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Does Cooperation Among Women Enhance or Impede Firm Performance?

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Abstract

Based on the notion that women cooperate more with women than with men, we investigate whether women managers work more effectively when monitored by women directors. We find that when a firm has women as its top managers, its accounting profitability increases with the proportion of women on the board of directors. However, the improvement in profitability is associated with earnings management. We show that women are likely to be appointed to precarious leadership positions, which puts pressure on them to ameliorate the weak earnings performance. Finally, consistent with the interaction between women resulting in an unfavourable response from investors, we document a negative stock market reaction to the appointment of female top managers in the presence of women on the board.

JEL classification: G10, G34

Keywords: Female interaction; top management; board of directors; firm performance; glass cliff

1. Introduction

In light of regulatory and social efforts to increase female representation in top corporate positions, academic literature has investigated the impact of women in top positions on corporate performance and policies. Some studies focus on female representation in top managerial positions, such as chief executive officer (CEO) and chief financial officer (CFO) (e.g. Adhikari, Agrawal & Malm, 2019; Faccio, Marchica & Mura, 2016; Huang & Kisgen, 2013). Other studies examine the relation between female representation on the board of directors and corporate outcomes such as firm performance (Adams & Ferreira, 2009), earnings quality (Gull, Nekhili, Nagati & Chtioui, 2018; Srinidhi, Gul & Tsui, 2011) and risk-taking (Adams & Ragunathan, 2017; Sila, Gonzalez & Hagendorff, 2016). While both corporate managers and boards of directors serve very important roles in corporations, most previous studies examine them in isolation. Since the behavioural economics literature suggests that women tend to cooperate better with other women (e.g. Eckel & Grossman, 2001; Greig & Bohnet, 2009; Kunze & Miller, 2017), the influence of women in various roles in corporations could be more than additive: having women working both as top managers and on the board of directors could influence firm policies in different ways when compared to only having women as top managers or as directors. Our study contributes to the literature by examining how female representation in top managerial positions interacts with female representation on the board of directors.

How the interaction between female top managers and female directors influences corporate performance is far from obvious. On the one hand, it could hinder firm performance, as greater cooperation between female managers and female directors tends to compromise the independence of the board of directors and, as a result, impede board monitoring and oversight.

On the other hand, female interaction could improve firm performance, as having women as both top managers and directors tends to facilitate information exchange between the top management team and the board. The effective interaction thus enhances the board's advisory role for top management, which leads to better strategic decisions that increase operational efficiency and profitability. Due to these two opposing theoretical forces, the collective effect of female interaction remains an open empirical question.

We employ a sample of Chinese listed firms to study the interaction between women in top management and on the board. China offers a unique setting to investigate this issue for at least two reasons. First, a considerable number of female professionals have risen to top positions in Chinese firms. The representation of women in leadership positions is considerably higher than in US firms.¹ This allows for greater variation in gender-related variables, which can be used to identify (if present) a female interaction effect. Simply put, it is impossible to examine gender-related issues if there are no women holding leadership roles. Second, because of China's strict implementation of the one-child policy over the past thirty years, women are likely to have as many opportunities as men in terms of education and upbringing (Tsui & Rich, 2002). There is evidence that educational resources in China allocated to women have multiplied and that women's college enrolment has substantially increased since the 1990s (Wu & Zhang, 2010). It is less likely that women in Chinese corporations are mere tokens, which enables us to circumvent the challenge of dealing with tokenism in current studies that use US or European data (e.g.

¹ The difference between China and the US in terms of women's occupancy of leadership positions is striking. Between 2000 and 2014, women on average held 11.2% of board seats, 26.2% of CFO positions and 5.0% of CEO positions in Chinese listed firms. In comparison, women in US listed firms held 10.0% of board seats, 8.8% of CFO positions and 2.2% of CEO positions.

Ahern & Dittmar, 2012; Lee & James, 2007; Matsa & Miller, 2013).

We estimate the relation between female interaction and firm performance using a panel dataset of 2,325 Chinese listed firms between 2000 and 2014. We classify firms as having women in top managerial positions if either the CEO or the CFO of the firm is female. We use the proportion of directors who are women to proxy for the presence of women on the board of directors. We find that when a firm has women in top managerial positions, its return on assets (ROA) increases with the proportion of women in the boardroom.

The accounting literature generally maintains that ROA, as a backward-looking measure, is related to specific corporate financial reporting strategies. More critically, there is evidence suggesting that ROA is frequently distorted by accrual-based earnings management (Burgstahler & Dichev, 1997). Indeed, we find that a higher degree of earnings management inflates ROA, which supports Dechow, Sloan and Sweeney's (1995) argument that using discretionary accruals is a way for management to achieve a desired level of earnings. Crucially, we provide evidence showing that female interaction has a positive association with earnings management, which in turn inflates the accounting rate of profitability.

The positive relation between female interaction and earnings management could be a result of firms' underperformance putting pressure on women – particularly those who are new to leadership positions. There is some evidence demonstrating that women are more likely than men to be appointed to precarious leadership positions in times of crisis or financial downturn (Ryan & Haslam, 2005, 2007). This is the well-known 'glass cliff' from which female top managers tend to fall. Recent examples include Marissa Mayer, who became the CEO of Yahoo in 2012, when the company reported a dramatic profit decline relative to its competitors Google and

Facebook, and Theresa May, who was appointed the United Kingdom's prime minister in 2016 to handle Brexit negotiations and subsequently bowed to intense pressure to resign. Women on glass cliffs confront mounting pressure to turn around failing businesses or deteriorating situations. In the face of increasing pressure to perform, female top managers have motives to manage reported earnings, which could be facilitated through their cooperation with female directors.

We find empirical evidence in support of this conjecture. First, our results indicate a glass cliff phenomenon prevailing in Chinese firms. In our sample, women are more likely than men to be appointed as CEOs or board directors to weakly performing firms. Second, female interaction has a significant and positive association with ROA only in the first year of tenure after female top managers step up to leadership positions, while the association disappears after one year. This finding suggests that as female top managers become more entrenched in their firms over time, the dampened performance pressure discourages their tendency to behave opportunistically (Morck, Shleifer & Vishny, 1988). Our further evidence shows that the interaction between *new* female top managers and female directors exacerbates earnings management only in the worst-performing firms. Those women who are appointed in the most precarious situations are likely to feel excess pressure to perform. Our results are also robust to different methodologies that mitigate endogeneity concerns.

If the increased accounting returns are associated with earnings management, the weakened earnings reporting quality could hurt investor interests and depress stock prices. Consistent with this expectation, our results show that the appointment of female top managers to firms with gender-diverse boards induces a negative short-term cumulative abnormal return.

In addition, we examine the long-term stock market reaction to the appointment of female top managers. We document a negative and significant buy-and-hold return during their first year post appointment, whereas the buy-and-hold return becomes statistically insignificant after the first year. The results reinforce our argument that female top managers face strong pressure in their initial year in office. Finally, we further alleviate endogeneity concerns by using female directors' sudden deaths as an exogenous shock to female interaction. We document positive abnormal returns to the weakened interaction between women following female directors' sudden deaths.

