measuring the weight of working capital in relation to assets, we expect a negative relationship with the probability of evidence of fraud in the FS, given that the higher this ratio, the lower the financing needs and, consequently, the lower the probability of fraud. This is because the higher this ratio, the lower the financing needs and, consequently, the lower the fraud probability.

We found evidence for Hypothesis 1.1 for the global sample, industrial activity sub-sample, and commercial activity sub-sample, which is in accordance with the results of Wang (2013). However, for the services activity sub-sample, the variable DEB-WC was positive, as opposed to what was expected, meaning that FS showing fraud signs presented higher liquidity and lower bankruptcy risk probability. The Hypothesis 1.2 was valid for the global sample and industrial activity sub-sample, which is in accordance with the results presented by Pearsons (2011). The Hypothesis 1.3 was only valid for the commercial activity sub-sample.

We found no evidence for Hypothesis 1.4, which is not in agreement with the results of Lennox et al. (2013) that refer that fraudulent companies tend to be younger. It is worth to highlight that for the

services activity sub-sample, FS showing fraud signs presented higher company age than non-fraudulent FS. Lastly, the Hypothesis 1.5 was not valid, except for FS included in the services sub-sample. On the contrary, for the global sample and commercial sub-sample, companies whose FS showed fraud signs were larger than companies whose FS showed no fraud signs. These results were opposite to those presented by Dechow et al. (2010).

The results that were obtained were contrary to the sign expectation:

- for the services activity sub-sample, in hypotheses 1.1 and 1.4, where FS which showed fraud signs have higher liquidity levels, are less likely to go bankrupt, and are in operation for longer than FS that showed no fraud signs. This shows that financial needs for companies with services activity are not an incentive to fraud, because these companies do not require large investments, namely in terms of inventory, and are smaller, which allows them to survive for longer without the fraud being detected.

- for the global sample and commercial activity sub-sample, in hypothesis 1.5, where FS that show fraud signs are larger than FS that show no fraud signs, which shows that fraud allows companies to grow.

Model to determine opportunities to commit fraud

Table 7 summarises the output of the logistic regression model used with the governance and control mechanisms model, according to the "Enter" method used for the global sample and sub-samples.

Table 7
Independent variables used with the governance and control mechanisms model

Hypotheses	Independent variables	Sign Exp.	Global sample	Industrial activity sub-sample	Commercial activity sub-sample	Services activity sub-sample
			B	B	B	B
	Explanatory					
$H_{2.1.}$	DISP-FIN	+	-0.001	-0.001	-0.001	0.003
$H_{2.2.}$	INC-FIN	+	-0.002	*-2.037	**-1.51	*-0.004
$H_{2.3.}$	BD	-	***0.692	0.224	0.373	*0.743
$H_{2.4.}$	AAUD	+	0.207	-20.3	-1.287	**2.252
$H_{2.5.}$	INV	+	-0.376	-1.494	-0.152	-3.916
$H_{2.6.}$	ACC-REC	+	***1.340	*1.968	-0.425	***2.81
$H_{2.7.}$	TUR-AT	-	0.064	-0.692	*0.206	0.071
$H_{2.8.}$	CAS	-	-9.338	0.102	-0.335	*-1.494
$H_{2.9.}$	SNC	-	0.078	-0.251	0.015	-0.268
	Control					
	LOC	+	*** 0.948	0.20	*0.728	***1.72
	BIG	?	***-0.975	**-2.00	-0.429	-1.07
	GDP	?	0.128	0.39	0.121	-0.208
	Constant		-2.42	-0.912	-1.788	-3.308
	R^2		9%	19%	11%	29%
				*$p<0.10$	**$p<0.05$	***$p<0.01$

The Hypothesis 2.4 was valid for the services activity, i.e. FS that showed signs of fraud also presented higher non-compliance rates in terms of appointing an auditor than FS that showed no signs of fraud. These results were in accordance with Chen et al. (2013).

We found evidence for Hypothesis 2.6 for the global sample and industrial and services activity sub-samples, meaning that FS that showed no fraud signs presented higher accounts receivable per assets unit that those that did not show fraud signs, which is consistent with the results of Dechow et al. (2011).

The Hypothesis 2.8 was valid for the services activity sub-sample, i.e. there was a negative relation between the decrease in cash payments and the probability of Portuguese companies showing FS fraud signs.

