Gender Diversity and Financial Statement Fraud

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Abstract

This study investigates the role of gender diversity in fraud commission and detection with a view to identifying whether companies with more female corporate leaders are less likely to be involved in financial statement fraud. Using a bivariate probit model, the role of female corporate leaders in financial statement fraud commission and detection is examined for Chinese listed companies from 2007 to 2018. The representation of female corporate leaders increases the likelihood of fraud detection, thus reducing firms' propensity to engage in fraud. The finding confirms that women are risk averse and more committed to ethical practices than men in corporate leadership positions. Moreover, this impact of gender diversity is contingent upon the nature of ultimate controllers of listed companies: more female representation in top leadership roles can mitigate fraud commission or detect fraud effectively in non-state-owned enterprises, but not in state-owned enterprises. In addition, the recent anti-corruption campaign initiated by Chinese President Jinping Xi is a powerful form of public governance. Female corporate leaders play a more positive role in mitigating fraud commission and detecting fraud commission in the post-campaign period than in the pre-campaign period.

Keywords Gender diversity, Financial statement fraud, Bivariate probit model, Anti-corruption campaign, State-owned enterprises

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1. Introduction

Financial statement fraud has received wide attention from the public, the press and regulators. The high-profile scandals, such as Enron, Qwest and Lehman Brothers, triggered a decline in public trust in capital markets (Throckmorton et al., 2015). Being the world's second largest economy, China also had a series of financial statement fraud cases during the last decade, including Yin Guangxia, Ke Long, Lan Tian, and Liang Mianzhen, resulting in an unparalleled crisis of investors' confidence (Zhu and Gao, 2011). Now, financial statement fraud is a major concern for investors in China and the Chinese regulators face the severe challenge of addressing this misconduct.[1]

Prior studies on fraud focus extensively on the factors contributing to fraud commission or detection. For instance, a smaller board of directors is less effective at monitoring managers (Sun et al., 2010). Firms with CEO duality increase the propensity to fraud (Chen et al., 2006). There is a lower likelihood of fraudulent financial reporting if financial reports are audited by the 'big four' accounting firms because the auditors are concerned about their reputation (Lennox and Pittman, 2010). Kuang and Lee (2017) find that with an increase in independent directors' connectedness, the likelihood of fraud detection decreases. As the likelihood of fraud commission is not equal to the likelihood of fraud detection, addressing the incomplete detection issue is important to the evaluation of corporate policies that are designed to reduce fraud.

Since the board of directors and supervisors are in charge of corporate governance and monitoring, researchers have examined the characteristics of corporate boards, including the influence of board gender diversity on corporate behaviors and firm performance. Literature shows that companies with more female corporate leaders have

[1] Based on the U.S. Statement on Auditing Standards No.99, fraudulent financial reporting refers to intentional misrepresentation in financial reports to mislead the users of financial reports. This results in situations where financial reporting is not presented, in all material respects, in conformity with the Generally Accepted Accounting Principles (Zhu and Gao, 2011).

better firm performance and superior governance quality (Adams and Ferreira, 2009). Regulators are calling for more females in top leadership roles (Liu, 2018). These proposals generate a crucial need for a better understanding of the benefits of gender diversity in corporate monitoring and governance including addressing corporate frauds. However, very few studies have focused on the impact of female corporate leaders on financial statement fraud, especially in the context of emerging economies where little data on fraud is available to the public. This study aims to fill this gap by examining financial statement fraud in China, the largest emerging economy. The findings from China are expected to provide some practical and policy implications for other emerging economies.

The research context of this study is China, as the Chinese capital markets have been developing rapidly, yet female directors are still underrepresented. China has both the world's second largest capital markets and economy (World Bank, 2019). However, female participation is low on corporate boards; women make up only 10% of board directors and own a mere 0.1% of firms' stocks (Luo et al., 2017). Subsequently, examining the impact of female corporate leaders on fraud is important for designing policies to curb managers' opportunistic behaviors. Using a bivariate probit model, this study examines the impact of gender diversity on financial statement fraud in Chinese listed companies between 2007 and 2018. It shows that female corporate leaders are related to the higher rate of fraud detection, reducing firms' propensity to engage in fraud. Gender diversity improves financial reporting quality.

This study offers important contributions to the literature. First, it distinguishes the different impacts that female corporate leaders have on fraud commission and detection. The use of a bivariate probit model, which is more advanced and well-established compared to a single probit model, can overcome the problems of partial observability and mitigate biases caused by incomplete fraud detection. Previous studies only consider detected fraud cases (Stuart and Wang, 2016). Following Wang (2013), this study employs a more advanced method and considers both the determinants of fraud commission and detection.

Second, this study alleviates the ambiguity of the monitoring role of female corporate leaders. Although the presence of women in top leadership positions is often considered to enhance board independence, monitoring, advisory capacity and resource allocation, the existing empirical evidence is mixed (Zalata et al, 2018). Given the differences across studies, this paper finds that female corporate leaders are more capable of detecting potential fraudulent behaviors in China, a country characterized by an imperfect legal environment and a low enforcement level.

Third, this is the first study that evaluates the relationship between gender diversity and financial statement fraud whilst conditioning on the impact of state control in the setting of Chinese listed firms. Most Chinese listed companies are characterized by concentrated ownership structures and controlling shareholders are often state or quasi-state institutions (Yu and Ashton, 2015). In addition, by taking advantage of China's recent anti-corruption campaign initiated by President Jinping Xi, this study extends the research of Zhang (2018) by comparing the effect of female corporate leaders on the likelihood of fraud commission and detection between the pre and post-campaign periods. The results confirm that the anti-corruption campaign improves public governance by enhancing corporate governance and raising the cost of fraud.

The structure of the paper is as follows: Section 2 outlines the institutional background and section 3 reviews the literature and develops hypotheses. Section 4 introduces the variables employed and the research model. Section 5 reports the research findings and section 6 concludes the paper.

2. Institutional background

2.1. Gender diversity in China

Women play an increasingly important role in modern society, the labor market and the economy. Compared to men, working women usually shoulder the double burden of running the household and managing the workplace. Due to cultural norms, this double burden is particularly onerous for Chinese women (Low et al., 2015). Consequently,

promotion systems are biased towards men and there is a lack of women in top management teams and boardrooms. According to Deloitte (2017), the percentage of women in Chinese boardrooms is 10.7%, which is far less than UK (20.3%), Australia (20.4%), France (40.0%) and also less than the developing countries such as India (12.4%). The lower female board rate in China is due to a lack of legislation and the 'dual roles' undertaken by working women. According to the Asian Development Bank (2017), China has one of the highest labor force participation rates for women in the Asia Pacific region. However, there is no legislation in place to promote gender diversity on corporate boards in China. While the China Securities Regulatory Commission (CSRC) issued the first *Code of Corporate Governance for Listed Firms* in 2002 recommending that firms adopt sound governance practices, the Code didn't require companies to maintain gender diversity in their boardrooms.

There has been some progress in China to increase gender diversity on boards in recent years. The proportion of female board members increased by 2.2% between 2014 and 2017. In addition, 5.4% of A-share listed company boards are chaired by women. In the context of listed firms, women contribute to improving board effectiveness and corporate performance (Deloitte, 2017). Despite this progress, the promotion of gender equality in China remains a concern. An investigation released in 2018 by Renmin University of China reveals that employers are still reluctant to offer important positions to women who have had a second child due to concerns of childcare (Zia, 2018).

2.2 Corporate fraud in China

The CSRC is the major regulator for corporate fraud in China and follows the model of Securities and Exchange Commission of U.S. (Conyon and He, 2016). It plays an important role in enforcing China's Securities Law and has the authority to investigate major fraudulent activities and issue administrative sanctions, such as fines, warnings, disgorgement of illegal gains, etc. The CSRC cannot issue civil sanctions, but its administrative sanctions against misrepresentation are the prerequisites for private

enforcement. Enforcement actions can also be carried out by the CSRC regional offices, where they are delegated power to address less severe offences. The regional offices can issue both non-administrative sanctions (i.e. supervisory measures) and administrative sanctions after October 2013. Chen et al. (2005) reveal that share prices drop significantly after the announcements of enforcement actions by the CSRC and the CSRC is influential in China's capital market. The Ministry of Finance is a national regulator that has jurisdiction over financial reporting of both unlisted and listed firms in China. The Shenzhen and Shanghai stock exchanges are the self-regulatory organizations that watch over minor violations and issue self-disciplinary measures against fraudulent firms (Xu et al., 2017).

