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Article

Financial Fraud, Independent Female Directors and CEO Power

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Abstract: This paper investigates the effect of female directors on financial fraud, focusing on the role of independent female directors and their demographics, such as experience, financial expertise, and audit committee membership. We find that independent female directors have a negative and significant influence on financial fraud, which is enhanced by their experience and financial expertise. The positive effect is also significant for those female directors that are members of the audit committee and have financial expertise. Independent female directors offset the increased likelihood of fraud in the presence of powerful CEOs, suggesting that the impact of their contribution is more valuable when there is managerial entrenchment.

Keywords: financial fraud; gender diversity; independent female directors; CEO power



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1. Introduction

The wave of financial scandals such as Enron and WorldCom, among others (Kim et al. 2013; Xu et al. 2018) have increased investors awareness to the negative impact of poor corporate governance practices on firms' capital allocation and market stability (Khanna et al. 2015). In 2002, the Sarbanes-Oxley Act (SOX) implemented regulation as a response to corporate financial malpractice, highlighting the need to increase independent directors, among other measures, to improve the efficiency of monitoring activities (Beasley 1996; Abbott et al. 2000). Despite, SOX legal penalties for misreporting that aimed to incentivise managers towards good practice (Karpoff et al. 2008), compliance with good corporate governance practices has not been fully addressed (Xu et al. 2018). For instance, the cases of financial fraud in USA firms increased by 12 per cent between 2003 and 2005 (Hogan et al. 2008; Uzun et al. 2004), mainly because of inflated revenues (52% of the fraud cases) that were followed to meet analysts' estimates (Kim et al. 2013). According to the 2020 PwC's Global Economic Crime and Fraud Survey, fraud cases have also extended globally, where bribery and corruption and accounting/financial statement fraud have reported increases¹.

As a result, the structure and composition of the board of directors remains relevant in the quest of improving corporate governance practices and the quality of financial reporting. Previous research has highlighted that board of directors' characteristics, such as education (Aier et al. 2005; Lewis et al. 2014), age (Troy et al. 2011) and tenure (Ali and Zhang 2015) have an impact on board effectiveness. Board gender diversity has also been suggested as a factor that enhances the monitoring ability of the board (Campbell and Mínguez-Vera 2008; Adams and Ferreira 2009), improving corporate governance practices and consequently lowering fraud cases (Kim et al. 2013; Cumming et al. 2015; Lenard et al. 2017). Likewise, female CEOs/CFOs have been found to mitigate financial fraud (Barua et al. 2010; Liao et al. 2019) by improving the quality on financial reporting.

This paper extends the literature that focuses on the relationship between female directors and financial fraud in several ways. First, we distinguish the relevance of the female directors' role (i.e., as independent) and their attributes (i.e., experience and expertise)

that would enhance not only their monitoring but also advising functions. That is, we place emphasis on the importance of non-executive female directors that have no ties or connections with shareholders or other board members in decreasing financial fraud. We hypothesize that independent-female directors will have a larger negative impact on decreasing the likelihood of fraud than inside-female directors. This is an important aspect of the analysis which is consistent with distinguishing gender diverse boards that are driven by tokenism or societal fairness (Farrell and Hersch 2005). Second, as in Zalata et al. (2018), we consider the importance of female directors on audit committees (i.e., independent by requirement—SOX 2002) to the likelihood of reducing financial fraud, measuring not only their membership to the audit committee in their role as monitors but also as advisors (i.e., financial experts). Third, by considering that the involvement of CEOs in fraud cases is common (Beasley et al. 2010), we analyse whether the input from independent-female directors is more valuable in decreasing financial fraud when companies have powerful CEOs. That is, we hypothesize that powerful CEOs might have more means to increase the likelihood of fraud, and that independent female directors would moderate this effect by increasing the effectiveness of monitoring. In our analytical framework, we recognize that the roles of directors are interchangeable between advisors and monitors, and consider that independency is more valuable within female directors. Therefore, the grounds of our theoretical framework are the agency and resource dependence theories (Hillman and Dalziel 2003), where the monitoring role of independent directors is complemented by advisory functions through expertise and experience (Terjesen et al. 2016).

Our main findings indicate that the negative effect from female directors on financial fraud is significant only for those that are independent. This negative relationship extends in line with increased experience and expertise, also noticing a significant impact when independent female directors are members of the audit committee. In addition, we find that in companies with powerful CEOs, the impact of independent female directors in reducing fraud is greater than for companies with less powerful CEOs, suggesting that independent female directors monitor CEOs decisions. This finding offers important evidence on the role of network and social dynamics in corporate decision-making confirming that the probability of fraud is not irrelevant to directors' interactions with their fellow executives in the corporation (Stevenson and Radin 2009; Barroso-Castro et al. 2016).

Our main contribution to the literature of financial fraud and gender diverse boards is threefold. First, we provide a different perspective by measuring the association of female directors that are independent, which implies that the impact of female directors on corporate outcomes goes beyond a behavioural gender difference based on ethicality and risk preferences (Cumming et al. 2015). Instead, we further account for the ability and skills attributable to the independent role of female directors that contribute to positive financial outcomes (e.g., less probability of financial fraud). That is, we consider that unbiased decision making arises from independent directors, and so, gender diversity among this cohort is more important towards conducting transparent and impartial monitoring and strategic decisions. Second, we shape the experience and expertise characteristics of independent female directors, recognizing that there might be a differential of abilities and skills at different spectrums of experience (e.g., age, external seats or tenure) and expertise (i.e., financial). In particular, we highlight the relevance of the audit committee in the likelihood of fraud, and therefore develop our analytical construction with this consideration. That is, we directly measure and test whether experience and financial expertise of independent female directors on both the board and the audit committee reduce the probability of fraud. Third, we account for the influence from CEOs to direct corporate behaviour (Khanna et al. 2015) and hypothesize that independent female directors are efficient moderators of powerful CEOs in avoiding corporate wrongdoing. Therefore, unlike prior studies, we unambiguously incorporate in our analysis the distinguishing contribution of an independent-female director, highlighting the conjoint effect of gender and role, in moderating the actions of a dominant manager. This is an important contribution since the agency conflict that arises in a corporation with a dominant CEO can be offset with a

board with gender diverse independent directors. Therefore, our analysis extends from the importance of independent directors in reducing corporate fraud to incorporate the behavioural aspects from gender differentials.

The structure of this paper is as follows: Section 2 provides literature review and hypotheses development. Section 3 discusses the research methodology and the model used in this research. Sections 4 and 5 present and discuss the research findings and further analyses, respectively. Section 6 concludes.

2. Literature Review and Hypotheses Development

2.1. Financial Fraud

Fraud and errors differ based on whether the underlying reasons of an action are intentional or unintentional, respectively (Hamilton 2016). Therefore, fraud refers to any intentional actions that mislead or deceive relevant stakeholders. These actions may include embezzlement, self-dealing, insider trading, disclosure of false information and misappropriation of assets (Conyon and He 2016). In particular, financial fraud refers to deceitful acts including overstating a firm's revenue, lowering expenses/costs, misreporting goodwill and incorrect recognition of losses/gains, which might affect both income statements and companies' balance sheet (Dechow et al. 2011; Lau and Ooi 2016).

Managers might misreport financial statements through earnings management to meet short-term goals (Fung 2015) failing to comply with GAAP standards (Hasnan et al. 2013; Sun et al. 2011). External factors that cause misreporting from a managerial perspective are the existence of debt, low liquidity and poor firms' performance, which pressures managers to engage in financial fraud (Amara et al. 2013). The absence of independent board members and low quality of the external audit aggravates the use of financial misreporting (McMullen 1996).