This paper makes two main contributions to gender-related studies in accounting and finance. First, our paper adds to the emerging research on impacts of gender interactions in corporations. Our analysis follows a similar vein to Amore, Garofalo and Minichilli (2014), who examine private family firms in Italy and document a positive effect of the interaction between female managers and female directors on firm performance. Our paper is also closely related to Flabbi, Macis, Moro and Schivardi (2019), who study the interaction between female managers and female employees using a sample of Italian manufacturing firms, the majority of which are private firms. Their article finds that the performance of firms led by female managers improves as the share of women in these firms' workforce increases. These existing studies primarily focus on private firms and therefore rely on the quality and credibility of reported accounting information as a performance proxy. Our study employs Chinese public firms to assess the stock market impact of female interaction and unveils a key, previously undocumented feature: female interaction leads to a short-lived increase in accounting-based profitability, but this is at least partially associated with earnings management, which ultimately depresses stock prices.

Second, our paper advances the glass cliff literature by analysing how challenges facing women in precarious leadership positions shape their strategies and actions to overcome those challenges. Our study relates to the ongoing debate on the existence and prevalence of the glass cliff phenomenon. For example, Ryan and Haslam (2005, 2007) observe glass cliff appointment patterns in UK firms, while Adams, Gupta and Leeth (2009) and Bechtoldt, Bannier and Rock (2019) find no evidence of the glass cliff phenomenon in US and German firms. Specifically, our paper contributes to these previous studies by uncovering evidence of the glass cliff facing female top managers in Chinese public firms. While the existing literature suggests that women on the glass cliff encounter heightened scrutiny and pressure to outperform their male counterparts (e.g. Glass & Cook, 2016), their subsequent attempts to counteract such pressure remain unknown. Our study fills this gap by showing the consequence of the glass cliff on female interaction in Chinese corporations.

The rest of the paper is organised as follows. Section 2 summarises the literature and develops the testable hypotheses. Section 3 describes the data and research methodology. Sections 4-6 present the empirical results. Section 7 concludes the paper.

2. Literature review and hypotheses development

2.1. Gender interaction between top managers and the board of directors

CEOs and CFOs, who often play the most influential roles in top management teams, have frequent interactions with boards of directors. The board serves two primary functions in these interactions. First, the board acts as a monitoring mechanism to address agency conflicts between managers and shareholders. Boyd (1994) and Chhaochharia and Grinstein (2009) find that effective board monitoring compromises CEOs' ability to pursue excess compensation.

Borokhovich, Parrino and Trapani (1996) show that in firms with more independent boards, CEOs are more likely to be appointed from outside the firms. Hoitash, Hoitash and Johnstone (2012) document that CFOs in firms with stronger board governance experience a larger decline in compensation following an improvement in internal control disclosure. The second function of the board is to provide professional expertise and advice to assist in managerial decision-making. Westphal (1999) finds that CEOs who have social ties (e.g. friendships) with board directors are more likely to receive expert support from the board. Haynes and Hillman (2010) document that board directors' human and social capital propels corporate strategy changes; however, this finding weakens in the presence of a powerful CEO.

In light of these dynamic relationships between CEOs/CFOs and boards of directors, we expect gender similarity to influence the nature of their interactions. Socio-economic research suggests that women cooperate more with women than with men. As Maccoby (1988) discusses, girls and boys are segregated when they are very young and are continually exposed to different gender groups for much of their childhood. Girls' same-sex relationships are characterised by cooperation and interpersonal harmony, while boys' same-sex relationships exhibit an inclination to compete and dominate (Maccoby, 1990). Such gender differences in attitudes and behaviours continue to manifest in adulthood. An experimental study by Eckel and Grossman (2001) shows that agreements among women are more easily achievable and that women are more likely to accept offers made by other women. Greig and Bohnet (2009) find that in Kenya women contribute more to the provision of public goods in all-female groups than in mixed-sex groups. This finding indicates that there is greater cooperation among women than men in daily life.

Academic evidence also illustrates that women in leadership positions tend to help other

women. Matsa and Miller (2011) find that firms with a higher proportion of women on the board tend to appoint more women to their top management teams. They interpret this finding as evidence of ‘women serving in positions of corporate leadership to help other women advance to top management’ (Matsa & Miller, 2011, p. 635). Weber and Zulehner (2010) show that start-up firms with women among the first appointments hire more women in the future. Price (2012) and Tate and Yang (2015) find that the presence of female leadership reduces wage disparity between female and male employees. Kunze and Miller (2017) report that greater female representation in leadership positions improves promotion rates for women in lower ranks. Taken together, it is plausible to expect that female top managers cooperate more with female directors than with male directors.

2.2. Hypotheses development

Interaction between female top managers and female directors can bring about two opposing effects on firm performance. The collective effect is thus an empirical question. On the one hand, female interaction could dampen the monitoring efficacy of the board of directors. Considering that a high level of gender similarity fosters trust and cooperation (Carli, 2001), female top managers are more likely to exert influence over the board if there are more women sitting on the board. Since the board is responsible for monitoring top management teams and overseeing the overall business, it should maintain an appropriate degree of independence to detect and discipline managerial misconduct (Hermalin & Weisbach, 1998; Shivdasani & Yermack, 1999). As close interaction among women connects the board to top management (Coles, Daniel & Naveen, 2014; Khanna, Kim & Lu, 2015; Lee, Lee & Nagarajan, 2014), the effectiveness of board monitoring could be undermined, leading to inferior firm performance

(Core, Holthausen & Larcker, 1999; Rosenstein & Wyatt, 1990).

On the other hand, interaction between female top managers and female directors could encourage the board to provide extra support to top management. Due to the strengthened cooperation, female top managers have opportunities to benefit from efficient information exchange with female directors. Female directors can also offer additional expert advice and knowledge to female top managers in the decision-making process (Adams & Ferreira, 2007). The improved operational efficiency leads to higher firm profitability. Further, more women rising to top levels of corporations could create a female-friendly corporate culture (Matsa & Miller, 2011; Tate & Yang, 2015). This prompts an equal and vibrant environment in which women can thrive and better perform, thereby enhancing firm performance.

Therefore, we formulate two competing hypotheses, as follows:

H1 (Board Independence Hypothesis): Interaction between female top managers and female directors impedes firm performance.

H2 (Operational Efficiency Hypothesis): Interaction between female top managers and female directors improves firm performance.

3. Data and research design

3.1. Sample construction

Our sample consists of all public firms listed on the Shanghai and Shenzhen Stock Exchanges with top management characteristics, board composition and firm-level financial statement data available on the China Stock Market and Accounting Research (CSMAR) database. In Chinese firms, the top executive officer in charge of major business operations is either the CEO or the chief manager (CM). If a firm has no CEO but has a CM, we take the

person holding the CM position to be the CEO. If a firm has both a CEO and a CM, we retain only the CEO. CFOs play a crucial role in the financial reporting process and thus affect the quality of reported earnings information (Barua, Davidson, Rama & Thiruvadi, 2010; Francis, Hasan, Park & Wu, 2015). As the sample of female CEOs alone is too small to yield any meaningful results, we follow Huang and Kisgen (2013) and include both CEOs and CFOs in our analysis. We then exclude financial and utility firms from our sample. The final sample comprises 17,585 firm-year observations from 2,325 firms over the period 2000 to 2014.