We find no evidence supporting the remaining hypotheses, neither for the global sample nor for the three sub-samples.

There were also results that were contrary to the sign expectation:

- for the industrial activity sub-sample, commercial activity sub-sample and services activity sub-sample, in hypothesis 2.2, there is a negative relationship between the positive variation of equity in the face of liabilities and the likelihood of fraudulent FS, i.e. for FS that show fraud signs there are less incentives to external financing for all sub-samples. On the one side, this might be because, in many Portuguese companies, the manager is also the owner, and owners are encouraged not to invest in companies that show fraud signs. On the other side, this might be because Portuguese creditors (financiers)

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are more willing to invest in companies than their owners, i.e. show higher risk exposure.

- for the global samples and services activity sub-sample

In hypothesis 2.3, the existence of a Board of Directors relates in a positive way to the likelihood of fraud signs in the FS of Portuguese companies. This might be because, in many Portuguese companies, the manager is also one of the owners, which raises issues as to the independence of the Board of Directors.

- for the commercial activity sub-sample

In hypothesis 2.7, the asset turnover is positively related to the probability of fraud signs in FS, which shows that fraud allows companies to have a growth in turnover greater than growth in assets.

The Hypotheses 2.1, 2.5 and 2.9 were neither valid for the global sample nor for the three sub-samples.

Model to determine the rationalisation of committing fraud

The Table 8 summarises the output of the logistic regression model used with the manager and environment characteristics model, according to the "Enter" method used for the global sample and sub-samples.

Table 8
Independent variables used with the manager and environment characteristics model

Hypotheses	Independent variables	Sign Exp.	Global sample	Industrial activity sub-sample	Commercial activity sub-sample	Services activity sub-sample
			B	B	B	B
	Explanatory					
$H_{3.1.}$	POSS-TAX	-	-0.266	-0.84	***-2.5	0.277
$H_{3.2.}$	GEN	-	**-0.606	-0.287	0	0.1
$H_{3.3.}$	MAN-TUR	+	*** 0.658	*** 1.1	0.45	* 0.46
$H_{3.4.}$	NUM"1"	+	-0.33	-0.072	0.01	* 0.61
$H_{3.5.}$	IND-SET	+	-0.025			
$H_{3.6.}$	PEN-INC	+	-0.043	-0.099	0.03	0.177
	Control					
	LOC	+	*** -0.671	-0.337	0.287	***1.29
	BIG	?	** 0.815	-1.318	-0.764	-0.502
	GDP	?	0.033	-0.034	-0.104	-0.175
	Constant		-1.155	-1.042	-0.789	-2.12
	R^2		7%	13%	7%	11%
				*p<0.10	**p<0.05	***p<0.01

We found evidence for Hypothesis 3.1 for the commercial activity sub-sample. Similar to the

results of Lennox et al. (2013), this study revealed that the chances of taking advantage of tax benefits were lower for FS that showed fraud signs. The Hypothesis 3.2 was valid for the global sample, which is in accordance with the results obtained by Steffensmeier and Allan (1996) that also mentioned that the probability of wrongful misconduct was lower in females.

Hypothesis 3.3 was valid for the global sample and industrial and services activity sub-sample. Dechow et al. (2010) also found increased manager turnover in situations where accounting misstatements were detected. The Hypothesis 3.4 was valid for the services activity sub-sample, i.e. there was a positive relation between number "1" as the first digit in net earnings and FS that showed fraud signs. This was also observed by Hogan et al. (2008).

The Hypotheses 3.5 and 3.6 were neither valid for the global sample nor for the three sub-samples.

Suggested global model

Considering the significant variables of each of the previous models, i.e. the significant variables identified for each fraud triangle component, this study suggests a single model that can help differentiate between FS that show fraud signs and FS that do not show fraud signs, using the "Enter" method for the global sample and sub-samples.