Common financial statement fraud cases committed by Chinese listed companies include false and insufficient disclosure of information, false income statements, false balance sheets and delayed disclosure of financial statements. False income statements have a higher incidence than false balance sheets, as income performance is an important criterion for regulators to determine listing and delisting in China (Zhu and Gao, 2011).

In China, there are three major types of punishment imposed on listed firms. These are administrative punishments, supervisory measures, and self-regulatory measures. Administrative sanctions are the most severe type of punishment and are usually warnings and fines. Under China's Securities Law, fines imposed on listed firms for corporate misrepresentation range from 300,000 Yuan to 600,000 Yuan (US$45,000 to US$90,000). Supervisory measures are time-sensitive corrective measures relating to the compliance and prudence supervision from regulators to prevent risks from spreading (CSRC, 2014). Some common supervisory measures include rectification notices, statements of regulatory concern, letters of warning, public statements, regulatory interviews, etc. Self-regulatory measures are imposed by the stock exchanges and common disciplinary measures include public criticism and public condemnation.

Determining which factors cause fraud commission and detection in China has received

increasing attention from scholars. Chen et al. (2006) report that firms with two persons serving as a CEO and chairperson, higher board dependence and fewer board meetings have a lower propensity to commit fraud. Chinese listed companies have a unique governance structure adopting a German style two-tier board structure: a board of supervisors and a board of directors. Jia et al. (2009) document that listed companies with larger supervisory boards, more supervisory board meetings are subject to more severe regulatory sanctions. There are also studies evaluating the role of state ownership in shaping corporate fraud. For companies with a state-owned background, government intervention in managerial appointment increases the managers' entrenchment effect. As a result, the board of directors and supervisors are not willing to hold managers accountable when they know about fraudulent activities (Chen et al., 2016).

2.3. Anti-corruption campaign

Corruption is an international phenomenon, especially in the emerging markets with imperfect legal environment and severe government intervention. The Transparency International Survey in 2018 ranked China 87th out of 180 countries for the corruption perception index, with a score of 39 (the index was calculated on a scale of 1 - 100). The prevalence of corruption in China has become an obstacle to economic growth (Zhang, 2018).

Shortly after President Xi took office in the 18th National Congress of the Communist Party of China (CPC) in November 2012, the Politburo of the Central Committee of the CPC promulgated eight provisions to regulate party members, which signaled the beginning of the anti-corruption campaign. The anti-corruption campaign was put forward by President Xi and his leadership team with a view to correcting the consequences of corruption and restoring China's economic growth (Pan and Tian, 2017). During the campaign, the vast majority of officials were subjected to strict monitoring by the Central Commission for Discipline Inspection (CCDI), media and the public (Zhang, 2018). One hundred and fifteen senior government officials had been arrested due to corruption by the end of 2016. The anti-corruption campaign has been

viewed as the boldest campaign against corruption in China (Ying and Liu, 2018).

3. Literature review and hypotheses development

3.1. Review of prior literature

The upper echelons theory offers insights on female leadership. It states that organizational outcomes are partially determined by the characteristics of top managers (Hambrick and Mason, 1984). Diversity can improve governance decisions by the board of directors and enable a beneficial shift in group dynamics. The first argument states that by including directors with diverse skills, which may differ across genders, boards are equipped with a broader skillset to tackle various governance challenges (Robinson and Dechant, 1997). The second argument shows that heterogeneous groups with various demographic characteristics have different behavior compared with homogenous groups. Specifically, gender diversity has the potential to change group dynamics by influencing cognitive conflicts and cohesion, causing a beneficial shift in the groupthink. Subsequently, it may result in better decision-making (Wahid, 2018).

Agency theory also advocates the benefits of female leadership. The board of directors monitors the performance of managers and mitigates principal-agent conflicts within a company. Female directors are more active in monitoring activities (Liu et al., 2014). There are two main factors that gender diversity might drive different business behaviors: ethical standards and risk preferences (Croson and Gneezy, 2009). In terms of the ethical perspective, previous research shows that women are more ethically sensitive than men. Women are more likely to speak out against unethical behaviors and become internal whistle-blowers. This is because men focus on personal achievement, while women focus on interpersonal relations and communal goals (Ho et al., 2015; Hersh, 2016). Studies supporting this view find that women are more sensitive to ethical issues in accounting decision making (Cohen et al., 1998). The stronger ethical standard of female leaders is expected to translate into stronger ethical leadership which discourages earnings management (Ho et al., 2015).

Another stream of studies focuses on the impact of gender on risk aversion and indicates that female corporate leaders are more risk-averse than male directors in making financial decisions (Croson and Gneezy 2009; Hanousek et al., 2019). A risk-averse individual is less likely to commit financial fraud. Women are more conservative and they normally adopt strategies that avoid the worst outcomes (Byrnes et al., 1999). Generally, the risk level of a company is significantly reduced following the appointment of a female CEO (Martin et al., 2009). Moreover, female corporate leaders are open to seeking advice from experts, which leads to a reduction in the risks of breaching laws or regulations. Subsequently, with a gender-diverse board, firms are less likely to underestimate the risks of fraud and lawsuits, thus engaging in socially responsible actions, leading to higher financial reporting quality (Wahid, 2018; Liu, 2018).

There may also be some negative consequences for financial reporting quality when adding more women to corporate boards for tokenism and female directors appointed are less qualified (Campbell and Minguez-Vera, 2008). Too much diversity may result in an excess cognitive conflict which impedes a board's ability to act decisively and cause significant communication problems for a listed firm (Schwab et al., 2016). In other words, board gender diversity may be detrimental to firm value as a result of unnecessary over-monitoring. However, Liu et al. (2014) report that over-monitoring results from gender diversity is not an issue in Chinese listed firms as the level of investor protection and the quality of corporate governance is still low.

3.2. *Hypothesis development*

3.2.1. Gender and fraud

A growing number of studies have shown that women are more ethical and are less likely to be involved in crime and litigations than men (Adhikari et al., 2019). Female corporate leaders are generally more conservative in financial reporting (Ho et al., 2015). When female corporate leaders are responsible for monitoring financial

reporting policies, they are more sensitive to potential litigations and default risks (Francis et al., 2015). In addition, female leaders are more trustworthy and more compliant with regulations and rules when they make financial decisions (Beu et al., 2003). Therefore,

H1: The representation of female corporate leaders is negatively associated with a firm's propensity to commit fraud, but is positively related to the detection of fraud.

3.2.2. Gender, fraud and state ownership

If a state-owned enterprise (SOE) maintains a gender balanced board, this brings credibility to the enterprise and reflects the government's efforts towards gender equality (Saeed et al., 2016). Female corporate leaders may be less likely to violate rules and more likely to report accounting irregularities due to their ethically sensitive and risk adverse characters (Cumming et al., 2015). However, the monitoring effect of female corporate leaders may be less obvious in Chinese SOEs for the following reasons:

First, compared to non-SOEs, the operational objectives of SOEs are to maximize shareholder wealth and also shoulder policy burdens. Those policy burdens may affect firm value negatively (Wu et al., 2012a, b). Female corporate leaders may be reluctant to challenge business decisions that have political considerations.

Second, the monitoring impact of female corporate leaders may be weakened in Chinese SOEs for the consideration of future political promotion. Successful leaders in SOEs could be rewarded with a promotion to a high prestige job in government. However, when fraud is detected, directors and senior managers from SOEs could face a higher probability of dismissal as the fraud news causes damage to the image of the state (Wang et al., 2019a). The dismissal implies a suicide of corporate leaders' political careers.

McGuinness (2018) finds that there is greater gender diversity in non-SOEs than SOEs; as the business skills and backgrounds of female corporate leaders are different, non-

SOEs must operate efficiently under the strategic leadership of directors with various backgrounds, in order to compete with SOEs in the competitive environment. The market-oriented approach in non-SOEs enables female corporate leaders to play a more active role in monitoring. Therefore, this study posits the following hypothesis:

H2: The representation of female corporate leaders plays a weaker role in fraud commission and detection in SOEs than non-SOEs.

3.2.3. Gender, fraud and anti-corruption campaign

Corruption weakens legal enforcement and exaggerates agency conflicts between shareholders and managers. In particular, female corporate leaders in a more corrupt corporate culture have stronger incentives to extract their private benefits by lowering corporate governance standards (Shleifer and Vishny, 1997). As the level of corruption increases, the external regulatory oversight is weakened, and internal corporate governance becomes even worse. In addition, corruption may cause managers to adopt suspicious accounting practices, which in turn increases the likelihood of fraud. Although female corporate leaders are deemed to act ethically, the monitoring role played by them is expected to be more pronounced following the launch of the anti-corruption campaign, as it significantly improves public governance (Zhang, 2018).