3.2. Empirical model

We examine the association between female interaction and firm profitability by estimating the following regression model:

$$\begin{aligned}
 \text{Firm profitability}_{i,t} &= \alpha_0 + \beta_1 \text{Female top manager}_{i,t} + \beta_2 \% \text{Female directors}_{i,t} \\
 &+ \beta_3 (\text{Female top manager}_{i,t} \times \% \text{Female directors}_{i,t}) \\
 &+ \sum \text{CONTROLS}_{i,t-1} + \text{Industry dummies} + \text{Year dummies} + \varepsilon_{i,t}
 \end{aligned} \tag{1}$$

where firm profitability is measured by *ROA*. *Female top manager* is a dummy variable equal to one if either the CEO or the CFO is female and zero if both are male. The dummy variable is constructed in a way that allows us to compare the presence of women as either the CEO or the CFO to the base group of firms that have both a male CEO and a male CFO. *%Female directors* is the proportion of female directors on the board. The interaction term, *Female top manager* \times *%Female directors*, captures the magnitude of female interaction.² The coefficient β_1

² We also use an alternative measure to capture female interaction. Based on the idea that female top managers having longer shared work experience with female directors constitutes greater female interaction, we measure female interaction using the overlap in tenures between female top managers and female

measures the effect of either the CEO or the CFO being female on firm profitability when *%Female directors* is set to zero (i.e. no women are on the board). β_2 measures the effect of female directors on firm profitability when *Female top manager* is set to zero (i.e. both the CEO and the CFO are male). β_3 measures how the difference in profitability between firms with either a female CEO or a female CFO and firms with both a male CEO and a male CFO varies with the proportion of women on the board. Since some CEOs and CFOs may also sit on the board, we construct an alternative proxy for board gender diversity, *%Other female directors*, which is the number of female directors, excluding those who are also the CEO or CFO of the firm, scaled by board size.

Consistent with the existing literature on gender diversity (Adams & Ferreira, 2009; Dezsö & Ross, 2012; Liu, Wei & Xie, 2014), our regression model controls for board characteristics and top management team characteristics. Yermack (1996) shows that firms with smaller boards tend to underperform. Core et al. (1999) and Rosenstein and Wyatt (1990) find that board independence is related to corporate governance quality and firm performance. Haleblan and Finkelstein (1993) document a relation between top management team size and firm performance. Thus, we control for the natural logarithm of the number of directors on the board ($\ln(\text{Board size})$), the proportion of independent directors on the board (*%Independent directors*) and the natural logarithm of the number of managers in the top management team ($\ln(\text{Management size})$).³

directors, constructed in the style of Zhang (2019). Our main conclusion based on this measure continues to hold. We thank an anonymous referee for suggesting this measure.

³ We define the top management team as all managers recorded in the top executive file of the CSMAR database.

We also include a wide array of firm-level characteristics as control variables. Fama and French (1998) document an inverse relation between leverage and firm value. Brush, Bromiley and Hendrickx (2000) show that sales growth is positively related to firm performance. Yermack (1996) finds that larger firms have better performance. Peng (2004) shows that younger Chinese firms have more effective governance structure and achieve better accounting performance. Mikkelsen and Partch (2003) demonstrate that high cash holdings can promote corporate investment without hindering firm performance. Eberhart, Maxwell and Siddique (2004) document an improvement in firms' operating performance following an increase in research and development spending. McConnell and Muscarella (1985) point out that firms seek to make capital investments that maximise shareholder value. Given these existing findings, we control for leverage ratio (*Leverage*), sales growth ($\ln(1+Sales\ growth)$), firm size ($\ln(Assets)$), firm age ($\ln(Firm\ age)$), cash holding (*Cash*), research and development expenditures (R&D) and capital investment expenses (*Capital expenditure*).

In addition, we control for ownership structure measures of *Government ownership*, *Institutional ownership* and *Managerial ownership*. The relation between government ownership and firm performance in China is less conclusive. Chen, Firth and Xu (2009) show that government ownership has a positive impact on firm performance, while Wei, Xie and Zhang (2005) document a negative relation between the two. Regarding the effects of the other two ownership types, McConnell and Servaes (1990) find that institutional investors have incentives to monitor and discipline managers to create corporate value. Coles, Lemmon and Meschke (2012) suggest that increasing managerial ownership up to a certain critical level can benefit shareholder value. We summarise all the variable definitions in Appendix 1.

Consistent with Amore et al. (2014), the control variables are lagged by one year relative to the dependent variable. Industry dummies and year dummies are included to account for industry-wide and yearly aggregate economic fluctuations, respectively. Equation (1) is estimated using ordinary least squares (OLS) regressions with robust standard errors clustered at the firm level.

4. Baseline results

4.1. Descriptive statistics

In Table 1, Panel A compares the gender diversity variables between Chinese firms and US firms. The mean value of the dummy indicator *Female top manager* in Chinese firms is 0.294, which is significantly higher than the mean of 0.042 in US firms. More specifically, the proportion of Chinese firms with female CEOs (5.0%) is more than twice that of US firms (2.2%). The proportion of Chinese firms with female CFOs (26.2%) is nearly thrice that of US firms (8.8%). On average, 11.2% of board members in Chinese firms are women, which is similar to the proportion of women on the board in US firms (10.0%). Panel B presents the summary statistics of accounting measures and control variables for listed firms in China. The average ROA is 4.8%. The average board has nine directors. Independent directors represent 34.5% of all board members. The top management team in an average firm consists of six managers.

<Insert Table 1 about here>

4.2. Female interaction and firm profitability

In Table 2, we present regression results for assessing the association between female interaction and ROA. In column 1, both the main effects of *Female top manager* and *%Female*

directors are statistically insignificant. This result suggests that when there are no female directors (i.e. *%Female directors* is set to 0), the presence of a female CEO/CFO has no significant effect on ROA; vice versa, when there is no female leadership in top management (i.e. *Female top manager* is set to 0), female directors are unlikely to influence ROA. The coefficient on the interaction term, *Female top manager* \times *%Female directors*, is positive and significant at the 5% level. This relation indicates that firms led by either a female CEO or a female CFO will only be different from male-led firms (i.e. a firm led by both a male CEO and a male CFO) if female top managers work alongside a gender-diverse board. A higher ROA is associated with a larger proportion of women on the board interacting with at least one female top manager. We find similar results in column 2 by using the alternative board gender diversity measure *%Other female directors*, which excludes cases where female CEOs/CFOs also serve as directors on the board. To address the omitted variable bias associated with unobserved time-invariant factors, we re-estimate the above relations by including firm fixed effects in columns 5 and 6 of Table 2. Our results are qualitatively unchanged.

<Insert Table 2 about here>

The accounting rates of returns could be manipulated by top management through accrual-based earnings management (Burgstahler & Dichev, 1997). In columns 3 and 4 of Table 2, we include earnings management as an additional explanatory factor for ROA. Following prior work (e.g. Aboody, Hughes & Liu, 2005; Bharath, Sunder & Sunder, 2008; Doyle, Ge & McVay, 2007), we measure *Earnings management* as the signed value of discretionary accruals estimated for a given year using Dechow and Dichev's (2002) model. We find that more aggressive earnings management inflates accounting profitability, consistent with Burgstahler and Dichev's (1997)

argument that managers often engage in accruals management to improve reported profitability. A firm fixed effects specification in columns 7 and 8 of Table 2 leads to a similar conclusion regarding the relation between earnings management and ROA.

With regard to the control variables, board independence is positively associated with ROA, consistent with the result documented in Liu, Miletkov, Wei and Yang (2015). The size of top management teams is negatively related to ROA, possibly because larger team size creates coordination and communication problems (see a discussion in Halebian & Finkelstein, 1993). Leverage is negatively related to ROA, which corroborates the notion that high leverage may reflect potential problems in firm profitability (Fama & French, 1998). Sales growth is significantly positively associated with ROA, in line with Brush et al. (2000), who argue that sales growth enables firms to fully employ production capacity to increase profits. Cash holding is positively related to ROA, which supports the argument that firms with large cash reserves can benefit from low costs of internal financing (Mikkelson & Partch, 2003). We find that firms with large government ownership tend to achieve better performance, consistent with the viewpoint that government ownership has the advantage of exercising monitoring and providing strategic advice for firms operating in a weak legal environment (Chen et al., 2009).