Although the US government increased regulations and implemented the Sarbanes-Oxley Act in 2002, financial fraud litigation is still common (Lenard et al. 2017), which highlights the importance of corporate governance mechanisms to decrease such acts (Beasley 1996; McMullen 1996; Uzun et al. 2004; Farber 2005).

2.2. Financial Fraud and Board Gender Diversity

The core argument underlying the importance of gender diversity in corporations departs from the relationship between gender and risk, where it has been observed that managerial overconfidence is moderated by a gender diverse boards (Barber and Odean 2001). Therefore, female directors on boards signal greater transparency and ethicality that fosters investors' confidence in a corporation (Larkin et al. 2013). Risk taking from a gender diverse board also shapes effective strategy through the making of financial and investment decisions, such as acquisitions (Huang and Kisgen 2013), less earnings volatility (Faccio et al. 2016), lower leverage (Cole 2013; Alves et al. 2015), increased quality of public disclosure (Gul et al. 2011) and greater engagement in their corporate social responsibilities (Williams 2003; Bear et al. 2010; Bernardi and Threadgill 2010).

2.2.1. Independent Female Directors

Gender diversity on boards of directors is a significant factor for the quality of financial reporting (Srinidhi et al. 2011; Lara et al. 2017; Gull et al. 2018), fewer financial restatements (Abbott et al. 2012) and performance by increasing the effectiveness on decision making (Francoeur et al. 2008; Adams and Ferreira 2009; Ye et al. 2010). Female directors differ from male directors in their core values and risk attitudes (Adams and Funk 2012), which has a significantly positive impact on firms' strategies (Solakoglu and Demir 2016), and earnings stability/lower debt ratios (Faccio et al. 2016).

From a financial fraud perspective, literature is inconclusive with respect to the role of women in leadership positions and the probability of fraud. On the one hand, firms with female directors were found to increase the quality of corporate reporting (Ye et al. 2010), and decrease the probability of corporate fraud (Lenard et al. 2017; Wahid 2019; Wang et al. 2022)

and corporate crime/misconduct (Steffensmeier et al. 2013; Velte 2021). On the other hand, Hilliard and Neidermeyer (2018) found, in an international setting, that the likelihood of women engaging in asset misappropriation is three times more than those of men.

A way to decrease financial malpractice is through effective corporate governance mechanisms, led by the board of directors (Uzun et al. 2004; Jia et al. 2009). In this respect, the value of independent directors to oversee corporate practices has been highlighted (Beasley 1996). In particular, higher ratios of outsider directors could deter the incidence of fraud (Chen et al. 2006) and decrease the likelihood of accounting scandals (Agrawal and Chadha 2005), conceivably because independent directors have reputation concerns for future appointments (Fich and Shivdasani 2007). Likewise, independent directors have been associated with reporting quality and voluntary disclosure (Goh et al. 2016). We develop our empirical framework grounded on the resource dependence theory, where independent directors are also valuable as advisors (Hillman and Dalziel 2003). That is, we consider that the efficiency on decision-making increases with the provision of different perspectives and experiences (Terjesen et al. 2016).

The literature concerning the differentials from female directors in general and those that are independent is more limited. It is still unclear to whether there are intrinsic differences between female directors that have ties with the company (i.e., as an employee, shareholder or relational) and those that have been appointed by merit (i.e., independent female directors). Wahid (2019) suggests that female directors are found to exert more effort in their governance roles, possibly because they are more independent (Terjesen et al. 2016). Nadeem (2020) documents that independent-female and executive directors have different effects on corporate policies. As such, the value of independent-female directors is more relevant towards monitoring of managerial actions, protecting stakeholder interests. Female directors' effectiveness aligns to whether their appointment is driven by social and political pressures or their performance prospects (Green and Homroy 2018). For instance, in markets where the culture is more family orientated, female directors are either appointed as a token (Chauhan and Dey 2017), or to retain the family control (Poletti-Hughes and Briano-Turrent 2019). With this in mind, the benefits that independent-female directors could bring to the strategic outcomes of the company might differ to those of inside-female directors as a result of valuable knowledge and relationship resources as described by the resource dependence theory (Hillman and Dalziel 2003).

Considering that an effective board is essential to decrease the probability of financial fraud and that board effectiveness increases with gender diversity (Poletti-Hughes and Briano-Turrent 2019) and independency (John and Senbet 1998), the relevance of independent female directors in decreasing financial fraud leads to the following hypotheses:

Hypothesis 1 (H1). *Independent female directors are more effective in decreasing the likelihood of financial fraud than inside female directors.*

2.2.2. Demographic Attributes of Independent Female Directors

According to the upper echelon's theory, the value of a director as an effective monitor and advisor may increase in line to the characteristics that contribute to their experience and expertise, such as age, education and tenure. For instance, directors age and education have been associated with the level of conservatism and ethical values (Hambrick and Mason 1984), which consequently contribute to sound quality of financial reports (Huang et al. 2012), voluntary disclosure (Bamber et al. 2010), environmental disclosure (Lewis et al. 2014) and less association with financial fraud (Troy et al. 2011).

Other director attributes as tenure and independence identify a decrease on corporate fraud (Kim et al. 2013; Beasley 1996). Feasibly because longer tenures reflect directors' commitment towards the firm, which combined with greater knowledge acquired during the serving time improves the quality on decision-making. Additionally, independent directors are more concerned about their reputation in the external market (Vafeas 2005) and therefore more likely to be diligent in limiting practices that deteriorate financial statement

quality or violate securities laws (Kim et al. 2013). Previous research on the association of directors' characteristics with fraud and financial restatements have mixed findings. For instance, directors' financial expertise is found to decrease financial restatements (Abbott et al. 2012), reduce earnings management (Zalata et al. 2022), but is not significantly related to financial fraud (Gao et al. 2017; Marzuki et al. 2019). Similarly, director's tenure is found to have a negative association (Beasley 1996) and a non-significant relationship (Gao et al. 2017) with fraud.

In the context of board gender diversity, female directors have more international experience and higher qualifications than their male counterparts (Singh et al. 2008), possibly because females have less opportunities to get appointments at senior levels when compared with males, which adds value to acquiring more skills, experience and expertise (Nguyen et al. 2020). Female directors' attributes (experience, skills, and business education) are essential in terms of independent appointments to boards (Nekhili and Gatfaoui 2013) and are relevant in enhancing board effectiveness (Johnson et al. 2013; Gull et al. 2018).

Considering that the attributes of directors (e.g., education, skills and experience) improve decision-making and that gender diversity enhances board effectiveness, the attitudes towards fraud may differ according to the experience and expertise of independent female directors, leading to the following hypotheses:

Hypothesis H2a (H2a). *Independent female directors are more effective in decreasing the likelihood of financial fraud according to their experience.*

Hypothesis H2b (H2b). *Independent female directors are more effective in decreasing the likelihood of financial fraud if they have financial expertise.*

2.2.3. Female Directors in the Audit Committee

The Sarbanes-Oxley Act 2002 (SOX 2002) requires that members of the audit committee are fully independent and that at least one of them has financial expertise. The presence of independent directors on the audit committee is a core issue for transparency and good corporate practice (Owens-Jackson et al. 2009), as it impacts on the decrease in fraudulent financial reporting (Abbott et al. 2000). Farber (2005) observed that firms successfully overcame their weaknesses in corporate governance by increasing the number of audit committee meetings, playing a significant role in the oversight of the auditing process (Beasley et al. 2009). Similarly, the effectiveness of the audit committee closely aligns to the financial and accounting expertise of its members (Troy et al. 2011; Badolato et al. 2014; Gull et al. 2018), decreasing the likelihood of issuing corporate financial restatements (Bedard et al. 2004) and the risk of financial errors (Klein 2002).