The suggested model for the global sample with a pseudo R^2 of 14% is:

$$LOGIT = -2.316 - 1.263DEB - WC + 0.601BAN - CF - 0.022SIZ - TU + 0.820BD$$
$$+ \quad\quad + 1.457ACC - REC - 0.356GEN + 0.547MAN - TUR$$
$$- + 0.783LOC - 0.938BIG + 0.068GDP$$

(4)

The suggested model for the industrial activity sub-sample with a pseudo R^2 of 24% is:

$$LOGIT = -3.402 + 1.658DEB - LI - 1.437DEB - WC + 1.126BAN - CF - 0.817INC - FIN$$
$$+ \quad\quad + 2.553ACC - REC + 0.793MAN - TUR$$
$$+ 0.939LOC - 0.232BIG + 0.416GDP$$

(5)

The suggested model for the commercial activity sub-sample with a pseudo R2 of 32%, is:

$$LOGIT = -9.849 - 1.970DEB - WC - 14.499PRO - AT + 0.548SIZ - AT - 0.426INC - FIN$$
$$+ \qquad + 0.447TUR - AT - 1.188POSS - TAX$$
$$+ 0.080LOC - 1.961BIG + 0.446GDP$$

$$(6)$$

And lastly, the suggested model for the services activity sub-sample with a pseudo R2 of 27% is:

$$LOGIT = -2.70 + 1.105DEB - WC + 0.335AGE - 0.285 SIZ - AT - 0.003INC - FIN$$
$$+ 1.457BD + 2.432 AAUD + 1.119ACC - REC - 1.233CAS + 0.353MAN$$
$$- TUR + 0.820NUM"1" + \qquad + 1.252LOC - 0.544BIG - 0.042GDP$$

$$(7)$$

Nineteen FS that showed fraud signs and fifty-seven FS that showed no fraud signs were added to the global sample to test the robustness of suggested models. Logit was calculated for the existence of FS that showed fraud signs and FS that showed no fraud signs.

Those additional tests revealed that the suggested models for the global sample and sub-samples presented higher fraud sign probabilities (thirty percent or higher) in observations concerning FS that showed fraud signs than for FS that showed no fraud signs.

Conclusions

This study showed that it is possible to find FS fraud signs based on company incentives and not on the authors of fraud, with the former being easier to obtain. The use of easy-to-observe variables to measure opportunity and rationalisation also complemented previous studies such as Lou and Wang (2019) and Skousen et al. (2009).

As expected, by combining the results in this study, it was possible to conclude that FS that showed fraud signs and reported lower profitability were also those that showed a lower tendency to take advantage of the chance to pay fewer taxes. Contrarily to what was expected, these results showed that there were no significant changes in management. This way, when assessing material misstatement risk, the auditor should consider the reporting of successive low profitability without there being management changes.

Results showed that the non-compliance with the duty of appointing an auditor was higher for companies with FS that showed fraud signs, and that were older and smaller. In this context, it was possible to conclude that small-sized reports were a common practice used to justify the non-compliance with the duty of appointing an auditor and to conceal the absence of a fraud detection mechanism.

We found evidence for Hypothesis 2.6 e 3.3 for the global sample and for the industrial and services activity sub-samples, that allowed to concluding that there were significant management changes whenever FS showing fraud signs reported higher accounts receivable. This relation in the scope of the agency and stakeholder theories combined with expressions identified in content analysis (e.g. "fake transactions", "bearer cheques and transfers to private accounts", "capital flight in suitcases loaded with cash" and "directors in the possession of high financial resources without any justification") allowed to conclude that presenting high accounts receivable to justify non-existing assets, or justifying client debt with non-existing commercial transactions, or the fact that the client had already paid but the financial resource was in the possession of a former manager, may all be strong evidences of fraud. This way, in relation to high accounts receivable, the auditor should define testing procedures, namely external confirmation requests, and alternative procedures in case that the evidence obtained is inconclusive.

This study contributes to the literature because it shows that proxies that detect FS fraud signs depend on activity sector. This may be an indication that models created for fraud detection should include more homogeneous activity sector samples so that company characteristics, and manager opportunities and rationalisation were influenced by similar goals and factors.

For future research, it would be interesting to apply the model to samples from different periods and different countries and such research should include the analysis of the social standing of managers of companies that report FS that show signs of fraud, namely: education, frequency of known fraud cases, and image before shareholders and local community. In addition, this study should be replicated using activity sector sub-samples to verify if it was possible to increase the predictive capacity of fraud detection models. Given that the purpose of this study was the detection of fraud signs, future studies should look into the consequences of fraud detection for managers, auditors, companies, owners and other stakeholders.

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