4.3. Female interaction and earnings management

As shown in the previous section, accounting rates of profitability can be inflated when managers manage discretionary accruals upwards. The observed positive relation between female interaction and accounting returns may be associated with earnings management. As we argued when developing the *Board Independence Hypothesis*, increased interaction between female directors and female managers ties the board to top management and potentially undermines

board monitoring. The weaker board governance can yield a negative impact on accounting quality (Agrawal & Chadha, 2005). Thus, it is reasonable to expect that female interaction facilitates opportunistic earnings management, which in turn inflates accounting returns.

In Table 3, we examine the association between female interaction and earnings management. The coefficient on the interaction term, *Female top manager* \times *%Female directors*, is positive and statistically significant in column 1. This result indicates that when a firm has women as both top managers and board directors, its discretionary accruals tend to be biased upwards, exaggerating reported earnings. The finding continues to hold when using the alternative board gender diversity measure *%Other female directors*, which excludes those female CEOs/CFOs holding directorships (see column 2), and when firm fixed effects are included to control for time-invariant unobserved heterogeneity at the firm level (see columns 3 and 4). Collectively, our evidence corroborates the idea that interaction between female top managers and female directors is inversely related to financial reporting quality, which in turn affects reported accounting profitability.

<Insert Table 3 about here>

4.4. Endogeneity

While our results in Tables 2 and 3 are robust to the inclusion of firm fixed effects, it is still possible that the relations between female interaction, accounting profitability and earnings management are subject to endogeneity. For example, a significant shock to unobservable characteristics such as corporate culture may lead to a change in women's representation in leadership positions and concurrently affect corporate performance or financial reporting. These shocks are likely to be time-varying and unobservable, such that their influences cannot be

alleviated by the inclusion of firm fixed effects.

In this section, we show that our results continue to hold when we adopt an instrumental variable approach to mitigating the endogeneity bias. Our three gender-related variables, i.e. *Female top manager*, *%Female directors* and their interaction, are likely to be endogenous. At a minimum, we must find two instrumental variables. Then their multiplication constitutes a third instrument (Wooldridge, 2010). To carry out overidentification tests, we need a fourth instrument in addition to the first three.

We construct a set of instruments in the style of Flabbi et al. (2019), who instrument female leadership measures by using their base-year values multiplied by the aggregate growth in the relevant female leadership measures at the regional level. This strategy assumes that aggregate trends in the gender composition of the leadership team and the board at the regional level are unrelated to the time-varying firm-level heterogeneity that leads to endogeneity. Regional trends can serve as valid instruments because the trends are correlated with the relevant gender measures in each firm within the region (thus the relevance condition is fulfilled), but are not directly associated with corporate performance or financial reporting in a specific firm (thus the exogeneity condition is satisfied). As an instrument for the presence of female top managers, we use the fraction of women in the top management team at the beginning of the sample period for each firm, multiplied by the annual regional growth of this fraction relative to the base year.⁴ This instrument is denoted as *Regional trend in %female executives*. The instrument for women's representation on the board of directors is constructed analogously by

⁴ The annual regional growth is the growth rate in the average fraction of women in top management across all firms in a province in a given year, relative to the base-year average.

using the base-year fraction of women on the board of directors multiplied by its annual regional growth relative to the base year. We denote this instrument as *Regional trend in %female directors*. The multiplication of these two instruments constitutes a third instrument. Because each firm’s base-year values are used to construct instruments, we exclude the base year observations from the regression analysis in order to satisfy the exogeneity condition. We then use province-level annual *GDP growth* as a fourth instrument, since regional economic growth may be correlated with women’s opportunities for empowerment and advancement.

In Table 4, we present the two-stage-least-squares (2SLS) regression results by employing the four instruments. The dependent variables in Panels A and B are ROA and earnings management, respectively. Columns 1 to 3 in both panels present the first-stage regressions, and column 4 presents the second-stage 2SLS results. Consistent with our previous results based on OLS and firm fixed effects, we find that the *instrumented* female interaction is positively and significantly associated with both ROA and earnings management.

<Insert Table 4 about here>

Table 4 also includes various specification tests for the validity of our instrumental variables. The first set of tests is for weak instruments and is carried out in two ways. First, for each first-stage regression, we report the first-stage F -statistic. All these statistics are statistically significant at the 1% level, indicating that weak instruments are not likely to be an issue. As our regressions include multiple endogenous regressors, we also report the Kleibergen-Paap Wald rk F statistic, which is a formal test of the null hypothesis that our model suffers from weak instruments. The Kleibergen-Paap Wald rk F statistics are statistically significant at the 5% level, which provides us with further confidence that weak instruments are unlikely to be a

significant threat to our estimates. In addition, we report the Hansen J statistic for overidentifying restrictions, which tests the null hypothesis that our instrumental variables are jointly exogenous. The J statistics are statistically insignificant. Failure to reject its null hypothesis provides some indication that our instrumental variables are exogenous. We also perform a Wald test for endogeneity. We fail to reject the null hypothesis that our potentially endogenous regressors can be treated as exogenous.

5. Female interaction and the glass cliff

What explains the high likelihood of earnings management in the presence of increased female interaction? This section attempts to answer this question. Extant accounting literature suggests that managers tend to manage reported earnings to avoid earnings decreases, which helps protect their compensation, career and reputation (e.g. Ali & Zhang, 2015; Bergstresser & Philippon, 2006; Burgstahler & Dichev, 1997; Degeorge, Patel & Zeckhauser, 1999). The benefit of earnings management is potentially large for women when there is pressure to perform and/or a firm's situation is precarious.

5.1. Appointments of women to glass cliff positions

There is little doubt that women remain disadvantaged in access to leadership roles. The invisible barrier that blocks women from reaching the upper management level is known as the 'glass ceiling' (Morrison, White, White & Van Velsor, 1987). Standard economic models attribute this phenomenon to women's shorter professional careers due to childbearing (e.g. Bielby & Baron, 1986; Lazear & Rosen, 1990) and discrimination in labour markets that enforce traditional gender stereotypes (e.g. Becker, 2010; Eagly & Karau, 2002; Field, Souther & Yore, 2020).

For women who have broken through the glass ceiling, literature shows that they are more

likely than men to find themselves on a ‘glass cliff’, such that their positions are associated with a high risk of failure. If the situation worsens and/or the business fails, it is women that are blamed rather than men. Specifically, Ryan and Haslam (2005) find that firms tend to appoint women to their boards after having experienced a remarkable financial downturn in previous months. Haslam and Ryan (2008) point out that glass cliffs are not restricted to board appointments but can be reproduced in other leadership contexts and organisational units that are in crisis. Elsaid and Ursel (2018) further show that women are more likely than men to be appointed as CEOs in business situations that are both less profitable and riskier. While these positions are precarious, women would be willing to accept such appointments due to their scarce career opportunities for advancement. Recently, Gupta, Mortal, Silveri, Sun and Turban (2020) document that women who have been appointed to CEO positions are more vulnerable to forced dismissal than their male counterparts.