Previous research concurs on the importance of the audit committee to improve transparency on firms reporting, which in turn, decreases earnings management (DeFond and Jiambalvo 1991; Klein 2002); improves disclosure (Kelton and Yang 2008) and reduces financial fraud (Beasley 1996; McMullen 1996; Abbott et al. 2000).

Given that financial statements are more accurate in line with a higher percentage of independent female directors in the audit committee (Pucheta-Martínez et al. 2016), the quality of financial information improves. Additionally, since the presence of female directors on boards reduces earnings management and financial restatements (Zalata et al. 2018; Oradi and Izadi 2019) and that expertise and ethicality improve the transparency on financial reporting (Chen et al. 2006; Ruiz-Jiménez et al. 2016) the following hypotheses are constructed:

Hypothesis H3a (H3a). *Firms with more female directors on audit committees decrease the likelihood of financial fraud.*

Hypothesis H3b (H3b). *Female directors with financial expertise on audit committees decrease the likelihood of financial fraud.*

2.2.4. The Moderating Effect of Female Directors on CEOs Power

According to agency theory, CEOs self-interests diverge from shareholders' wealth maximisation leading to the expropriation of firm resources (Jensen and Meckling 1976). Increased power by long-tenured CEOs and those that are also Chairs exacerbate the likelihood of wealth expropriation (Adams et al. 2005; Koo 2015). These aspects are described by the managerial discretion theory (Hambrick 2007) that explain managers flexibility to influence corporate policies, in where a dominant CEO might limit independent judgement from directors (Haynes and Hillman 2010). Powerful CEOs might also influence CFOs behaviour towards accounting manipulation (Feng et al. 2011; Laux and Laux 2009) and financial misconduct (Altunbaş et al. 2018; Adams et al. 2005; Feng et al. 2011), especially when rewards are linked to stock price increases. By contrast, the bargaining ability of powerful CEOs benefit corporations in gaining investment opportunities against competitors, leading to increased firms' value (Tanikawa and Jung 2019).

CEOs negative actions that arise from excessive power could be alleviated by effective board monitoring (Fama and Jensen 1983; Combs et al. 2007), enhanced by both independence (Altunbaş et al. 2018) and gender diversity of the board (Adams and Ferreira 2009; Srinidhi et al. 2011; Cumming et al. 2015). The merge of both factors emphasizes the importance of disentangling the role of female directors (i.e., as independent) to study the factual potential of their impact on decision making. The conditions on both environment and role (i.e., independent) in which a female director contributes to decision making are critical factors under which gender differences might materialise (Schopohl et al. 2020). Therefore, since independent female directors are an important factor to reinforce boards' effectiveness (Poletti-Hughes and Briano-Turrent 2019), they might be efficient moderators to CEOs actions that increase the likelihood of financial fraud, especially concerning to efficient monitoring (Usman et al. 2018). The above discussion leads to the following hypothesis:

Hypothesis H4 (H4). *Independent female directors inversely moderate the effect of CEO power on financial fraud.*

3. Research Methodology

3.1. Data and Sample Selection

The collection of fraud data took place up to the second quarter of 2018, which allowed to obtain information of definite filed fraud cases to 2015 (as it takes time for a potential fraud case to be filed as an actual case). Therefore, the period of analysis is from 2000 to 2015. The sample data includes all publicly listed non-financial US firms with complete information available from the Compustat database. This data is matched with directors' information from BoardEx.

Fraud data were obtained from two sources. First, we used the Accounting Auditing Enforcement Release (AAERs) from the SEC website, which includes the most relevant cases that breached GAAP principles, providing a comprehensive source for publicly listed firms (Beasley et al. 2000). The second source is the Stanford Law School's Securities Class Action Clearinghouse (SSCAC), which includes private and publicly listed companies. The sample of fraud firms excludes ongoing cases (as the final outcome is still uncertain) and those dismissed by the courts (Kuang and Lee 2017) and totals 346 firms—149 firms from AAERs and 197 firms from SSCAC, with a total of 737 cases of fraud among them. In some instances, fraud was explicitly noted in both AAERs and SSCAC, whereas other firms were identified as violating rule 10(b)-5 of the SEC Act of 1934, which defines an evident intent to deceive by altering financial figures of material fact on firms' financial position (Beasley et al. 2000; Fich and Shivdasani 2007). In this instance, fraud is defined as a failure to disclose material information, embezzlement, aggressively inflated revenues/expenses, earning manipulation, recognising fictitious transactions and misappropriation of assets (Beasley 1996; Kim et al. 2013). Following Abbott et al. (2000) the sample of fraud firms does not include sanctions unrelated to financial reporting such as allegation of fraud against external auditors. The final sample including non-fraud firms totals 2008 firms and

19,301 firm-year observations. All financial variables have been winsorised at the 1% and 99% levels in order to deal with outliers (Bharath and Shumway 2008).

3.2. Research Model and Variables Measurement

It is determined that fraud is a function of several factors that include the key variables of analysis, as follows:

$$\Pr(\text{Fraud}) = f(\text{independent-female directors}, \text{Independent female directors demographics}, \\ \text{independent female directors} * \text{powerful CEO}, \text{control variables})$$

In the logistic regression, fraud is the dependent variable taking the value of one if firms committed fraud and zero otherwise (Beasley 1996; Kim et al. 2013). The regression coefficients indicate the relationship between each explanatory variable (X_i) and fraud (outcome/ Y). Marginal effects are presented in most tables to represent the instantaneous rate of change as a good approximation to the amount of change in the likelihood of fraud that will be produced by a unit change in the explanatory variables (Cumming et al. 2015).

We measure the ratio of both female and independent female directors to board size (Gull et al. 2018). Additionally, for the base analysis, we present regressions with a count variable, rather than a ratio—as variation in the ratio does not necessarily convey variation in the number of women on the board.

Independent female directors' demographics are experience, financial expertise, audit committee membership and financial expertise on the audit committee.

Experience is an index that ranges from 0 to 3, being 3 considered as the greatest level of experience. This index is the sum of three characteristics (variables) of independent female directors: age, tenure, and previous board seats. Each of these variables are set to one if their value is higher than the median value of the independent female directors' characteristics. High experience is a ratio of independent female directors with an experience index ≥ 2 to total board size. Low experience is a ratio of independent female directors with an experience index < 2 to total board size.

Financial expertise is the ratio of independent female directors with a CPA or MBA to total board size.

Ind fem on AC is the ratio of independent female directors on the audit committee to total members of the audit committee (Sun et al. 2011; Gull et al. 2018). Fin expertise on AC is the ratio of independent female directors in the audit committee with a CPA or MBA to audit committee size.

A powerful CEO is measured with a dummy variable defined with two proxies. First, CEO power 1 is set to one when there are both CEO-chair duality and a CEO's tenure larger than the sample median (Lewellyn and Muller-Kahle 2012), and zero otherwise. Tenure represents expertise because of knowledge gains regarding firms' activities and networks developed with key stakeholders through time; whereas CEO-chair duality reflects the corporate structure that pertains power. Second, following Xu et al. (2018), CEO power 2 considers age as a further characteristic, and is set as a dummy variable that equals one when: (i) CEO/Chair duality and (ii) tenure $>$ the sample median, and (iii) the differential of the average age of board members to that of the CEO is larger than the sample median, and zero otherwise.