The choice to engage in fraud and bear appropriate punishments has been framed as an economic decision taking consideration of cost and benefit analysis. The decision to offend is associated with how much managers can earn from fraud against the costs and probability of being caught. To deter fraud, punishments should produce sufficient disutility to outweigh any gains (Werden, 2009). Xie and Lu (2003) find that corrupt officials from Chinese regulatory authorities (e.g., CSRC officials) often receive bribes from fraud companies to help them conceal financial misconduct. However, during the anti-corruption campaign period, the vast majority of government officials are subjected to strict monitoring from the CCDI. Moreover, the CCDI welcomes scrutiny from the public to report suspicious cases committed by officials. Consequently, the

probability of being caught increases and the likelihood of being bribed is lowered (Zhang, 2018).

Female corporate leaders are more risk averse, less tolerant to opportunistic behaviors and ethically sensitive to punishment (Aluja, 2004; Ho et al., 2015). This is especially the case after the initiation of the anti-corruption campaign, as the expected cost of fraud exceeds the benefits. Specifically, if collusion is found, both female corporate leaders and corrupt officials face severe punishments, such as dismissal from their political party and imprisonment. Under such a circumstance, they are less likely to commit fraud. Zhang (2018) documents the benefits of enhanced public governance during the post-campaign period. Therefore, this study posits:

H3: The monitoring effectiveness of female corporate leaders is more pronounced during the anti-corruption campaign period.

4. Research methodology

4.1. Prior studies in addressing fraud partial observability

Empirical studies of fraud normally adopt a single logit or probit model. This approach overlooks the latent process of those listed companies that commit fraud and without being caught. Traditional methods are confined to only examine those detected fraud cases, but not those fraud cases not yet been caught (Shi et al., 2016). To reduce the biases resulting from incomplete detection, several approaches have been adopted in prior studies. For instance, Dyck et al. (2010) restrict their samples of fraudulent firms to large firms, the reason being large firms are subject to more public scrutiny, thus it is less likely to have undetected fraud cases.

The Heckman two-step model has also been applied in recent studies (e.g., Tan et al., 2017) to address the partial observability concerns. The Heckman two-stage model involves the estimation of a probit model for selection in the first step. The inverse Mills ratio (Lambda) is calculated from the probit model, capturing the unobservable factors affecting managers' decisions to commit fraud. In the second stage, an OLS regression

model is performed with the Lambda using as an additional independent variable, in order to capture the effect of all the unmeasured fraud characteristics on the dependent variable (Heckman, 1979).

4.2. Bivariate probit model

Following Wang (2013), this study uses a bivariate probit model to address the partial observability of fraud. The observed cases of detected fraud depend on the outcomes of two latent and distinct processes: fraud commission and fraud detection. The bivariate model is superior to a single probit model (Poirier, 1980). We use this model to extend previous work on fraud to a new area.

Firstly, we undertake tests to examine if a bivariate probit model is appropriate. Akaike information criterion (AIC) and Bayesian information criterion (BIC) values between a bivariate probit model and a simple probit model are compared. Lower values of AIC and BIC imply a better model fit (Bromiley and Harris, 2014). The AIC and BIC statistics support the use of bivariate probit models. The variance inflation factor (VIF) test shows that the mean VIF is less than 2 in different models, the multicollinearity issue is not a concern. All independent variables are lagged by one year to account for the issue of potential reverse causality. In addition, standard errors are clustered by firms to deal with repeated observations over time.

We follow the approach of Wang (2013), defining fraud as a function of two latent variables: fraud commission and fraud detection. F_i^* represents the firm i's potential to commit financial statement fraud. D_i^* denotes the firm i's potential for fraud being detected conditional on the firm i committing financial statement fraud. The model is given as follows:

$$F_i^* = x_{F,i}\beta_F + u_i \quad (1)$$

$$D_i^* = x_{D,i}\beta_D + v_i \quad (2)$$

$x_{F,i}$ are the independent variables that explain firm i's propensity to commit fraud, and

$x_{D,i}$ include variables that explain firm i's potential for getting detected. u_i, v_i are zero-mean disturbances with a bivariate normal distribution.

F_i^* is transferred into a binary variable F_i to model fraud commission, where $F_i = 1$ if $F_i^* > 0$, and $F_i = 0$ otherwise. D_i^* is transformed into a binary variable D_i for the fraud detection model (conditional on fraud commission), where $D_i = 1$ if $D_i^* > 0$, and $D_i = 0$ otherwise. As D_i and F_i cannot be directly observed, Z_i as an interaction term between D_i and F_i is considered, where

$$Z_i = F_i * D_i \tag{3}$$

$Z_i = 1$ if the firm i has committed fraud and also been detected. $Z_i = 0$ if the firm i has not committed fraud or firm i has committed fraud but has not been detected by regulators.[2] The empirical specification for Z_i is:

$$P(Z_i = 1) = P(F_i\, D_i = 1) = P(F_i = 1, D_i = 1) = \Phi(x_{F,i}\beta_F, x_{D,i}\beta_D, \rho) \tag{4}$$

$$P(Z_i = 0) = P(F_i D_i = 0) = P(F_i = 0, D_i = 0) + P(F_i = 1, D_i = 0) = 1 - \Phi\,(x_{F,i}\beta_F, x_{D,i}\beta_D, \rho) \tag{5}$$

Where Φ is the bivariate standard normal cumulative distribution function. In order to fully identify the model parameters, $x_{F,i}$ and $x_{D,i}$ in the two equations cannot include exactly the same variables. The model can then be estimated by using the maximum-likelihood method with the following log-likelihood function:

[2] Poirier (1980) developed a 'bivariate probit model with partial observability'. This model assumes that F_i and D_i cannot be observed in all circumstances. When firms' fraudulent cases are detected and revealed by regulators ($z_i = 1$), we know that F_i = 1 and D_i = 1. However, if the fraud cases are not observed ($z_i = 0$), there are three possible combinations: (i) F_i = 0 and D_i = 0, (ii) F_i = 0 and D_i = 1, (iii) F_i = 1 and D_i = 0. When F_i = 0 and D_i= 0, it refers to a firm that does not participate in fraud. When F_i = 0 and D_i = 1, this situation does not exist as a firm can not be detected for fraudulent behaviors if it doesn't commit fraud. Therefore, we are interested in the scenario (iii) where F_i = 1 and D_i = 0, as it indicates that a firm commits fraud but has not been detected.

$$L(\beta_F, \beta_D, \rho) = \sum_{z_i=1} \log\big(P(Z_i = 1)\big) + \sum_{z_i=0} \log\big(P(Z_i = 0)\big) \tag{6}$$

$$= \sum_{i=1}^{N} \{z_i \log\big[\Phi\big(x_{F,i}\beta_F, x_{D,i}\beta_D, \rho\big)\big] + (1$$

$$- z_i) \log\big[1 - \Phi\big(x_{F,i}\beta_F, x_{D,i}\beta_D, \rho\big)\big]\}$$

4.3. Data and variables

The data covers all Chinese companies listed on the Shenzhen and Shanghai stock exchanges from 2007 to 2018. The financial statement fraud variable is hand-collected from the sanction reports issued by regulators, the CSRC, the Shanghai and Shenzhen stock exchange websites and 'CNINFO' website.[3] These sanction reports have been verified by regulators to ensure data quality and sample reliability. A content analysis method is applied to code different types of financial statement fraud. Corporate governance and financial performance variables are obtained from the China Stock Market and Accounting Research (CSMAR) database. In consideration of the new accounting standards being adopted in 2007, which fundamentally converged with the International Financial Reporting Standards, we utilize an 11-year data period from 2007 to 2018. The original sample includes 24,331 firm-year observations. We firstly exclude 646 observations from the financial sector and then 3,023 observations where data is unavailable. The final sample consists of 20,662 observations.

The dependent variable is fraud commission that is equal to one if a firm commits fraud and zero otherwise. As fraud commission cannot be directly observed, a bivariate probit model is used to solve this partial observability problem and another dependent variable is introduced: fraud detection. If a firm is subject to a sanction decision imposed by regulators, fraud detection equals one and zero otherwise. Several prior studies have

[3] The 'CNINFO' website is authorized by the CSRC, as an information platform, to cover Chinese listed companies' files in China.

adopted this model (e.g., Wang et al., 2010; Wang, 2013; Wang et al., 2019a).