To test whether the glass cliff phenomenon is present in Chinese firms, we examine the determinants of gender in CEO, CFO and board director appointments in Table 5. If women are more likely to be appointed to underperforming firms, then the glass cliff argument is supported. We focus on past performance, measured as ROA with a lag, as the key explanatory variable. The dependent variable *Female CEO* (*Female CFO*) is a dummy variable set equal to one if a female CEO (CFO) is appointed, and zero otherwise. The dependent variable *#Female directors* is the number of female directors who are newly appointed to the board. We control for board size ($\ln(\text{Board size})$), board independence ($\% \text{Independent directors}$), management team size ($\ln(\text{Management size})$), total compensation paid to both the top management team and the board of directors ($\ln(1+\text{Compensation})$), institutional ownership as a proportion of total shares

outstanding (*Institutional ownership*), standard deviation of monthly stock returns (*Stock return volatility*), firm size ($\ln(\text{Assets})$), board gender diversity (*%Female directors*) and proportion of women in the top management team (*%Female executives*). These control variables are lagged by one year relative to the dependent variable. Farrell and Hersch (2005) show that firms are likely to add a woman to the board when the departing director was female. We thus control for the gender of the predecessor by considering whether there is a female CEO (CFO) stepping down in column 1 (column 2) of Table 5 and the number of female directors departing the board in column 3.

<Insert Table 5 about here>

The results in Table 5 show that firms with lower ROA in the previous year are more likely to appoint a female CEO, which is arguably the most prominent managerial position in corporations. In addition, we find that more female directors are appointed when firms have lower ROA in the preceding year. These results lend support to the presence of the glass cliff phenomenon in Chinese corporations. Further, the relation between women's appointments and departures is positive and statistically significant, consistent with the idea that corporations add women to maintain their gender diversity target. Our findings continue to hold when firm fixed effects are included to the model specifications in columns 4 to 6.

5.2. Female interaction and pressure on women to perform on the glass cliff

Female leaders who are appointed during times of financial downturn are exposed to mounting pressure to revive the fortunes of failing businesses (Glass & Cook, 2016). Specifically, female leaders have to overcome several challenges after their appointments. First, as a result of women's underrepresentation at top organisational levels, women tend to receive less workplace

support and face more resistance to their authority from male peers (Taylor, 2010). Second, women are often evaluated more unfavourably than men, even when they perform as well as their male counterparts (Agars, 2004; Eagly & Karau, 2002; Eagly, Makhijani & Klonsky, 1992). Third, due to women's minority status, female leaders are highly visible and critically scrutinised (Eagly, Karau & Makhijani, 1995; Glass & Cook, 2016). A survey study by Ragins, Townsend and Mattis (1998) reports that nearly 99% of female top executives in Fortune 1000 companies feel the need to consistently exceed performance expectations in order to distinguish themselves from their male peers. If the business continues to fall, women on the glass cliff are likely to be replaced by men (Cook & Glass, 2014). Under the heightened performance pressure, female top managers could engage in opportunistic behaviours by exploiting the weak board monitoring of a gender-diverse board.

Since the pressure to perform may be stronger at the time of managers entering leadership positions (Hambrick & Fukutomi, 1991), we are likely to observe a significant female interaction effect for managers who are new to the position. The female interaction effect could weaken over years as female managers become more entrenched in firms. We decompose the dummy indicator of *Female top manager* into two separate indicators: (1) *New female top manager* is equal to one if either a female CEO or a female CFO is newly appointed to the position in a given year, and zero otherwise; and (2) *Incumbent female top manager* is equal to one if both the female CEO and the female CFO have a tenure of more than one year, and zero otherwise. The two dummy variables are then multiplied by *%Female directors*.

In Table 6, we find that only the interaction of new female top managers with female directors is associated with an increase in ROA, whereas incumbent female top managers do not

have such an interaction effect (see column 1). The regressions based on *%Other female directors* (see column 2) and firm fixed effects (see columns 3 and 4) yield similar inferences.⁵ The results suggest that newly appointed female top managers, who are under great pressure to perform, tend to exploit their cooperation with female directors to improve reported earnings.

<Insert Table 6 about here>

To ameliorate the deteriorating profits, women appointed in precarious situations could undertake opportunistic earnings management. In Table 7, we test for this proposition by splitting the sample into four groups based on the quartiles of one-year lagged ROA, where the quartiles are identified within each industry-year. In firms with the worst past performance, i.e. firms whose lagged ROA is in the first quartile (columns 1 and 2), the interaction between new female top managers and female directors is positively associated with earnings management.⁶ In firms with lagged ROA above the first quartile (columns 3 to 8), female interaction is not significantly related to earnings management. These relations still hold when we control for firm fixed effects in Panel B. Our evidence supports the conjecture that firms' past underperformance puts pressure on female top managers who are new to glass cliff positions and motivates them to manage reported earnings.

<Insert Table 7 about here>

Our results may appear to contradict the evidence from the 'big bath' accounting literature

⁵ We cannot present 2SLS results for this analysis, as it is challenging to find appropriate instrumental variables for the two closely intertwined variables: *New female top manager* and *Incumbent female top manager*.

⁶ When *New female top manager* equals one, the one-year lagged ROA used to split the sample is corporate performance under the previous management.

(e.g. Christensen, Paik & Stice, 2008; Haggard, Howe & Lynch, 2015; Kirschenheiter & Melumad, 2002).⁷ According to this strand of literature, a big bath is a large, one-time write-off taken by a firm's management. Following managerial turnover, new managers often take a big bath to cut the current year's earnings in order to inflate earnings figures in later years. If a firm undertakes a big bath, we should observe a significant decrease in profitability following the turnover. However, we observe an increase in profitability, but only when past performance is poor. Those poorly performing firms are in precarious situations and thus have little scope to introduce asset write-downs or other negative non-recurring charges. It is unlikely that we would observe strong evidence of 'baths' among those firms.

Furthermore, our results are present only when there are women in leadership positions, whereas the big bath literature does not consider the gender of officers or directors. Instead, our findings are consistent with the glass cliff literature (e.g. Main & Gregory-Smith, 2018; Ryan, Haslam, Morgenroth, Rink, Stoker & Peters, 2016), which describes the tendency of women to be appointed to risky and precarious leadership positions. Women in these positions are likely to feel excess pressure to save the failing business (e.g. Glass & Cook, 2016). This is consistent with our results that performance improves only among the worst-performing firms. Further, we find that performance only improves in the presence of women both in top management and on the board of directors. This result implies a potential response by women in top managerial positions interacting with women on the board when they are appointed in precarious situations.

6. Stock market reactions to changes in female interaction

⁷ We thank an anonymous referee for suggesting that we reconcile our findings with the big bath accounting literature.

6.1. Short-term market reaction to appointments of female top managers

If female interaction is associated with a deterioration in earnings quality, then an increase in female interaction is likely to be perceived as a negative signal by the stock market. We carry out an event study and assess the stock market reaction to the appointments of female top managers to firms with gender-diverse boards. Intuitively, following these appointments, the strengthened interaction with female directors is likely to result in a negative abnormal stock return.