Control variables concerning board characteristics include board size, board independence, CEO duality (except in models with powerful CEOs) and service from the Big4 auditors (Kuang and Lee 2017; Liao et al. 2019). Board size is the natural logarithm of the number of board directors. Board independence is a ratio of independent directors to all board directors. Board size and independence have been associated with board monitoring effectiveness, negatively and positively, respectively (Raheja 2005). CEO duality is a dummy variable that equals one when the CEO also serves as Chair. CEO's duality increases CEO power, which in turn reduces boards' supervisory activities (Tuggle et al. 2010). The Big4 auditors is a dummy variable that equals one when the firms are audited by one

of the Big4 audit firms (Deloitte, PwC, KPMG or Ernst & Young) and zero otherwise (Kuang and Lee 2017).

Control variables concerning financial information include firms' size, Loss, leverage, market to book ratio and ROA.

ROA is the net income over total assets. Size is the natural logarithm of total assets. Loss equals one when a firm reports a Loss, and zero otherwise. Leverage is the ratio of total liabilities to total assets. Market to book is the ratio of firms' market value to book value of equity. As has been noted in previous literature the higher the value of the variables (except ROA) the greater is the incentive for managers to meet analysts' forecasts via means of earnings manipulation, which might well lead to financial fraud (Ye et al. 2010; Srinidhi et al. 2011; Arun et al. 2015). By contrast, low ROA signals poor profitability, which increases the likelihood of engaging in earnings manipulation and lower standards of accounting quality that could lead to fraud (Lara et al. 2017).

4. Empirical Results

4.1. Descriptive Statistics

Table 1 presents the distribution of firms by year. The number of observations in the fraud cohort is 737 (4% of the total sample). Table 2 presents the number of fraud cases by industry, which as in Kuang and Lee (2017), occurred most frequently in business services, electronic and other electrical equipment manufactures and chemical and allied industries. Table 3 presents t-tests for mean differences between fraud and non-fraud firms. Fraud firms have more cases of CEO duality, Big4 auditing and Loss, and also have higher market to book ratios; whereas they present lower levels of board independence, with less independent female directors.

Experience and expertise of independent female directors is greater in the non-fraud cohort, as is the proportion of female directors in the audit committee and their expertise.

Table 1. Firms distribution by years for fraud and non-fraud cases.

Year	Total Sample	Fraud	Non-Fraud
2000	455	62	393
2001	581	71	510
2002	610	64	546
2003	1143	100	1043
2004	1399	92	1307
2005	1509	78	1431
2006	1559	46	1513
2007	1553	42	1511
2008	1464	29	1435
2009	1400	29	1371
2010	1375	31	1344
2011	1358	33	1325
2012	1291	22	1269
2013	1287	19	1268
2014	1202	17	1185
2015	1115	2	1113
Total	19,301	737	18,564

Table 2. Firms distribution by industry codes for fraud and non-fraud firms.

Industry Name Based on Two-Digit Standard Industrial Classification (SIC)	No. Obs.	%	Fraud = 0	Fraud = 1	
10	Metal Mining	140	0.73	138	2
12	Coal mining	84	0.44	82	2
13	Oil and gas extraction	934	4.84	929	5
15	Building construction—general contractors	232	1.20	222	10
16	Water, Sewer, Pipeline Construction	90	0.47	88	2
17	Construction-Special Trade	63	0.33	59	4
20	Food and kindred products manufacturers	544	2.82	520	24
23	Apparel and other finished products manufacturers	208	1.08	203	5
27	Printing publishing and allied industries	209	1.08	205	4
28	Chemicals and allied products manufacturers	2223	11.52	2135	88
30	Rubber and miscellaneous plastics manufacturers	212	1.10	210	2
32	Stone clay glass and concrete products manufacturers	89	0.46	88	1
33	Primary metal industries manufacturers	232	1.20	229	3
34	Fabricated metal products manufacturers	369	1.91	365	4
35	Industrial and commercial machinery manufacturers	1345	6.97	1277	68
36	Electronic and other electrical equipment manufacturers	2121	10.99	2005	116
37	Transportation equipment manufacturers	549	2.84	533	16
38	Measuring and analysing instruments manufacturers	1466	7.60	1420	46
39	Miscellaneous manufacturing	174	0.90	171	3
42	Motor freight transportation	176	0.91	175	1
44	Water transportation	89	0.46	86	3
45	Transportation by air	153	0.79	149	4
48	Communications	433	2.24	419	14
49	Electric gas and sanitary services	311	1.61	302	9
50	Wholesale trade—durable goods	465	2.41	456	9
51	Wholesale trade—non-durable goods	392	2.03	375	17
53	General merchandise stores	144	0.75	133	11
54	Food stores	122	0.63	117	5
55	Automotive dealers and service stations	200	1.04	194	6
56	Apparel and accessory stores	335	1.74	329	6
57	Home furniture and furnishings stores	68	0.35	67	1
58	Eating and drinking places	251	1.30	244	7
59	Miscellaneous retail	364	1.89	348	16
67	Oil Royalty Traders	592	3.07	578	14
72	Personal services	51	0.26	46	5
73	Business services	2375	12.31	2232	143
75	Auto Rent and Lease, No Drivers	69	0.36	67	2
78	Motion pictures	54	0.28	53	1
79	Amusement and recreation services	266	1.38	264	2
80	Health services	410	2.12	395	15
82	Educational services	57	0.30	55	2
83	Child Day Care Services	36	0.19	30	6
87	Engineering and accounting and management services	446	2.31	432	14
99	Non-classifiable establishments	158	0.82	139	19
	Total	19,301	100%	18,564	737

Table 4 presents a correlation matrix of all explanatory variables. The largest correlations between key and control variables included in the same model are highlighted in bold. There are two instances in where the correlation coefficient is large (for Loss and ROA, and firm size and BS, with -0.65 and 0.62 , respectively). The VIF values to test for multicollinearity were less than 10, suggesting that there are no concerns to this regard.

Table 3. *t*-Tests for mean differences between fraud and non-fraud cases.

Variables	Full Sample		Fraud		Non-Fraud		<i>t</i> -Test Diff
	19,301		737		18,564		
No. of Observations	(1)	(2)	(3)	(4)	(5)	(6)	(5)-(3)
	Mean	SD	Mean	SD	Mean	SD	
Key variables							
Female proportion	0.085	0.100	0.075	0.098	0.085	0.100	0.011 ***
Ind fem	0.071	0.090	0.057	0.081	0.071	0.090	0.014 ***
Inside fem	0.014	0.046	0.017	0.061	0.014	0.045	−0.003 *
High Experience	0.031	0.062	0.021	0.051	0.031	0.063	0.010 ***
Low Experience	0.039	0.067	0.035	0.063	0.039	0.067	0.0039 *
Fin expertise	0.027	0.057	0.017	0.045	0.027	0.057	0.010 ***
Non-fin expertise	0.043	0.070	0.039	0.069	0.043	0.070	0.003
Ind fem on AC	0.090	0.154	0.068	0.137	0.090	0.155	0.022 ***
Fin expertise on AC	0.042	0.110	0.024	0.080	0.043	0.111	0.018 ***
Non-fin expertise on AC	0.046	0.113	0.044	0.109	0.046	0.113	0.002
CEO power 1	0.360	0.480	0.345	0.475	0.361	0.480	0.015
CEO power 2	0.457	0.498	0.466	0.499	0.457	0.498	−0.008
Control variables							
ROA	−0.016	0.208	−0.059	0.252	−0.016	0.206	0.043 ***
Firm Size	13.118	2.007	13.484	1.875	13.103	2.011	−0.381 ***
Leverage	0.460	0.223	0.465	0.245	0.460	0.222	−0.006
Market/Book	0.436	1.334	0.778	1.959	0.422	1.301	−0.356 ***
Loss	0.305	0.460	0.383	0.487	0.302	0.459	−0.082 ***
Big4	0.747	0.435	0.822	0.383	0.744	0.436	−0.078 ***
CEO/Chair duality	0.604	0.489	0.709	0.454	0.600	0.490	−0.110 ***
BS	8.071	2.251	8.205	2.597	8.066	2.236	−0.140 *
BI	0.727	0.149	0.665	0.177	0.729	0.147	0.064 ***