Main independent variables include female, SOEs and anti-corruption. In this paper, the variable female (female ratio) is defined as the proportion of female directors, supervisors and senior managers in a listed company. To examine hypothesis 2, samples are divided into SOEs and non-SOEs based on the nature of a firm's ultimate controller. To examine hypothesis 3, observations are divided into pre-anti-corruption campaign period (i.e., 2007-2012) and post-anti-corruption campaign period (i.e.,2013-2018), where anti-corruption is a dummy variable coded as one for the observations in or after 2013 and zero otherwise.[4]

Similar to the approach of Wang et al. (2019a), several control variables relating to the likelihood of fraud commission are also included. CEO duality is included as a CEO who is also the chairperson may have more power to falsify financial accounts. This study also includes supervisory board size and supervisory board meeting frequency as the monitoring efficiency of supervisory boards affects financial reporting quality (Firth et al., 2007). More frequent supervisory board meetings presumably result in a higher level of oversight as supervisors can devote more time to performing their duties (Jia et al., 2009). CEO ownership is also controlled due to the incentive alignment effect. The average age of board of directors, supervisors and senior managers are controlled as older corporate leaders tend to be more conservative, ethical, and risk averse (Sun et al., 2019). These variables are only included in the commission equation, as a firm's internal governance mechanism is more likely to affect insiders' propensity to commit fraud instead of triggering a regulatory investigation. This is particularly true in China, where boards of directors and supervisors may dissuade fraudulent behavior through private meetings instead of reporting corporate misconduct to regulators (Chen et al., 2006). BIG4 is controlled as large accounting firms are more concerned with preserving reputation, thus they can effectively deter fraud and increase financial reporting quality (Lennox and Pittman, 2010). Firm size is measured as the natural logarithm of total

[4] President Xi officially took office in the 18th National Congress of the Communist Party of China on the 14th November 2012.

assets. Small listed-firms are subject to less regulatory scrutiny and are more likely to commit fraud to satisfy analysts' forecasts and attract investors (Wang et al., 2019a).

The control variables relating to the fraud detection model are also included. Firm leverage and sales growth rate are considered as firms with higher leverage or high-growth firms tend to receive more attention from regulators and shareholders. Wang (2013) shows that firms with higher research and development expenditures (R&D) are less likely to get caught for fraud. ROA, Tobin's Q and annual stock returns are included as firm performance indicators. We use a firm's demeaned standard deviation of monthly stock returns to control firm's abnormal return volatility and demeaned monthly stock turnover to measure abnormal stock turnover. Firms with higher stock return volatility are more likely to bring large investment losses for investors and draw the attention of regulators. Financial variables are included as poor financial performance is more likely to trigger a regulatory investigation.

This study includes institutional ownership in both commission and detection equations. As institutional investors are sophisticated investors with professional knowledge and resources, they can monitor self-serving managerial manipulation (Wang et al., 2019b). Thus, firms are less likely to commit fraud. This paper has also controlled year, industry, and location effect. The variable definitions are summarized in Table 1.

[Insert Table 1 about here]

5. Results

5.1. Descriptive statistics

Panel A of Table 2 presents the mean descriptive statistics. Panel B presents the standard deviation, minimum, maximum, and median value of the variables. On average, the proportion of female corporate leaders is 16.3%, slightly higher than 14.0% as reported by Cumming et al. (2015), indicating that female participation as business leaders is gradually increasing over time. As shown by Panel B, the median of the female ratio is 14.3%. 51.4% of observations are SOE-controlled firms, implying the state dominance

in Chinese listed firms. On average, institutional investors own 23.6% of the shares; the supervisory board has 3.8 directors and holds 4.7 meetings annually. Large accounting firms generally have superior expertise and more resources to perform a high-level audit service, and this study finds 15.3% of the Chinese listed companies hire big four auditors.[5] In 19.7% of samples CEOs have a combined CEO duality position and the average CEO ownership is 2.2%.

Panel A of Table 2 also compares the characteristics of fraudulent and non-fraudulent firms. There are 19,904 observations not involved in financial statement fraud and 758 observations having committed financial statement fraud.[6] The average proportion of female corporate leaders for the fraud sub-sample is 17% and 16.3% for the non-fraud subsample. In addition, 51.7% of non-fraud firms are SOEs, which is 9.3% higher than those of fraud firms, implying firms with a state-owned background are less likely to be caught for fraudulent activities. Fraudulent firms are smaller, have lower supervisory board size, and higher CEO duality. Fraudulent firms have lower ROA and stock returns, higher stock turnover, and abnormally higher stock return volatility. We also compare fraud against non-fraud firms in gender diverse versus non-gender diverse subgroups in the Appendix 1.

[Insert Table 2 about here]

5.2. Regression results

Table 3 presents results for hypotheses 1 and 2. Model 1 shows that the coefficient of Female is significantly negative in the fraud commission model and positive in the fraud detection model. This shows that higher female representation in top leadership

[5] The ranking of accounting firms is published every year by the Chinese Institute of Certified Public Accountants on the basis of revenue, comprehensive evaluation scores of penalty and discipline deductions, other indices and the number of employed CPAs. The big four auditors are Deloitte, PwC, Ernst & Young and KPMG.

[6] For 758 fraud observations in our sample, there are 156 (21%) firm-year observations subject to administrative punishments, 488 (65%) firm-year observations subject to supervisory measures and the remaining 14% of observations subject to self-disciplinary measures.

positions reduces the likelihood of fraud commission and increases the likelihood of fraud detection. The result supports the view that female corporate leaders are more conservative, ethical, and risk-adverse in accounting tasks. They avoid unethical activities.

Models 2 and 3 present the results for hypothesis 2. Samples are divided into SOEs (10,611 observations) and non-SOEs (10,051 observations). It is reported that female representation is less likely to commit fraud and more likely to detect fraud in non-SOEs. On the contrary, female representation does not influence fraud commission and detection in SOEs. Hypothesis 2 is supported such that the representation of female corporate leaders plays a weaker role in fraud commission and detection in SOEs than non-SOEs, irrespective of pre-or post-anti-corruption campaign period. Strong government intervention or control in SOEs that reduces the monitoring role of female corporate leaders (Wang et al., 2017) could be a reason for the results.

[Insert Table 3 and Table 4 here]

Table 4 reports the results for hypothesis 3. Samples are divided into the pre-campaign period subsample (8,534 observations) and the post-campaign period subsample (12,128 observations). It is reported that female corporate leaders are not related to the propensity of fraud commission or fraud detection in the pre-anti-corruption campaign subsample. In contrast, female corporate leaders are negatively related to fraud commission and positively related to fraud detection in the post-anti-corruption campaign subsample, irrespective of SOEs or non-SOEs. The results may suggest that the anti-corruption campaign significantly raises fraud costs. Due to their risk-averse nature, female corporate leaders are more likely to report questionable acts and less likely to commit fraud during the post-campaign period. Moreover, Alam and Petruska (2012) show an increase in accounting conservatism for fraud firms during the Security Exchange Commission investigation period. Zhang (2018) reveals that the anti-corruption campaign leads to lower corporate corruption culture, and firms are less likely to commit fraud in the post-campaign period. This research finding is in line with these two studies. Overall, Hypothesis 3 is supported.

Regarding control variables in the fraud commission equations, large firms are less likely to commit fraud, as large firms face more regulatory scrutiny. Institutional ownership leads to a lower likelihood of fraud commission. This finding confirms that institutional investors in China are active monitors. For the fraud detection model, firm leverage is positively related to fraud detection; ROA is negatively related to fraud detection. These suggest that firms with lower leverage or higher ROA are less likely to trigger regulatory investigations. In addition, firms that experience higher return volatility are more likely to trigger regulatory investigations, as regulators regard this kind of behavior as an indication of fraud (Wang, 2013).