We first focus on female CEO appointments and then employ female CFO appointments as a robustness test. We examine the CEO appointments with a gender change – in other words, where a female CEO is appointed to replace a male CEO or vice versa – because only these events provide variation in female interaction. We collect a sample of 224 such CEO appointment announcement events, which includes 16 appointments following the predecessor’s retirement.⁸ We create a binary variable, *Female CEO appointment*, which equals one if the new CEO is female, and zero otherwise. *Female CEO appointment* is then multiplied by *%Female directors* or *%Other female directors* to capture the female interaction effect. We estimate cumulative abnormal returns (CARs) over two different event windows, from day 0 to 1 and from –1 to 1, where day 0 is the CEO appointment announcement date. The expected return used to compute the CAR comes from a market model with an equal-weighted market index return as the market return over an estimation window (–149, –23) (in trading days) prior to the appointment announcement date.⁹ The average CAR (0, 1) around the CEO appointments is –0.20%, while

⁸ Our results continue to hold if the 16 appointments following CEO retirement are excluded.

⁹ The estimation period of (–149, –23) in trading days is roughly half a calendar year.

the average CAR $(-1, 1)$ is nearly 0.

In Panel A of Table 8, we present the results for OLS regressions of CARs on female interaction following female CEO appointments. We observe a negative and significant coefficient on the interaction term between *Female CEO appointment* and *%Female directors*, indicating that the appointment of female CEOs is associated with a more negative CAR when there are more women on the board. This supports the conjecture that increased female interaction following a woman's appointment as CEO engenders a negative market reaction.

<Insert Table 8 about here>

In Panel B of Table 8, we regress CARs on female interaction following CFO appointments.¹⁰ We obtain 89 corporate announcements of CFO appointments that involve gender changes.¹¹ We create a dummy variable, *Female CFO appointment*, which equals one if the new CFO is female, and zero otherwise. The CARs are estimated for two different event windows, $(0, 1)$ and $(-1, 1)$, where day 0 is the CFO appointment announcement date. The average CAR $(0, 1)$ surrounding the CFO appointments is -0.26% , while the average CAR $(-1, 1)$ is -0.32% . In Panel B of Table 8, the coefficient on the interaction term between *Female CFO appointment* and *%Female directors* is negative and significant. This result suggests a negative market reaction to intensified female interaction following appointments of female CFOs, consistent with our finding based on female CEO appointments.

¹⁰ We collect data on CFO appointment announcements from the CSMAR corporate announcement dataset. To identify these announcements, we conduct keyword search terms on CFO names and manually identify the announcements relating to the appointments of new CFOs and the reasons for their predecessors' dismissal.

¹¹ The 89 CFO appointment announcement events include four appointments following the previous CFO's retirement. If we exclude these four appointments, our findings are still valid.

6.2. Long-term market reaction to appointments of female top managers

Our previous results show that female interaction has a significant association with firm outcomes only in the first year of a woman assuming a leadership role. It is thus likely that the stock market reaction goes beyond the short event window to the first year after a female top manager is appointed. We examine the long-term buy-and-hold (B&H) returns following the announcements of female top manager appointments.¹²

First, we focus on female CEO appointments. Given that the average CEO tenure in our sample is three years, we calculate the B&H returns over (0, 245), (0, 490) and (0, 735) event windows (in trading days),¹³ where day 0 is the CEO appointment announcement date. We create a sample of treatment firms, including firms in which a female CEO is appointed to replace a male CEO. Firms with a constant male CEO (i.e. no CEO replacement) are chosen as control firms. We require that the treatment firms and their matched control firms have stock return data for at least 500 trading days over three consecutive years after the CEO appointment date. We exclude CEO appointments around which there is a merger and acquisition within three years. After these procedures, we obtain 216 CEO appointments with a male-to-female gender change.

We match treatment firms and control firms based on the following criteria: (1) the matched pairs are in the same year, (2) the market capitalisation of the control firm is within +/- 30% of the market capitalisation of the treatment firm, (3) the absolute difference

¹² B&H return $_{iT} = \prod_0^T (1 + r_{it}) - 1$, where r_{it} is the stock return of firm i on day t , and T is the event window.

¹³ On average, Chinese stock exchanges have 245 trading days.

in *%Female directors* between the treatment and control firms is less than 0.01, and (4) the control firm has the closest market-to-book ratio to the treatment firm. These procedures ultimately yield 173 matched pairs between treatment and control firms.¹⁴

In Panel A of Table 9, we show that there are no significant post-matching differences in the characteristics used to match treatment and control firms, justifying our matching approach. *%Female directors* is nearly identical across the two groups of firms post matching. Thus, the treatment firms (male-to-female CEO changes) exhibit stronger female interaction after the appointments as compared to control firms (constant male CEOs). The paired *t*-tests further show that, relative to control firms with constant male CEOs, treatment firms with female CEO appointments on average experience a decline in the B&H return in the one-year post-appointment period. However, the average B&H return is not significantly different across the two groups when the new CEOs hold their positions for two or three years.

<Insert Table 9 about here>

In Panel B of Table 9, we estimate the B&H return post female CFO appointments. The average CFO tenure in our sample is also three years. We create a treatment sample that consists of firms in which a female CFO is appointed to replace a male CFO. Firms with a constant male CFO are chosen as control firms. We match treatment firms and control firms using the same steps as before. We obtain only 31 matched pairs of treatment and control firms.¹⁵ The paired

¹⁴ Of the 173 matched pairs, only 10 appointments followed the previous CEO's retirement. If those 10 appointments are excluded, the test results remain qualitatively unchanged.

¹⁵ There is no mandatory requirement for Chinese listed companies to announce their CFO replacements to the public. CFO replacements are thus less publicised than CEO replacements. In the 31 matched female CFO appointment events, only one appointment follows the previous CFO's retirement. After this single appointment is removed, the *t*-test results remain statistically insignificant.

t -tests show that there is no significant difference in the B&H returns between the two groups of firms. Admittedly, the sample size might be too small to generate any significant results.

Taken together, the results corroborate the idea that female top managers encounter strong performance pressure during their first year in leadership roles. As they become more entrenched in firms over time, they experience less pressure to perform, leading to an insignificant market reaction in the long run.¹⁶

6.3. Market reaction to sudden deaths of female directors

We employ the sudden deaths of female directors to perform a market reaction test.¹⁷ The sudden deaths of female directors attenuate the interaction between women in top management and on the board of directors. As the sudden deaths occur randomly and are exogenous to concurrent firm characteristics and stock prices, they offer an exogenous identification of how female interaction is evaluated by the stock market. Exploiting these sudden death events also alleviates endogeneity concerns related to the appointment and composition of corporate boards (Nguyen & Nielsen, 2010).

We collect data on corporate announcements of executive and director deaths from the CSMAR database.¹⁸ The CSMAR corporate announcement dataset provides structured

¹⁶ If the stock market reacts to female interaction only in the first year following the appointment, it is less likely that female interaction would affect Tobin's Q, which is a prevalent measure of long-term market-based performance in the longitudinal data. We calculate Tobin's Q following Firth, Lin and Wong (2008). The untabulated OLS regression results show that female interaction has no significant effect on Tobin's Q.

¹⁷ We thank an anonymous referee for proposing the analysis based on sudden deaths to address endogeneity.

¹⁸ We identify only seven CEO deaths and two CFO deaths. The death observations for top managers are too few to draw any meaningful inferences. We thus focus on director deaths only.

summaries of material news and events relating to executive and director changes. We search the text content of these announcements to identify whether or not the replacements are due to sudden deaths. We classify deaths as sudden (1) when their cause includes heart attack, stroke or accident; and (2) when the specific cause is unreported, the death is described as unexpected or sudden (Nguyen & Nielsen, 2010; Shi, Hoskisson & Zhang, 2017). We obtain a sample of 60 sudden death observations of directors, including only three female director deaths.¹⁹

We estimate the short-term CARs to the announcements of directors' sudden deaths.²⁰ We set the dummy variable *Female director death* equal to one if the deceased director is female, and zero otherwise. The death of female directors constitutes a sudden disruption in the interaction between women in top management and on the board of directors. Thus, the interaction term between *Female top manager* and *Female director death* captures the reduction in female interaction due to a female director's sudden death.