*** $p < 0.01$, * $p < 0.10$.

Table 4. Correlation matrix.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
1 Fem																				
2 Ind fem	0.89 *																			
3 Inside fem	0.44 *	−0.01																		
4 High Experience	0.58 *	0.66 *	−0.01																	
5 Low Experience	0.63 *	0.71 *	−0.01	−0.05 *																
6 Fin expertise	0.54 *	0.61 *	−0.01	0.32 *	0.50 *															
7 Non-fin expertise	0.68 *	0.77 *	−0.01	0.57 *	0.49 *	−0.03 *														
8 Ind fem on AC	0.65 *	0.72 *	0.01	0.46 *	0.52 *	0.53 *	0.48 *													
9 Fin expertise on AC	0.43 *	0.48 *	−0.01	0.24 *	0.41 *	0.79 *	−0.02 *	0.66 *												
10 Non-fin exp on AC	0.45 *	0.50 *	0.01	0.38 *	0.31 *	−0.04 *	0.67 *	0.69 *	−0.04 *											
11 ROA	0.09 *	0.08 *	0.03 *	0.08 *	0.03 *	0.04 *	0.07 *	0.06 *	0.02 *	0.05 *										
12 Firm Size	0.31 *	0.36 *	−0.01	0.34 *	0.15 *	0.20 *	0.29 *	0.24 *	0.15 *	0.17 *	0.35 *									
13 Leverage	0.14 *	0.17 *	−0.01	0.17 *	0.06 *	0.11 *	0.12 *	0.11 *	0.09 *	0.06 *	−0.01	0.41 *								
14 Market/Book	0.22 *	0.24 *	0.02 *	0.25 *	0.08 *	0.09 *	0.22 *	0.13 *	0.05 *	0.12 *	0.04 *	0.38 *	0.19 *							
15 Loss	−0.10 *	−0.10 *	−0.03 *	−0.09 *	−0.04 *	−0.04 *	−0.08 *	−0.06 *	−0.03 *	−0.05 *	−0.65 *	−0.33 *	−0.02 *	−0.06 *						
16 BS	0.32 *	0.34 *	0.02 *	0.30 *	0.17 *	0.18 *	0.28 *	0.23 *	0.15 *	0.15 *	0.14 *	0.62 *	0.30 *	0.33 *	−0.18 *					
17 BI	0.17 *	0.29 *	−0.21 *	0.24 *	0.16 *	0.20 *	0.20 *	0.13 *	0.13 *	0.05 *	0.01	0.19 *	0.08 *	0.08 *	−0.01	0.12 *				
18 CEO/Chair duality	0.02 *	0.02 *	0.01	0.03 *	−0.00	−0.01	0.04 *	0.01	−0.02 *	0.04 *	0.12 *	0.14 *	0.06 *	0.07 *	−0.12 *	0.07 *	−0.12 *			
19 Big4	0.18 *	0.21 *	−0.02 *	0.18 *	0.11 *	0.14 *	0.15 *	0.16 *	0.11 *	0.10 *	0.13 *	0.51 *	0.17 *	0.12 *	−0.14 *	0.33 *	0.16 *	0.04 *		
20 CEO power 1	−0.01	−0.01	0.01	0.02 *	−0.04 *	−0.02 *	−0.01	−0.02 *	−0.03 *	0.01	0.14 *	0.08 *	0.01 *	0.03 *	−0.15 *	0.01	−0.07 *	0.73 *	0.02 *	
21 CEO power 2	−0.02 *	−0.03 *	0.01 *	−0.01	−0.03 *	−0.03 *	−0.01	−0.02 *	−0.03 *	0.01	0.11 *	0.01 *	0.01	0.01	−0.11 *	−0.02 *	−0.14 *	0.66 *	−0.01	0.88 *

This table presents pairwise correlations among explanatory variables. See Appendix A for variable definitions. * Denotes significance at the 5% level.

4.2. Financial Fraud and Independent Female Directors

Tables 5–8 present the marginal effects of the logit regressions with random effects (following Cumming et al. 2015). Table 5 examines the association between female directors and financial fraud. Columns (1) and (2) shows that the probability of fraud decreases with the increase in female directors on the board. This result is consistent with previous literature regarding corporate fraud (Kim et al. 2013; Cumming et al. 2015; Capezio and Mavisakalyan 2016). Board independence also appears to have a negative influence on fraud based on the value of the marginal effect (−0.098). Similar results were noted by Beasley (1996) and Uzun et al. (2004), emphasising the importance of effective monitoring of independent directors over the activities of a firm’s board of directors, which in turn contribute to a lower likelihood of fraud. To examine this effect further, we first construct an interaction between the proportion of female directors and board independence and second, we use the ratio Ind fem (Columns 3 to 6). We find support for H1 in column (6), which presents a significant and negative marginal effect for independent female directors [a decrease in fraud of 0.95% (9%*−0.106)], whereas the estimator for inside female directors is not significant.

We find that firm’s size, Market/Book and CEO’s duality increase significantly the likelihood of fraud, whereas ROA reduces fraud significantly (as in Lara et al. 2017). The results of control variables are consistent in all models.

Table 5. Financial fraud and female directors (marginal effects).

Variables	(1)	(2)	(3)	(4)	(5)	(6)
N fem	−0.005 * (0.002)					
Fem		−0.051 ** (0.025)				
BI	−0.098 *** (0.015)	−0.098 *** (0.015)	−0.092 *** (0.016)			
Fem * BI			−0.068 ** (0.034)			
N ind fem				−0.011 *** (0.003)		
Ind fem					−0.105 *** (0.032)	−0.106 *** (0.031)
Inside fem						−0.001 (0.050)
Board Size	−0.006 (0.010)	−0.008 (0.009)	−0.008 (0.009)	−0.001 (0.010)	−0.005 (0.009)	−0.005 (0.009)
Loss	0.001 (0.004)	0.001 (0.004)	0.001 (0.004)	0.001 (0.004)	0.001 (0.004)	0.001 (0.004)
Leverage	−0.008 (0.011)	−0.008 (0.011)	−0.008 (0.011)	−0.010 (0.011)	−0.010 (0.011)	−0.010 (0.011)
Firm Size	0.012 *** (0.002)	0.012 *** (0.002)	0.012 *** (0.002)	0.011 *** (0.002)	0.011 *** (0.002)	0.011 *** (0.002)
ROA	−0.039 *** (0.010)	−0.039 *** (0.010)	−0.039 *** (0.010)	−0.039 *** (0.010)	−0.039 *** (0.010)	−0.039 *** (0.010)
Market/Book	0.002 * (0.001)	0.002 * (0.001)	0.002 * (0.001)	0.002 ** (0.001)	0.002 ** (0.001)	0.002 * (0.001)
Big4	0.005 (0.006)	0.005 (0.006)	0.005 (0.006)	0.002 (0.006)	0.003 (0.006)	0.003 (0.006)
CEO/Chair duality	0.021 *** (0.005)	0.021 *** (0.005)	0.021 *** (0.005)	0.023 *** (0.005)	0.023 *** (0.005)	0.023 *** (0.005)
Observations	19,301	19,301	19,301	19,301	19,301	19,301
Log pseudolikelihood	−2274.09	−2273.26	−2273.56	−2309.58	−2308.32	−2308.32
Wald chi2 (p-value)	0.000	0.000	0.000	0.000	0.000	0.000

This table shows the marginal effects of female directors on fraud using a logistic regression for panel data with random effects. Definitions for all variables are in Appendix A. Year and industry dummies are included in all models. Robust standard errors clustered by firm in parentheses *** p < 0.01, ** p < 0.05, * p < 0.10.