5.3 Addressing endogeneity: an instrumental variable approach

To address endogeneity concerns, we construct two instrumental variables (IV) to estimate the main regression model via the two-stage least squares (2SLS) method. We firstly review recent literature for their choices of appropriate instrumental variables. Specifically, Liu et al. (2016) use the mean percent of women directors in the firm's 2-digit US SIC coded industry as the instrumental variable. Consequently, following Liu et al. (2016), the first instrumental variable is the industry average proportion of female corporate leaders in each province at the specific year. The industry classification is based on the listed firms' 2-digit CSRC industrial classification code and it is collected from the CSMAR database. The rationale for using this instrument variable is that listed firms in the same industry may have the similar proportion of female corporate leaders at the regional level. Consequently, whether a firm appoints female board of directors, or female board of supervisors or female managers may depend on the industrial and provincial elements rather than firm-specific elements (Compton et al. 2019; Wang and Zhang, 2020). Lee and Marvel (2014) and Compton et al. (2019) point out that the likelihood of a firm appointing female entrepreneurs is higher if the regional industry proportion of female leader is greater. This instrumental variable is assumed to be exogenous because the industry average proportion of female corporate leaders in each province should not have any relationship with financial statement fraud commission

or detection. Specifically, the propensity of fraud commission is unlikely to be associated with industry average proportion of female corporate leaders in each province, as fraud commission is a firm-level behavior rather than industrial and provincial level behavior. In other words, the industry average of female representation per province has no direct impact on motivating individual firm to commit fraud. Subsequently, the industrial and provincial level of female representation proportion hardly affects a firm's incentives to manipulate financial statements. In addition, there is no connection between the industry average proportion of female corporate leaders in a province and the probability of regulatory detection. Central or local regulators do not set their targets of regulatory investigation simply based on the industry average proportion of female corporate leaders in a particular province. Moreover, previous empirical literature such as Liu et al. (2014) use the same instrumental variable, and find it meets the requirements of relevance and exogeneity. Therefore, this variable is considered as a valid exogenous instrument.

The second instrument we use is the ratio of female labor participation, which is calculated as the female labor participation rate to the total labor participation rate for the Chinese province where a given firm is headquartered, following the suggestions of Jurkus et al. (2011), Conyon and He (2017) and Chen et al. (2017). This ratio is collected from the Chinese Research Data Service Platform (CNRDS) database. The rationale for using this instrument variable is that listed firms in provinces where the female labor participation ratio is higher are more likely to find good female candidates as their corporate leaders, consequently they can tap into larger talent pools. Therefore, the higher female labor participation ratio, the greater ratio of females as corporate leaders. In addition, it is unlikely that this instrumental variable would affect our outcome variables. That is, the female labor participation rate of a province should not affect the propensity of firm's financial statement fraud commission or detection. In particular, firms commit fraud largely due to financial pressure of meeting the third-party expectation or opportunities of weak internal governance mechanisms (Yang et al., 2012), however, the provincial female labor participation level is unlikely to create

pressure or opportunities for firms to commit fraud. From a regulatory detection perspective, the female labor participation ratio of a province cannot signal any abnormal performance of a firm. As a result, regulatory attention cannot be triggered by provincial female labor participation rate, no matter high or low. Subsequently, this instrument reasonably meets the exogeneity requirement.

The first-stage estimation results are reported in column (1) of Table 5. The dependent variable is the proportion of female corporate leaders, and the explanatory variables include the two instruments mentioned above i.e., the proportion of industry average female corporate leaders in each province per year and the ratio of female labor participation, as well as the same control variables in the baseline regressions. For brevity, only the coefficients for the main variables of interest are reported in Table 5. Both instruments are positively and significantly related to the female corporate leader proportion at the 1% level, which are in line with the rationale behind the instruments. That is, a firm has a higher proportion of female corporate leaders if its industrial female leader level is more pronounced at the provincial level and the female labor participation ratio in a province where the firm's headquarters is located is greater. In addition, the instrumental variables have met the instrument exogeneity and the instrument relevance conditions. Specifically, the Cragg-Donald's Wald F-statistic 9485.265, which is well above the Stock-Yogo weak identification test of 10% critical value of 19.93, supporting the strength of the instrumental variables (Stock and Yogo, 2005). Therefore, the null hypothesis that the instruments are weak is rejected. The next test is the Sargan-Hansen test on the validity of our instruments. Based on Murray (2006), the null hypothesis for Sargan-Hansen test is that the instruments are valid in the sense that they are not correlated with the error term in the estimated equation. The p-value of the Sargan-Hansen statistic is 0.348, indicating that the instruments are valid, i.e., all instruments are uncorrelated with the error terms. The second-stage estimates are reported in columns (2) and (3) where the dependent variables are fraud commission and fraud detection respectively. The predicted values of female ratio are significantly and negatively related to the likelihood of fraud commission, but positively related to

the likelihood of fraud detection. This result is in line with our baseline regression results, implying that female corporate leaders are more likely to monitor and detect managers' opportunistic behaviors. This also suggests that our main results are robust in different model specifications.

[Insert Table 5 about here]

5.4. Robustness Analysis

We conducted the following additional tests to ensure the robustness of the results. First, as members of the board of directors, board of supervisors, and senior managers have different roles in organizations and, as such, the effects of women on fraud manifest may differ. Therefore, this paper further examines female representation on the boards of directors, supervisory boards, and senior management separately.[7] Chinese listed companies have a unique governance structure, adopting a German style two-tier board structure: a board of supervisors and a board of directors (National People's Congress, 2015).[8] Members on the board of directors and the board of supervisors are appointed by shareholders through a shareholder meeting, while senior managers are appointed by the board of directors. The board of directors includes both executive directors and non-executive directors. Executive directors e.g., CEO and chief finance officer (CFO) are involved in a company's day-to-day operations. Non-executive directors (also refer to independent directors) provide advice, evaluate corporate strategy, and monitor company management, etc. (Solomon, 2013). The position and composition of senior

[7] According to the Notice of the China Securities Regulatory Commission on Promulgating the Standards Concerning the Contents and Formats of Information Disclosure by Companies Offering Securities to the Public, listed firms should disclose information about their directors, supervisors and senior managers.

[8] In 1993, the Company Law of the People's Republic of China required listed firms to form both a board of directors and board of supervisors. The responsibilities of a board of directors are similar to those of U.S. companies' corporate boards. However, the board of supervisors have a different set of powers and responsibilities: to review the financial position of the company, to supervise the compliance with the laws and regulations, and to correct any illegal and unethical behaviors. The board of supervisors should have at least three elected representatives of shareholders and non-managerial employees (Cho et al., 2007).

managers may differ among companies, but this position generally includes deputy general managers, operation managers, directors of human resources, assistant general managers, and chief engineers. The senior managers work for the company in a senior capacity, and they are concerned with the main issues relating to the operations of the business.

This study shows that the proportion of female corporate leaders is 16.3% on average (including 7.7% female board of directors, 5.9% female board of supervisors, and 2.7% female senior managers). Table 6 shows that the results still hold. First, as shown in Model 1, female board of directors can detect fraud. Among female boards of directors, more than 40% of them are independent directors. Therefore, we further examine the impact of female independent directors on fraud and results are presented in Model 2. It is reported that female independent directors can effectively detect fraud, reducing the likelihood of fraud commission. In other words, the presence of female independent directors on company boards contributes to the effective monitoring of executives by introducing an independent voice to the boardroom. For the female boards of supervisors, the results are reported in Model 3. We find that female supervisors can perform supervisory roles effectively, in terms of detecting fraud and reducing fraud commission, thus improving financial reporting quality. The influence of female senior managers on financial statement fraud commission and detection is reported in Model 4, and there is no significant relationship between female senior managers and financial fraud commission or detection. This is in line with previous findings that independent directors and board of supervisors mainly perform monitoring roles while senior managers perform operational roles (Solomon, 2013).

Second, as Wang (2013) argues that many fraudulent firms are active acquirers, we follow her model and add ‘Capexr’ and ‘Noma’ in the robustness test. Variable ‘Noma’ refers to the number of mergers and acquisitions per year for a listed firm, and variable ‘Capexr’ refers to a firm’s capital expenditures to its total assets. The results reported in Table 7 are consistent with the main findings.

Third, we further address the question regarding whether female corporate leaders’

monitoring effectiveness is driven by the type of firms or the event of anti-corruption campaign. We find that female corporate leaders overall play a monitoring role in disciplining fraudulent behaviors, and the nature of non-state ownership and the initiation of anti-corruption campaign can further reinforce such a monitoring effect. In particular, we divided our samples into four sub-groups, state-owned enterprises before the initiation of anti-corruption campaign; state-owned enterprises after the initiation of anti-corruption campaign; non-state-owned enterprises before the initiation of anti-corruption campaign; and non-state-owned enterprises after the initiation of anti-corruption campaign.

Panel A of Table 8 shows the overall impact of female corporate leaders on fraud commission and detection in four different categories. Specifically, we find that female corporate leaders reduce the likelihood of fraud commission and increase the likelihood of fraud detection in non-SOEs for both pre- and post-anti-corruption campaign periods. In addition, the female corporate leaders can effectively discipline wrongdoings in SOEs after the initiation of the anti-corruption campaign. However, female corporate leaders cannot reduce the fraud incidence in SOEs before the initiation of the anti-corruption campaign.