In Table 10, we regress the two-day and three-day CARs surrounding the sudden death announcements on female interaction. We observe a significantly positive coefficient on the interaction term *Female top manager* \times *Female director death*, which suggests that the stock market responds positively to reduced female interaction following a female director's sudden death. This finding is consistent with the argument that curbing female interaction benefits investor interests.

<Insert Table 10 about here>

¹⁹ None of the deceased female directors hold a dual position of CEO or CFO.

²⁰ Our focus is on the sudden deaths of directors rather than the new appointments following these deaths, because the sudden deaths are more exogenous compared to future new appointments.

7. Conclusion

Given the mounting pressure on women to perform, we argue that female top managers interact differently with a gender-diverse board than with a male-only board. Our empirical results lend support to this idea by showing that the presence of female top managers has a larger positive effect on ROA in firms with more gender-diverse boards. However, the improvement in ROA is associated with earnings management. When female top managers are monitored by female directors, the likelihood of earnings management increases, leading to higher accounting returns. Our evidence further reveals that the significant association between female interaction and earnings management is only present in the first year after a woman is appointed as a top manager to a poorly performing firm. This finding is consistent with the idea that women who are appointed to glass cliff leadership positions are under great pressure to ameliorate the weak earnings performance. Finally, we document a negative abnormal stock return to the appointment of female top managers to firms with gender-diverse boards, which suggests a negative market response to intensified female interaction.

An inherent research design challenge in corporate governance studies is endogeneity. While this applies to much of board and management composition research, endogeneity is particularly acute in our setting because both the gender of officers and directors and accounting-based measures could be endogenously determined by firms' choices of corporate governance structure. To mitigate this problem, we have adopted various methods, including firm fixed effects, instrumental variables and the identification based on exogenous sudden deaths. These tests provide some assurance that endogeneity is unlikely to drive our results. However, given how pervasive the endogeneity concern is in corporate governance research, our results should

still be interpreted with caution.

Our paper has important implications for policymaking. In China, a considerable number of women have broken the glass ceiling and ascended to the top level of corporate hierarchy, but the challenges facing women in leadership positions are not negligible. The evidence of a glass cliff in Chinese firms suggests that women leaders face strong pressure to recover weak corporate performance. The resultant female interaction is detrimental to stock investors in light of the higher likelihood of earnings management.

Our study does not suggest that firms should avoid female top managers working alongside female directors. Rather, we call for China's policymakers to consider adopting a corporate governance code to tackle gender stereotypes when making leadership appointment decisions. If women above the glass ceiling had equal opportunities in recruitment and advancement, and possessed many of the resources offered to men in the workplace, then the disproportionate performance pressure on female leaders would be lessened, making the undesirable female interaction less likely.

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Table 1 Descriptive statistics

This table presents descriptive statistics of gender diversity and control variables. Panel A compares the gender composition of top management and boards of directors between Chinese firms and US firms. For US firms, the data on CEO and CFO gender is obtained from Execucomp, and the data on board gender diversity is from RiskMetrics. Panel B describes the summary statistics of firm-level variables in Chinese firms. See Appendix 1 for variable definitions.

Panel A: Gender diversity comparison between China and USA							
	Mean	SD	Min	P25	Median	P75	Max
<i>China</i>							
Female top manager	0.294	0.456	0.000	0.000	0.000	1.000	1.000
Female CEO	0.050	0.217	0.000	0.000	0.000	0.000	1.000
Female CFO	0.262	0.440	0.000	0.000	0.000	1.000	1.000
%Female directors	0.112	0.110	0.000	0.000	0.111	0.182	0.833
%Other female directors	0.102	0.104	0.000	0.000	0.100	0.154	0.667
<i>USA</i>							
Female top manager	0.042	0.201	0.000	0.000	0.000	0.000	1.000
Female CEO	0.022	0.147	0.000	0.000	0.000	0.000	1.000
Female CFO	0.088	0.283	0.000	0.000	0.000	0.000	1.000
%Female directors	0.100	0.097	0.000	0.000	0.100	0.167	0.667
%Other female directors	0.089	0.092	0.000	0.000	0.091	0.143	0.667
Panel B: Descriptive statistics of Chinese firms							
	Mean	SD	Min	P25	Median	P75	Max
ROA	0.048	0.087	-0.562	0.026	0.049	0.080	0.355
Earnings management	-0.011	0.202	-0.960	-0.067	-0.013	0.041	1.169
Ln(Board size)	2.257	0.228	1.386	2.197	2.197	2.398	3.219
%Independent directors	0.345	0.103	0.000	0.333	0.333	0.385	1.000
Ln(Management size)	1.809	0.377	0.000	1.609	1.792	2.079	3.761
Leverage	0.494	0.320	0.040	0.316	0.476	0.622	3.208
Ln(1+Sales growth)	0.132	0.462	-9.212	-0.011	0.128	0.270	11.810
Ln(Assets)	21.480	1.217	10.840	20.700	21.350	22.110	28.480
Ln(Firm age)	1.873	0.767	-1.710	1.369	2.050	2.485	3.138
Cash	0.183	0.141	0.000	0.085	0.146	0.240	1.000
R&D	0.001	0.006	0.000	0.000	0.000	0.000	0.216
Capital expenditure	0.058	0.068	-0.702	0.016	0.043	0.085	0.453
Government ownership	0.171	0.236	-0.006	0.000	0.000	0.354	0.971
Institutional ownership	0.169	0.188	0.000	0.022	0.096	0.261	0.939
Managerial ownership	0.015	0.062	0.000	0.000	0.000	0.000	0.647

Table 2 Female interaction and firm profitability

This table presents regressions of ROA on the interaction between the presence of female top managers and board gender diversity. See Appendix 1 for variable definitions. Intercepts are included but not reported. Cluster-robust t -statistics are reported in brackets. ***, ** and * indicate statistical significance at the 1%, 5% and 10% levels, respectively.