4.3. Financial Fraud and the Characteristics of Independent Female Directors

Table 6 tests H2a to H3b. Column (1) presents a negative and significant estimator for both high and low experience of the independent female directors on fraud. In support of H2a, we find that a greater impact for high than for low experience of independent female directors [1.0% (6.2%*−0.162) vs. 0.5% (6.7%*−0.079), respectively]. We also find support for H2b (column 2) that tests whether the increase in financial expertise of independent female directors influence the decrease on fraud. The result shows that there is a significant negative association between independent female directors with financial qualifications and fraud, while a no significant association is presented when independent female directors lack of financial expertise. This finding suggests that the sole presence of female directors on boards of directors is not enough in lowering the probability of fraud, but companies with female directors who have financial background are key towards achieving this aim.

Table 6. Independent female directors characteristics and their effect on financial fraud (marginal effects).

Variables	Experience	Financial Expertise	On Audit committee	
			Proportion	Financial Expertise
	(1)	(2)	(3)	(4)
High experience	−0.162 *** (0.044)			
Low experience	−0.079 ** (0.036)			
Fin expertise		−0.183 *** (0.049)		
Non-fin expertise		−0.058 (0.038)		
Ind fem on AC			−0.024 * (0.016)	
Fin expertise on AC				−0.053 ** (0.023)
Non-fin expertise on AC				0.006 (0.020)
BS	−0.006 (0.009)	−0.005 (0.009)	−0.008 (0.009)	−0.007 (0.009)
Loss	0.001 (0.004)	0.000 (0.004)	0.001 (0.004)	0.000 (0.004)
Leverage	−0.008 (0.011)	−0.008 (0.011)	−0.011 (0.011)	−0.009 (0.011)
Firm Size	0.012 *** (0.002)	0.011 *** (0.002)	0.010 *** (0.002)	0.010 *** (0.002)
ROA	−0.037 *** (0.010)	−0.037 *** (0.010)	−0.038 *** (0.010)	−0.036 *** (0.010)
Market/Book	0.002 ** (0.001)	0.002 ** (0.001)	0.002 (0.001)	0.002 * (0.001)
Big4	0.002 (0.006)	0.002 (0.006)	0.002 (0.006)	0.001 (0.006)
CEO/Chair duality	0.024 *** (0.005)	0.024 *** (0.005)	0.024 *** (0.005)	0.024 *** (0.005)
Observations	19,301	19,301	19,301	19,301
Log pseudolikelihood	−2318.68	−2317.25	−2312.61	−2327.79
Wald chi2 (p-value)	0.000	0.000	0.000	0.000

This table presents the marginal effects of the characteristics of female directors on fraud commission using a logistic regression for panel data with random effects. Definitions for all variables are in Appendix A. Year and industry dummies are included in all models. Robust standard errors clustered by firm in parentheses *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$.

Column (3) presents findings in support of H3a, where there is a negative and significant association between the ratio of female directors in the audit committee and fraud.

As SOX requires that audit committees should include at least one member with financial expertise, we examine whether the expertise of the independent female directors on the audit committee would influence fraud (column 4). We distinguish independent female directors with and without financial qualifications, and find that only independent directors in the audit committee with financial expertise significantly decrease the probability of fraud in support of H3b. This result indicates that one unit increase in the standard deviation of financial expertise on the audit committee decreases the likelihood of fraud by 0.583% (11.0%*−0.053). We further construct a proxy for financial expertise with data from the Institutional Shareholder Services (ISS), which provides financial expertise data on the audit committee that is consistent with SEC/SOX definitions (Zalata et al. 2018). Results (unreported) remain consistent.

4.4. Financial Fraud, Independent Female Directors and CEO Power

Table 7 presents the marginal effects of the mediating effect of independent female directors on CEOs power to influence the likelihood of fraud. First, we observe that CEO power (columns 1 and 3) is positively associated with the probability of fraud. In columns 2 and 4 the results of the interaction of CEO power and the independent female ratio present support for H4. Independent female directors moderate the actions from powerful CEOs that increase the probability of fraud. We find that the marginal effects of the interaction term, using CEO power 1 and CEO power 2, are reductions on the likelihood of fraud. These findings suggest that board effectiveness rises with independent female directors (Poletti-Hughes and Briano-Turrent 2019), possibly because independent-female directors provide an unbiased perspective that enhances the provision of monitoring and advisory activities (Terjesen et al. 2016).

Table 7. The moderating effect of independent female directors on CEOs power and financial fraud (marginal effects).

Variables	CEO Power 1		CEO Power 2	
	(1)	(2)	(3)	(4)
CEO power	0.006 ** (0.003)	0.012 ** (0.005)	0.009 ** (0.004)	0.014 *** (0.004)
Ind fem		−0.100 *** (0.036)		−0.083 *** (0.027)
CEO power * Ind fem		−0.088 * (0.051)		−0.064 * (0.035)
BS	−0.009 (0.008)	−0.006 (0.010)	−0.009 (0.010)	−0.006 (0.008)
Loss	0.002 (0.001)	0.002 (0.001)	0.002 (0.001)	0.002 (0.001)
Leverage	0.010 (0.001)	0.011 (0.002)	0.010 (0.002)	0.012 (0.001)
Firm Size	−0.011 *** (0.009)	−0.010 *** (0.011)	−0.010 *** (0.011)	−0.009 *** (0.009)
ROA	−0.001 *** (0.004)	−0.001 *** (0.004)	−0.001 *** (0.004)	−0.001 *** (0.004)
Market/Book	−0.046 * (0.009)	−0.048 ** (0.010)	−0.046 * (0.010)	−0.047 ** (0.009)
Big4	0.002 (0.005)	0.003 (0.006)	−0.001 (0.006)	0.001 (0.005)
Observations	18,473	18,473	18,473	18,473
Log pseudolikelihood	−2283.93	−2284.0404	−2269.7019	−2256.2757
Wald chi2 (p-value)	0.000	0.000	0.000	0.000

This table presents the marginal effects of the characteristics of female directors on fraud commission using a logistic regression for panel data with random effects. Definitions for all variables are in Appendix A. Year and industry dummies are included in all models. Robust standard errors clustered by firm in parentheses *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$.

To investigate further, Table 8 presents the results of subsampled data categorising groups for firms with powerful and weak CEOs (based on the median of the calculated index), respectively. We find that the marginal effect of independent female directors is larger in decreasing the likelihood of fraud in columns 1 and 3 for the groups of powerful CEOs (−0.194 and −0.177, respectively).

Table 8. Independent female directors and fraud: Subsamples according to CEO power—i.e., more power vs. less power (marginal effects).