Similarly, based on the results presented in Table 6, we further examine the impacts of different female corporate leaders i.e., female board of directors, female board of supervisors, and female senior management on the propensity of fraud commission and detection among four different groups. Similar results are reported in Panel B and Panel C of Table 8 for female board of directors and board of supervisors. The results indicate that female board of directors and supervisors can effectively detect managerial opportunistic behaviors and reduce the likelihood of fraud commission in non-SOEs or SOEs during the anti-corruption campaign period. However, the monitoring effect is not significant in SOEs prior to the initiation of the anti-corruption campaign. For female managers, our results are presented in Panel D of Table 8, which are in line with the results reported in Model 4 of Table 6. Female senior managers cannot reduce fraud propensity or encourage regulatory detection in SOEs or non-SOEs, before or after the

anti-corruption campaign. This is understandable, as female senior managers mainly perform the role of managing day-to-day business rather than monitoring. Lastly, we also re-examine the results in Table 7 by splitting samples into these four categories. The results are presented in Panel E of Table 8. With more control variables added into both commission and detection equations, we find consistent results. In other words, female corporate leaders can reduce the likelihood of fraud commission and increase the likelihood of fraud detection in non-SOEs or during the post-anti-corruption campaign periods. In summary, our results show that female corporate leaders, including female board of directors and female board of supervisors indeed play an effective monitoring role in reducing corporate fraudulent behaviors, and the existence of non-state ownership and the initiation of anti-corruption campaign can further reinforce such a monitoring effect.

[Insert Tables 6-8 about here]

6. Conclusions

The topic of gender diversity has gained much popularity over the past decade. Women are more risk averse and ethically sensitive than men. This study examines the relationship between gender diversity and financial statement fraud in Chinese listed companies between 2007 and 2018, by using a bivariate probit model. The results show that female corporate leaders are associated with a higher ability of fraud detection, reducing firms' propensity to engage in fraud. Hence, gender diversity improves financial reporting quality. However, among firms with a state-owned background, the monitoring ability of female corporate leaders is significantly reduced. This indicates that female corporate leaders cannot effectively monitor or detect managers' opportunistic behaviors in the SOEs, where political connections between firms and governments are prevalent. Female corporate leaders are less likely to commit and more likely to reveal fraud cases in the post anti-campaign period than in the pre-anti-campaign period.

The results offer important implications for policy makers. First, the findings indicate that female corporate leaders increase boards' monitoring ability and reduce the incidence of financial statement fraud. Therefore, adding female voices into corporate leadership teams is important as it lowers the risk of fraud commission. However, compared to U.S. or other developed economies, the female participation rate as corporate leaders is still low in China, and there is a lack of legislation that encourages corporate gender diversity or requires the minimum number of female directors. Given the outcomes of this study, it is suggested that regulators in China should encourage gender balance in corporate leadership to reap the benefits of gender diversity.

Second, we recommend that policy makers consider the nature of ultimate controllers of listed companies as it has a contrasting effect on the monitoring effectiveness of board gender diversity. For regulators, a reduction of state influence and political intervention in listed companies could strengthen female leaders' disciplining function. As companies gradually pay more attention to workforce gender equality in China, female representation helps institutionalize a normative climate in companies. We hope in future female representation plays an active monitoring role in SOEs as well as in non-SOEs.

Lastly, the anti-corruption campaign has largely improved the legal and institutional environments in China, and the monitoring role of female corporate leaders becomes more pronounced in the post-campaign period. Therefore, both central and local governments and regulators should continue to discipline unethical behaviors of executives, strengthen law enforcement and the legal environment.

This study also offers several avenues for future research. First, while female corporate leaders can detect fraud more effectively, the channels through which they carry out monitoring activities are not considered. For instance, female corporate leaders may become internal whistle-blowers and report fraudulent activities to auditors or regulators (Rothschild and Miethe, 1999). Female corporate leaders may utilize meetings with supervisors or internal audit committee members who have expertise in financial reporting to affect other managers' behaviors. It would be interesting to

identify the monitoring channels of female corporate leaders for future research. Some of these whistle-blowing activities or meetings are behind closed-doors, future research will benefit from analyzing primary data of such information. Second, it would be interesting to identify whether there will be different fraud behaviors when female corporate leaders actually hold the top positions of listed firms as in Chinese culture power hierarchy plays an overriding role in corporate decision-making.

Table 1 Variable definitions.

Variable Type	Variable name	Definition
Dependent variable	Financial statement fraud	A dummy variable equals one if a firm commits financial statement fraud and zero otherwise
Main variables	Female	The proportion of female directors, supervisors and senior managers in a listed company.
	SOEs	A dummy variable equals one if the ultimate controller of a listed firm is state or state agencies and zero otherwise
	Anti-corruption	A dummy variable equals one for the observations after 2012 and zero otherwise
Control variables	Institution	The proportion of shares held by institutional investors
	Duality	A dummy variable equals one if a CEO also serve as the chairman and zero otherwise
	Big4	A dummy variable equals one if the firm's auditor is one of the four biggest auditors and zero otherwise
	SB size	The number of members of the supervisory board
	SB meeting	The number of supervisory board meetings held in a year
	CEO ownership	The proportion of total outstanding shares held by CEO
	Firm size	Natural logarithm of a company's total assets
	Age	Natural logarithm of the average age of the board of directors, board of supervisors and senior managers
	R&D	Ratio of research and development expenditures to total assets
	Leverage	The ratio of total liabilities to the company's total assets
	Growth	Growth rate of total sales
	ROA	The ratio of net profits to total assets
	Tobin's Q	The ratio of market value of common equity divided by the book value of total assets
	Stock returns	Annual firm stock returns (with cash dividend reinvested)
	Abnormal volatility	The demeaned standard deviation monthly stock returns in a year
	Abnormal turnover	The demeaned monthly stock turnover in a year
	Year dummies	Dummy variables for the year when a fraud case is reported
	Industry dummies	Dummy variables for the industry classification of the samples according to the *Industry Classification Guideline* issued by CSRC in 2012
	Location dummies	Dummy variables for the location of listed firms. The classification of firms' location is based on Wan et al. (2006)

Table 2 Descriptive statistics

Panel A	Summary statistics and comparison between fraud and non-fraud firms			
Variables	Full sample	Non-fraud	Fraud firms	Mean difference
Female	0.1629	0.1626	0.1704	-0.008*
SOEs	0.514	0.517	0.423	0.093***
Anti-corruption	0.587	0.586	0.619	-0.033*
Institution	0.236	0.237	0.19	0.047***
Duality	0.197	0.196	0.227	-0.031**
Big4	0.153	0.154	0.128	0.026*
SB size	3.799	3.804	3.669	0.135***
SB meeting	4.730	4.733	4.635	0.099
CEO ownership	0.022	0.022	0.022	0.000
Firm size	22.046	22.059	21.702	0.357***
Age	3.866	3.866	3.86	0.006***
R&D	0.009	0.009	0.008	0.002***
Leverage	0.483	0.481	0.548	-0.067***
Growth	0.212	0.211	0.24	-0.029
ROA	0.038	0.039	0.009	0.030***
Tobin's Q	2.086	2.077	2.311	-0.233***
Stock returns	0.322	0.325	0.25	0.075**
Abnormal volatility	-0.008	-0.009	0.003	-0.011***
Abnormal turnover	-0.001	-0.003	0.041	-0.043***
Panel B	**Std. Dev.**	**Min**	**Max**	**P50**
Female	0.109	0	1	0.143
SOEs	0.500	0	1	1
Anti-corruption	0.492	0	1	1
Institution	0.230	0	0.851	0.154
Duality	0.398	0	1	0
Big4	0.360	0	1	0
SB size	1.240	1	15	3
SB meeting	2.236	0	22	4
CEO ownership	0.075	0	0.435	0
Firm size	1.311	19.124	25.947	21.903
Age	0.067	3.689	4.007	3.871
R&D	0.014	0.000	0.072	0.001
Leverage	0.213	0.064	1.066	0.486
Growth	0.595	-0.645	4.345	0.113
ROA	0.062	-0.212	0.226	0.034
Tobin's Q	1.996	0.204	12.181	1.497
Stock returns	0.816	-0.729	3.564	0.082
Abnormal volatility	0.050	-0.110	0.209	-0.016
Abnormal turnover	0.200	-0.376	0.696	-0.037

Table 3 Regression results: gender diversity, SOEs and financial statement fraud

	Model 1		Model 2 (SOEs)		Model 3 (non-SOEs)	
Variables	P(F)	P(D|F)	P(F)	P(D|F)	P(F)	P(D|F)
Female	-0.657**	0.960***	-0.784	0.809	-1.135**	2.132**
	(0.282)	(0.335)	(0.713)	(0.749)	(0.522)	(0.911)
Institution	-0.069	-0.104	-1.183***	1.244***	0.329	-0.682
	(0.158)	(0.182)	(0.357)	(0.436)	(0.416)	(0.534)
Duality	0.056*		0.011		0.067	
	(0.029)		(0.039)		(0.082)	
SB size	-0.019*		0.009		-0.055	
	(0.010)		(0.009)		(0.038)	
SB meeting	-0.003		0.011*		-0.021*	
	(0.005)		(0.007)		(0.013)	
CEO ownership	0.052		1.032		0.036	
	(0.146)		(1.273)		(0.331)	
Age	0.086		-0.195		0.508	
	(0.169)		(0.223)		(0.449)	
Firm size	-0.036***		-0.064***		-0.097**	
	(0.012)		(0.019)		(0.049)	
Big4	-0.005		-0.069*		0.075	
	(0.031)		(0.037)		(0.090)	
R&D		-0.868		-2.053*		-5.459*
		(0.970)		(1.130)		(3.260)
Leverage		0.465***		0.539***		0.776***
		(0.100)		(0.128)		(0.291)
Growth		0.074***		0.005		0.345***
		(0.026)		(0.022)		(0.115)
ROA		-1.679***		-1.367***		-4.516***
		(0.368)		(0.328)		(1.125)
Tobin's Q		0.032***		0.026**		-0.011
		(0.010)		(0.012)		(0.014)
Stock returns		-0.089***		-0.019		-0.136**
		(0.023)		(0.027)		(0.067)
Abnormal volatility		0.851***		0.574**		0.660
		(0.304)		(0.281)		(0.881)
Abnormal turnover		0.125*		0.068		0.374
		(0.072)		(0.069)		(0.238)
Constant	-0.079	0.270	2.211**	-0.609	-0.704	-0.208
	(0.687)	(0.374)	(1.018)	(0.396)	(1.618)	(1.436)
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes
Industry dummies	Yes	Yes	Yes	Yes	Yes	Yes
Location dummies	Yes	Yes	Yes	Yes	Yes	Yes
Log likelihood		-3084.340		-2993.803		-1708.275
Chi-squared		377.28***		73.45***		78.57***
Observations	20,662	20,662	10,611	10,611	10,051	10,051

P(F) is the probability of fraud commitment and P(D|F) is the probability of fraud detection conditional on fraud commitment. ***, ** and *, denote statistical significance at the 1%, 5% and 10% levels respectively.

Table 4 Regression results: gender diversity, anti-corruption campaign and fraud

Variables	Pre-campaign		Post-campaign	
	P(F)	P(D|F)	P(F)	P(D|F)
Female	-0.982	1.920	-1.010**	1.808**
	(0.813)	(1.338)	(0.506)	(0.855)
Institution	-1.169***	1.984**	-0.719**	0.712
	(0.447)	(0.948)	(0.331)	(0.504)
Duality	0.028		0.049	
	(0.094)		(0.042)	
SB size	-0.047		-0.011	
	(0.030)		(0.013)	
SB meeting	0.015		0.001	
	(0.020)		(0.006)	
CEO ownership	2.555*		-0.512	
	(1.316)		(0.312)	
Age	1.188*		-0.237	
	(0.670)		(0.281)	
Firm size	-0.101**		-0.060**	
	(0.048)		(0.028)	
Big4	-0.231		0.001	
	(0.208)		(0.036)	
R&D		-0.732		-3.101
		(4.560)		(2.513)
Leverage		1.220**		0.662
		(0.479)		(0.450)
Growth		0.156		0.137
		(0.097)		(0.102)
ROA		-3.545**		-1.872
		(1.527)		(1.293)
Tobin's Q		0.013		0.028
		(0.038)		(0.028)
Stock returns		-0.190**		-0.048
		(0.083)		(0.056)
Abnormal volatility		2.916**		0.710
		(1.471)		(0.642)
Abnormal turnover		0.515		0.025
		(0.318)		(0.112)
Constant	-3.276	-0.969	1.540	0.368
	(2.191)	(1.201)	(1.294)	(0.430)
Year dummies	Yes	Yes	Yes	Yes
Industry dummies	Yes	Yes	Yes	Yes
Location dummies	Yes	Yes	Yes	Yes
Log likelihood		-1169.698		-1882.876
Chi-squared		56.39***		44.39***
Observations	8,534	8,534	12,128	12,128

P(F) is the probability of fraud commitment and P(D|F) is the probability of fraud detection conditional on fraud commitment. ***, ** and *, denote statistical significance at the 1%, 5% and 10% levels respectively.

Table 5: Instrumental variable approach

Instrumental variable regression			
	1st stage	2nd stage	
Variables	Female leader proportion	Fraud	
		P(F)	P(D|F)
Female_Industry	0.964***		
	(0.007)		
Female labor participation	0.976***		
	(0.287)		
Female		-2.205***	2.497*
		(0.831)	(1.316)
Other variables	Controlled	Controlled	Controlled
Year dummies		Yes	Yes
Industry dummies		Yes	Yes
Location dummies		Yes	Yes
R-squared	0.519		
Log likelihood			-3034.974
F-statistics	20.21***		
Sargan statistic test (p-value) (overidentification test of all instruments)	0.881(0.348)		
Cragg-Donald (CD) Wald F-statistic	9485.265		
Stock and Yogo (2005) ID test for critical values: 10% maximal IV	19.93		
Anderson canon. corr. LM statistic for under-identification test	9894.829***		
Observations	20,662	20,662	20,662

Table 5 reports the instrumental variable (IV) regression results. The endogenous variable is the proportion of female corporate leaders. The instrumental variables are Female_Industry and female labor participation ratio. Female_Industry is the proportion of women corporate leaders in the firm's 2-digit CSRC coded industry within each province per year. Female labor participation ratio refers to the proportion of female labor participation rate in the Chinese province where a company has its headquarter. Column 1 reports the first-stage estimation results while Columns 2 and 3 report the second-stage results. P(F) is the probability of fraud commitment and P(D|F) is the probability of fraud detection conditional on fraud commitment. ***, ** and *, denote statistical significance at the 1%, 5% and 10% levels.

Table 6 Robustness tests: Females on a board of directors (BOD), female independent directors, females on a board of supervisors (BOS), female senior managers and financial statement fraud

	Model 1		Model 2		Model 3		Model 4	
Variables	P(F)	P(D|F)	P(F)	P(D|F)	P(F)	P(D|F)	P(F)	P(D|F)
Female BOD	-0.954	2.337*						
	(0.628)	(1.220)						
Female independent directors			-3.258**	6.073**				
			(1.561)	(2.951)				
Female BOS					-2.660***	4.834***		
					(0.822)	(1.531)		
Female managers							0.566	-0.570
							(0.665)	(0.740)
Institution	-0.438*	0.441	-0.604**	0.686	-0.741***	0.950**	-0.261	0.116
	(0.259)	(0.452)	(0.307)	(0.476)	(0.241)	(0.400)	(0.175)	(0.220)
Duality	0.037		0.035		0.050		0.041	
	(0.036)		(0.036)		(0.038)		(0.029)	
SB size	-0.019		-0.016		-0.025*		-0.023**	
	(0.012)		(0.013)		(0.013)		(0.012)	
SB meeting	0.001		0.001		-0.002		-0.001	
	(0.006)		(0.006)		(0.006)		(0.005)	
CEO ownership	0.059		-0.011		0.128		-0.013	
	(0.191)		(0.179)		(0.183)		(0.140)	
Age	-0.040		-0.105		0.149		0.065	
	(0.211)		(0.203)		(0.200)		(0.162)	
Firm size	-0.060***		-0.058**		-0.047**		-0.029**	
	(0.019)		(0.029)		(0.019)		(0.012)	
Big4	-0.007		-0.012		0.011		0.002	
	(0.041)		(0.038)		(0.038)		(0.031)	
R&D		-4.474*		-4.425		-1.353		-0.027
		(2.407)		(3.390)		(1.611)		(0.890)
Leverage		0.856**		0.747		0.716**		0.415***
		(0.337)		(0.536)		(0.343)		(0.129)
Growth		0.154**		0.117		0.131*		0.060**
		(0.073)		(0.089)		(0.069)		(0.026)
ROA		-2.779**		-2.442		-2.515**		-1.619***
		(1.167)		(1.808)		(1.242)		(0.559)
Tobin's Q		0.047*		0.041		0.039		0.037***
		(0.026)		(0.032)		(0.024)		(0.014)
Stock returns		-0.043		-0.043		-0.132**		-0.074***
		(0.049)		(0.049)		(0.067)		(0.026)
Abnormal volatility		1.089*		1.007		1.193*		0.714**
		(0.638)		(0.834)		(0.682)		(0.328)
Abnormal turnover		0.191		0.174		0.180		0.140*
		(0.141)		(0.172)		(0.135)		(0.077)
Constant	0.534	-0.218	0.873	-0.231	-0.272	0.209	-0.774	1.169*
	(0.878)	(0.676)	(0.975)	(0.953)	(0.783)	(0.519)	(0.791)	(0.697)
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Location dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	20,662	20,662	20,662	20,662	20,662	20,662	20,662	20,662