Variables	CEO Power 1		CEO Power 2	
	More Power	Less Power	More Power	Less Power
	(1)	(2)	(3)	(4)
Ind fem	−0.194 *** (0.068)	−0.087 *** (0.033)	−0.177 *** (0.040)	−0.076 *** (0.030)
BS	−0.005 (0.017)	−0.012 (0.011)	0.004 (0.013)	−0.016 (0.010)
Loss	0.008 (0.006)	−0.004 (0.005)	0.010 * (0.006)	−0.005 (0.005)
Leverage	0.022 (0.019)	−0.016 (0.012)	0.022 (0.015)	−0.027 ** (0.011)
Firm Size	0.011 *** (0.003)	0.011 *** (0.002)	0.010 *** (0.002)	0.012 *** (0.002)
ROA	−0.019 (0.019)	−0.054 *** (0.011)	−0.032 ** (0.015)	−0.051 *** (0.011)
Market/Book	0.002 (0.001)	0.002 ** (0.001)	0.003 (0.001)	0.002 (0.001)
Big4	0.010 (0.010)	−0.004 (0.006)	0.005 (0.008)	−0.004 (0.006)
Observations	6035	12,337	7970	10,464
Log pseudolikelihood	−693.02511	−1572.5714	−986.450	−1285.773
Wald chi2 (p value)	0.000	0.000	0.000	0.000

This table presents the marginal effects of the characteristics of female directors on fraud commission using a logistic regression for panel data with random effects. Definitions for all variables are in Appendix A. Year and industry dummies are included in all models. Robust standard errors clustered by firm in parentheses *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$.

5. Further Analysis

5.1. Two Stages Least Square (Heckman Correction)

The corporate finance literature notes that the relationship between female directors and firm outcomes is endogenous because of reverse causality/simultaneity (Srinidhi et al. 2011; Gull et al. 2018; Zalata et al. 2018). The proportion of female directors on boards is an endogenous variable because it depends on firm and contracting environment characteristics, and some of these characteristics may drive the likelihood of fraud. Inferences from our previous models may be biased because the potential self-selection problem that arises from the predictability of the number of female directors on boards. We address such concern by applying a two-stage least squares/Heckman correction.

In the first stage (Table 9), we modelled with a probit regression for the inclusion of female directors on boards. In particular, we regress a dummy variable that equals one when a firm has at least one female or one independent-female director on the board (columns 1 and 2, respectively). The explanatory variables are the same control variables that we used previously and include the female industry ratio as an instrumental variable (Liu et al. 2014). Herein, the Mills ratio is computed from the parameters of the first stage and is used as an exogenous variable in a linear probability model for the second stage regressions to control for selection bias. In this stage board size was removed from the regression to avoid a multicollinearity problem between board size and the Mills ratio (correlation of 0.67). Models from Tables 5–7 are replicated in Table 10 confirming that our previous results are not affected by the endogenous relationship.

Table 9. Independent female directors and fraud. Heckman correction (first stage).

Variables	Fem	Ind Fem
	(1)	(2)
Female industry ratio	1.902 *** (0.363)	2.027 *** (0.327)
ROA	0.053 (0.068)	0.005 (0.071)
Firm size	0.067 *** (0.008)	0.089 *** (0.009)
CEO/Chair duality	0.044 ** (0.021)	0.019 (0.022)
Market/Book	0.134 *** (0.0156)	0.098 *** (0.012)
Big4	0.097 *** (0.028)	0.167 *** (0.029)
Leverage	0.040 (0.050)	0.019 (0.052)
BS	1.906 *** (0.050)	1.837 *** (0.051)
Loss	−0.040 (0.029)	0.014 (0.030)
BI	1.082 *** (0.079)	2.362 *** (0.082)
Constant	−5.895 *** (0.136)	−7.207 *** (0.142)
Observations	19,301	19,301
Pseudo R ²	0.200	0.241
LR Statistic	5373.80	6425.97
p value	0.000	0.000

This table shows a probit estimation of female directors’ participation on the board. *Definitions of all variables are in Appendix A.* Year and industry dummies are included in all models. Robust standard errors in parentheses *** $p < 0.01$, ** $p < 0.05$.

Table 10. Independent female directors and financial fraud. Heckman correction (second stage).

	Panel (A) Proportion of Independent Female Directors			
	All Female		Independent Female	
	(1)	(2)	(3)	(4)
Fem	−0.069 ** (0.030)			
BI	−0.155 *** (0.022)	−0.148 *** (0.022)		
Fem * BI		−0.087 ** (0.037)		
Ind fem			−0.135 *** (0.034)	−0.134 *** (0.034)
Inside fem				0.010 (0.079)
Mills ratio	−0.037 *** (0.011)	−0.037 *** (0.011)	0.040 *** (0.011)	0.040 *** (0.011)
Constant	−0.043 (0.030)	−0.048 (0.030)	−0.205 *** (0.044)	−0.206 *** (0.044)
Observations	19,301	19,301	19,301	19,301
Adj. R ²	0.035	0.035	0.026	0.026

Table 10. Cont.

Panel (B) Characteristics of Independent Female Directors				
	Experience	Expertise	On Audit Committee	
	(1)	(2)	(3)	(4)
High Experience	−0.140 *** (0.032)			
Low Experience	−0.060 * (0.031)			
Fin expertise		−0.122 *** (0.033)		
Non-fin expertise		−0.075 ** (0.033)		
Ind fem on AC			−0.037 ** (0.017)	
Fin expertise on AC				−0.049 *** (0.014)
Non-fin expertise on AC				−0.030 * (0.018)
Mills ratio	0.028 *** (0.009)	0.028 *** (0.009)	0.042 *** (0.010)	0.030 *** (0.009)
Constant	−0.202 *** (0.038)	−0.197 *** (0.0378)	−0.205 *** (0.044)	−0.196 *** (0.038)
Observations	19,301	19,301	19,301	19,301
Adj. R ²	0.037	0.037	0.025	0.036
Panel (C) Independent Female Directors as Moderators of CEO power				
	CEO Power 1		CEO Power 2	
	(1)	(2)	(3)	(4)
CEO power	0.010 ** (0.005)	0.018 *** (0.006)	0.012*** (0.004)	0.019 *** (0.005)
Ind fem		−0.109 *** (0.038)		−0.108 *** (0.040)
CEO power * Ind fem		−0.103 ** (0.050)		−0.079 * (0.045)
Mills ratio	0.050 *** (0.010)	0.044 *** (0.010)	0.049 *** (0.010)	0.044 *** (0.010)
Constant	−0.223 *** (0.044)	−0.224 *** (0.044)	−0.224 *** (0.044)	−0.226 *** (0.044)
Observations	18,527	18,527	18,526	18,526
Adj. R ²	0.020	0.023	0.021	0.023

This table presents regressions of a linear probability model where a change in the probability of fraud is associated with a unit change in the explanatory variables. Definitions for all variables are in Appendix A. Year, industry dummies and other control variables are included in all models (unreported). Robust standard errors in parentheses *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$.

5.2. Propensity Score Matching

Following Kuang and Lee (2017), we test whether the non-randomness in fraud incidents affects our previous findings. We construct a subsample that includes all firms that had committed fraud on a given year and match such sample with a cohort of control firms using propensity score matching. The selection of controls was performed using a probit model with variables that include firm size, market to book and ROA, and adjusted by stock exchange and two-digit industry dummies (Beasley 1996; Kim et al. 2013). Next, we form a matched sample that includes firms with high predicted probabilities of fraud above the median of the sample based on the previous estimates (Kuang and Lee 2017) and subsequently include all corresponding time periods. Therefore, the total sample after p-score matching is 10,611 firm-year observations. We replicate prior analyses from Tables 5–7 and the results summarized in Table 11 remain consistent with our findings.