P(F) is the probability of fraud commitment and P(D|F) is the probability of fraud detection conditional on fraud commitment. ***, ** and *, denote statistical significance at the 1%, 5% and 10% levels, respectively.

Table 7: Robustness tests: Considering capital expenditures and mergers & acquisitions

More variables are added into models		
	P(F)	P(D|F)
Female	-1.421***	2.029***
	(0.519)	(0.737)
Capex		-0.660
		(0.930)
Noma	0.007	-0.004
	(0.009)	(0.010)
Constant	1.084	-0.602
	(1.623)	(1.744)
Other variables	Controlled	Controlled
Year dummies	Yes	Yes
Industry dummies	Yes	Yes
Location dummies	Yes	Yes
Log likelihood		-3018.498
Chi-squared		125.23***
Observations	20,649	20,649

In Panel A, Noma refers to the number of merger & acquisitions per year for a listed firm, and Capexr refers to a firm's capital expenditures to its total assets. P(F) is the probability of fraud commitment and P(D|F) is the probability of fraud detection conditional on fraud commitment. ***, ** and *, denote statistical significance at the 1%, 5% and 10% levels.

Table 8 Robustness tests: SOEs and anti-corruption campaign

	SOEs & Pre-anti-corruption campaign		SOEs & Post-anti-corruption campaign		Non-SOEs & Pre-anti-corruption campaign		Non-SOEs & Post-anti-corruption campaign	
Panel A: female corporate leaders, SOEs, and anti-corruption campaign								
	Model 1		Model 2		Model 3		Model 4	
Variables	P(F)	P(D|F)	P(F)	P(D|F)	P(F)	P(D|F)	P(F)	P(D|F)
Female	-0.455	0.334	-0.991*	1.531**	-2.371***	4.769***	-1.535**	1.924*
	(0.523)	(0.556)	(0.585)	(0.766)	(0.829)	(1.649)	(0.665)	(1.136)
Control variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year & Industry & Location dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	5,167	5,167	5,444	5,444	3,367	3,367	6,684	6,684
Panel B: female board of directors (BOD), SOEs, and anti-corruption campaign								
	Model 1		Model 2		Model 3		Model 4	
Variables	P(F)	P(D|F)	P(F)	P(D|F)	P(F)	P(D|F)	P(F)	P(D|F)
Female BOD	-2.973	4.353	-1.380**	2.306*	-2.144*	4.662**	-2.306*	4.355**
	(2.478)	(4.014)	(0.693)	(1.177)	(1.274)	(1.880)	(1.254)	(1.864)
Control variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year & Industry & Location dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	5,167	5,167	5,444	5,444	3,367	3,367	6,684	6,684
Panel C: female board of supervisors (BOS), SOEs, and anti-corruption campaign								
	Model 1		Model 2		Model 3		Model 4	
Variables	P(F)	P(D|F)	P(F)	P(D|F)	P(F)	P(D|F)	P(F)	P(D|F)
Female BOS	-1.627	1.886	-2.553*	4.407*	-3.726**	6.763**	-4.933***	3.495*
	(1.982)	(2.221)	(1.425)	(2.310)	(1.601)	(3.182)	(1.862)	(1.889)
Control variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year & Industry & Location dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	5,167	5,167	5,444	5,444	3,367	3,367	6,684	6,684
Panel D: female management, SOEs, and anti-corruption campaign								
	Model 1		Model 2		Model 3		Model 4	
Variables	P(F)	P(D|F)	P(F)	P(D|F)	P(F)	P(D|F)	P(F)	P(D|F)
Female Management	4.269	-3.636	3.057	0.466	-1.910	-0.220	-1.830	1.746
	(2.774)	(4.425)	(2.619)	(1.211)	(2.624)	(1.171)	(2.892)	(2.895)
Control variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year & Industry &	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	5,167	5,167	5,444	5,444	3,367	3,367	6,684	6,684
Panel E: female corporate leaders, more control variables, SOEs, and anti-corruption campaign								
	Model 1		Model 2		Model 3		Model 4	
Variables	P(F)	P(D|F)	P(F)	P(D|F)	P(F)	P(D|F)	P(F)	P(D|F)
Female	-1.457	1.799	-1.538*	3.036**	-2.865**	3.504**	-1.385**	2.129**
	(1.016)	(1.319)	(0.854)	(1.286)	(1.327)	(1.633)	(0.639)	(0.881)
Capex		-0.557		-3.078		-3.237*		-0.255
		(0.673)		(2.367)		(1.727)		(0.764)
Noma	0.094**	-0.114***	-0.055**	0.076	-0.002	0.036	0.006	-0.003
	(0.037)	(0.043)	(0.024)	(0.069)	(0.019)	(0.027)	(0.010)	(0.014)
Year & Industry & Location dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	5,165	5,165	5,443	5,443	3,360	3,360	6,681	6,681

P(F) is the probability of fraud commitment and P(D|F) is the probability of fraud detection conditional on fraud commitment. ***, ** and *, denote statistical significance at the 1%, 5% and 10% levels respectively.

Appendix 1: Comparison of fraud against non-fraud firms in gender diverse versus non-gender diverse sub-groups[9]

Variables	**Non-gender diverse firms**			**Gender diverse firms**		
	Non-fraud firms	Fraud firms	Mean difference	Non-fraud firms	Fraud firms	Mean difference
Female	0.000	0.000	0.000	0.176	0.186	-0.011***
SOEs	0.666	0.554	0.112*	0.505	0.411	0.094***
Anti-corruption	0.458	0.477	-0.019	0.596	0.632	-0.036*
Institution	0.205	0.164	0.041	0.240	0.193	0.047***
Duality	0.140	0.154	-0.014	0.201	0.234	-0.033**
Big4	0.169	0.062	0.107**	0.153	0.134	0.018
SB size	3.910	3.600	0.310*	3.795	3.675	0.120**
SB meeting	4.535	4.215	0.319	4.750	4.674	0.076
CEO ownership	0.010	0.011	-0.001	0.023	0.023	0.000
Firm size	22.309	22.016	0.293	22.039	21.673	0.366***
Age	3.881	3.882	-0.001	3.865	3.858	0.007***
R&D	0.008	0.006	0.002	0.009	0.008	0.001***
Leverage	0.503	0.599	-0.096***	0.479	0.543	-0.064***
Growth	0.193	0.201	-0.008	0.213	0.244	-0.031
ROA	0.037	-0.003	0.040***	0.039	0.010	0.030***
Tobin's Q	1.744	1.452	0.292	2.105	2.391	-0.287***
Stock returns	0.382	0.215	0.167	0.321	0.254	0.067**
Abnormal volatility	-0.010	0.002	-0.012*	-0.008	0.003	-0.011***
Abnormal turnover	-0.012	0.040	-0.052**	-0.002	0.041	-0.043***

[9] We define the gender diverse group as those observations with at least one female leader and non-gender diverse group with no female leader. There are 1,563 non-gender diverse observations, including 1,498 non-fraud observations and 65 fraud observations. In contrast, there are 19,099 observations in the gender diverse group, including 18,406 non-fraud observations and 693 fraud observations respectively. For the gender diverse group, the average proportion of female corporate leaders for the non-fraud sub-sample is 17.59% and 18.64% for the fraud subsample, indicating that a higher proportion of female corporate leaders is associated with higher likelihood of fraud detection.

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