Table 11. Independent female directors and financial fraud. (p-score matching).

Panel (A) Proportion of Independent Female Directors				
	(1)	(2)	(3)	(4)
Fem	−2.621 ** (1.043)			
BI	−2.804 *** (0.637)	−2.580 *** (0.662)		
Fem * BI		−3.248 ** (1.439)		
Ind fem			−4.045 *** (1.345)	−4.195 *** (1.297)
Inside fem				−1.544 (1.908)
constant	−9.592 *** (1.270)	−9.709 *** (1.284)	−10.65 *** (1.298)	−10.64 *** (1.297)
Observations	10,611	10,611	10,611	10,611
Log pseudolikelihood	−1779.237	−1779.967	−1797.375	−1796.836
Wald chi2 (p-value)	0.000	0.000	0.000	0.000
Panel (B) Characteristics of Independent Female Directors				
	Experience	Expertise	On Audit Committee	
	(1)	(2)	(3)	(4)
High Experience	−5.729 *** (1.619)			
Low Experience	−2.961 ** (1.440)			
Fin expertise		−6.846 *** (1.942)		
Non-fin expertise		−2.199 (1.522)		
Ind fem on AC			−1.196 * (0.650)	
Fin expertise on AC				−1.972 ** (0.915)
Non-fin expertise on AC				−0.132 (0.798)
constant	−10.52 *** (1.225)	−10.35 *** (1.215)	−10.07 *** (1.268)	−9.775 *** (1.191)
Observations	10,611	10,611	10,611	10,611
Log pseudolikelihood	−1777.988	−1776.238	−1804.104	−1785.941
Wald chi2 (p-value)	0.000	0.000	0.000	0.000
Panel (C) Independent Female Directors as Moderators of CEO Power				
	CEO Power 1		CEO Power 2	
	(1)	(2)	(3)	(4)
CEO power	0.161 * (0.137)	0.377 ** (0.174)	0.307 ** (0.127)	0.512 *** (0.165)
Ind fem		−3.591 *** (1.023)		−3.392 *** (1.092)
CEO power * Ind fem		−3.421 ** (1.543)		−2.818 ** (1.384)
constant	−9.396 *** (1.127)	−10.39 *** (1.152)	−9.545 *** (1.134)	−10.54 *** (1.157)
Observations	10,256	10,256	10,255	10,255
Log pseudolikelihood	−1804.313	−1788.745	−1802.071	−1786.845
Wald chi2 (p-value)	0.000	0.000	0.000	0.000

This table presents logistic regressions for panel data with random effects. Definitions for all variables are in Appendix A. Year, industry dummies and other control variables are included in all models. Robust standard errors clustered by firm in parentheses *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$.

6. Conclusions

This paper investigates the importance of gender diversity on decreasing the probability of financial fraud, by focusing on the role of female independent directors and their characteristics (i.e., experience and financial expertise). This analysis is extended to the role of female directors on the audit committee and to the moderating effect of independent female directors towards the actions of powerful CEOs with respect to fraud.

The main findings suggest that independent female directors (in both board of directors and audit committee) as their characteristics (i.e., age, tenure, external seats and financial expertise) play an important role in lowering financial fraud. More importantly, independent female directors moderate significantly the increased probability of fraud elicited by CEOs, especially in firms where CEOs are more powerful.

Our findings are robust to endogeneity concerns and the randomness of the fraud cases as verified by estimators calculated with the Heckman correction and p-score matching, respectively. The implication of our findings highlights the relevance of distinguishing the role of the female director (i.e., as independent), which rationalise both the monitoring and advisory functions in increasing board effectiveness, in comparison with inside female directors who do not decrease the likelihood of fraud significantly. In addition, the economic impact of a board with independent female directors on decreasing the likelihood of fraud highlights that among independent female directors, there is a spectrum of experience and expertise, in which older independent female directors with greater tenures and financial expertise have a larger impact in decreasing the likelihood of fraud.

These findings contribute to the understanding of not only gender differences in ethical corporate behaviour, but also the importance of the role of the appointment (i.e., independent director). We supplement the gender and management literature by providing evidence about the role of directors when gender diversity is considered and fraud. Our findings have implications for all company stakeholders to esteem the value of external appointments of female directors in achieving a gender-diverse board.

There are some limitations associated with this research. First, because of the availability of data, we were not able to distinguish independent directors from a strict perspective. That is, some of the independent directors in our data might have worked previously in the firm or have family ties with the corporation—grey directors. Second, further data regarding the independent female directors' characteristics, which could affect their monitoring, could enhance the findings of this paper (e.g., share options and social connections). These aspects might be relevant in this type of research and could be considered in future studies where such data is accessible.

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Appendix A

Table A1. Definition of Variables.

Dependent variable	
Fraud	It is a dummy variable that equals one if a firm was involved in: failure to disclose material information, embezzlement, aggressively inflated revenues/expenses, earning manipulation, recognising fictitious transaction and misappropriation of asset (Beasley 1996; Kim et al. 2013) and zero otherwise.
Explanatory variables	
Key variables	
Fem	Ratio of female directors to board size.
Ind fem	Ratio of independent-female directors to board size.
Inside fem	Ratio of executive-female directors to board size.
N fem	Number of female directors on the board
N ind fem	Number of independent-female directors on the board
CEO power1	Dummy variable that equals one when there is: (i) CEO/Chair duality and (ii) tenure > the sample median, and zero otherwise.
CEO power2	Dummy variable that equals one when: (i) CEO/Chair duality and (ii) tenure > the sample median, and (iii) the differential of the average age of board members to that of the CEO is larger than the sample median, and zero otherwise.
Independent female directors' characteristics	
Experience index	This index is the sum of the three variables below (calculated for independent female directors only). It ranges from 0 to 3, being 3 considered as the greatest level of experience: <ol style="list-style-type: none"> Age: Dummy variable that equals one when age is above the median. Tenure: Dummy variable that equals one when the number of years in the same board is above the median. Seats: Dummy variable that equals one when the quoted boards to date is above the median.
High Experience	Ratio of independent female directors with an experience index => 2 to total board size.
Low Experience	Ratio of independent female directors with an experience index < 2 to total board size.
Fin expertise	Ratio of independent female directors with a CPA or MBA to total board size.
Non-fin expertise	Ratio of independent female directors without financial expertise to total board size.
Ind fem on AC	Ratio of independent female directors on the audit committee to total audit committee size
Fin expertise on AC	Ratio of independent female directors in the audit committee with a CPA or MBA to audit committee size.
Non-fin expertise on AC	Ratio of independent female directors in the audit committee without a CPA or MBA to audit committee size.
Control variables	
BS Board size	Logarithm of the total number of board directors.
BI Board independence	Ratio of independent directors to board size.
CEO/Chair duality	A dummy that equals one when the CEO and Chair are the same person and zero otherwise.
ROA	Ratio of net income to total assets.
Loss	Financial loss: dummy variable that equals one if the net income is negative and zero otherwise.
Leverage	Ratio of total liabilities to total assets.
Firm Size	Logarithm of total assets.
Market to book	Ratio of firms' equity to book value.
Big4	Dummy that equals one if firms are audited by a big four auditing company and zero otherwise.
Instrumental variables	
Female industry ratio	Proportion of female directors in the same industry based on a two-digit code.
Mills ratio	Inverse Mills ratio computed from the first stage probit regression.

Note

- ¹ <https://www.pwc.com/gx/en/forensics/gecs-2020/pdf/global-economic-crime-and-fraud-survey-2020.pdf> (last accessed on 27 December 2021).

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