<i>Dependent variable = ROA</i>								
	OLS				Firm Fixed Effects			
	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]
Female top manager	-0.002 [-0.56]	-0.001 [-0.47]	-0.002 [-0.65]	-0.002 [-0.54]	-0.007 [-0.87]	-0.003 [-0.39]	-0.008 [-0.84]	-0.003 [-0.36]
%Female directors (a)	-0.017 [-1.50]		-0.018 [-1.51]		-0.028 [-0.77]		-0.033 [-0.79]	
Female top manager \times a	0.035** [2.07]		0.037** [2.01]		0.146** [2.08]		0.170** [2.06]	
%Other female directors (b)		-0.017 [-1.50]		-0.018 [-1.51]		-0.031 [-0.85]		-0.036 [-0.86]
Female top manager \times b		0.037** [2.03]		0.039* [1.93]		0.141** [1.97]		0.165** [1.98]
Earnings management			0.004** [2.24]	0.004** [2.24]			0.063*** [4.86]	0.063*** [4.86]
Ln(Board size)	-0.002 [-0.53]	-0.002 [-0.55]	0.000 [0.11]	0.000 [0.09]	-0.024 [-1.62]	-0.024 [-1.61]	-0.014 [-0.89]	-0.014 [-0.89]
%Independent directors	0.007 [0.60]	0.007 [0.61]	0.008 [0.64]	0.008 [0.64]	0.077*** [3.00]	0.076*** [2.98]	0.083*** [2.83]	0.082*** [2.79]
Ln(Management size)	-0.006** [-2.14]	-0.006** [-2.15]	-0.004 [-1.51]	-0.004 [-1.52]	-0.021*** [-2.68]	-0.021*** [-2.70]	-0.018** [-2.11]	-0.018** [-2.13]
Leverage	-0.005 [-0.84]	-0.005 [-0.85]	-0.003 [-0.58]	-0.003 [-0.59]	-0.004*** [-7.53]	-0.004*** [-7.53]	-0.004*** [-7.86]	-0.004*** [-7.85]
Ln(1+Sales growth)	0.023*** [7.82]	0.023*** [7.83]	0.022*** [7.10]	0.022*** [7.10]	0.025*** [3.44]	0.025*** [3.44]	0.023*** [2.92]	0.023*** [2.92]
Ln(Assets)	0.007*** [6.28]	0.007*** [6.28]	0.006*** [5.70]	0.006*** [5.70]	0.001 [0.09]	0.001 [0.09]	-0.011 [-1.02]	-0.011 [-1.02]
Ln(Firm age)	-0.001 [-1.05]	-0.002 [-1.08]	-0.000 [-0.23]	-0.000 [-0.25]	-0.010* [-1.89]	-0.010* [-1.96]	-0.009 [-1.45]	-0.009 [-1.52]
Cash	0.089*** [9.63]	0.089*** [9.62]	0.096*** [9.74]	0.096*** [9.73]	0.071** [2.50]	0.071** [2.48]	0.076** [2.36]	0.076** [2.34]
R&D	-0.110 [-1.04]	-0.113 [-1.07]	-0.100 [-0.87]	-0.103 [-0.90]	0.237 [1.11]	0.233 [1.10]	0.434 [1.63]	0.435 [1.63]
Capital expenditure	0.104*** [7.64]	0.103*** [7.63]	0.116*** [7.67]	0.115*** [7.67]	0.003 [0.11]	0.003 [0.10]	0.013 [0.37]	0.012 [0.36]
Government ownership	0.007* [1.69]	0.007* [1.69]	0.008* [1.84]	0.008* [1.84]	0.017** [2.28]	0.017** [2.30]	0.020*** [2.65]	0.021*** [2.68]
Institutional ownership	0.024*** [4.80]	0.024*** [4.79]	0.022*** [3.95]	0.022*** [3.95]	0.009 [0.72]	0.009 [0.70]	0.005 [0.39]	0.005 [0.36]
Managerial ownership	0.046*** [4.18]	0.046*** [4.19]	0.058*** [3.84]	0.058*** [3.85]	0.019 [1.56]	0.019 [1.47]	-0.020 [-1.23]	-0.021 [-1.35]
Industry FE	yes	yes	yes	yes	no	no	no	no
Year FE	yes	yes	yes	yes	yes	yes	yes	yes
R ²	0.092	0.092	0.096	0.096	0.163	0.163	0.176	0.176
N	17585	17585	15256	15256	17585	17585	15256	15256

Table 3 Female interaction and earnings management

This table presents regressions of earnings management on the interaction between the presence of female top managers and board gender diversity. See Appendix 1 for variable definitions. Intercepts are included but not reported. Cluster-robust t -statistics are reported in brackets. ***, ** and * indicate statistical significance at the 1%, 5% and 10% levels, respectively.

<i>Dependent variable = Earnings management</i>				
	OLS		Firm Fixed Effects	
	[1]	[2]	[3]	[4]
Female top manager	-0.011 [-0.40]	0.001 [0.04]	-0.042 [-0.53]	-0.032 [-0.47]
%Female directors (a)	-0.102 [-1.17]		-0.386 [-1.29]	
Female top manager \times a	0.314* [1.75]		0.550* [1.70]	
%Other female directors (b)		-0.104 [-1.19]		-0.395 [-1.35]
Female top manager \times b		0.271** [1.97]		0.502* [1.68]
Ln(Board size)	-0.038 [-0.72]	-0.039 [-0.73]	-0.011 [-0.13]	-0.011 [-0.13]
%Independent directors	0.009 [0.09]	0.010 [0.10]	-0.074 [-0.62]	-0.076 [-0.63]
Ln(Management size)	0.013 [0.95]	0.012 [0.92]	0.046 [1.11]	0.045 [1.10]
Leverage	0.115 [0.53]	0.115 [0.53]	0.037 [0.15]	0.037 [0.15]
Ln(1+Sales growth)	-0.008 [-0.41]	-0.009 [-0.42]	-0.032 [-0.84]	-0.032 [-0.84]
Ln(Assets)	-0.024 [-0.81]	-0.024 [-0.82]	-0.065 [-0.52]	-0.065 [-0.52]
Ln(Firm age)	0.025 [1.00]	0.025 [0.99]	0.058 [0.98]	0.057 [0.96]
Cash	0.311 [0.84]	0.310 [0.84]	0.592 [0.91]	0.592 [0.90]
R&D	-2.055** [-2.21]	-2.093** [-2.27]	-2.188** [-2.18]	-2.206** [-2.20]
Capital expenditure	0.292 [0.98]	0.292 [0.98]	0.357 [0.87]	0.358 [0.87]
Government ownership	0.054* [1.71]	0.053* [1.67]	0.037 [0.72]	0.037 [0.72]
Institutional ownership	-0.012 [-0.27]	-0.013 [-0.28]	0.021 [0.36]	0.020 [0.35]
Managerial ownership	-0.076 [-1.08]	-0.073 [-1.04]	-0.096 [-0.99]	-0.097 [-1.00]
Industry FE	yes	yes	no	no
Year FE	yes	yes	yes	yes
R ²	0.004	0.004	0.127	0.127
N	15256	15256	15256	15256

Table 4 Instrumental variable estimation

This table presents 2SLS regressions of ROA and earnings management on the interaction between the presence of female top managers and board gender diversity. The dependent variable *Female interaction* in column 3 is the multiplication of *Female top manager* and *%Female directors*. There are four instrumental variables: (1) *Regional trend in %female executives* is each firm's base-year fraction of women in top management times the annual regional growth of this fraction relative to the base year; (2) *Regional trend in %female directors* is each firm's base-year fraction of women on the board times the annual regional growth of this fraction relative to the base year; (3) the multiplication of the first two instruments; and (4) province-level annual *GDP growth*. Each firm's base year observation is excluded from the regressions. Intercepts are included but not reported. The control variables are the same as those included in column 1 of Table 2. Cluster-robust *t*-statistics are reported in brackets. ***, ** and * indicate statistical significance at the 1%, 5% and 10% levels, respectively.

Panel A: 2SLS estimation for ROA					
	<i>1st stage</i>			<i>2nd stage</i>	
	[1]	[2]	[3]		[4]
	Female top manager	%Female directors	Female interaction		ROA
Regional trend in %female executives (a)	1.414*** [22.50]	0.036*** [7.44]	0.056*** [5.53]	<i>Female top manager</i>	-0.005 [-0.86]
Regional trend in %female directors (b)	0.394*** [7.13]	0.701*** [49.10]	0.173*** [9.62]	<i>%Female directors</i>	-0.027 [-1.37]
a × b	-0.969*** [-5.18]	-0.112*** [-3.51]	0.555*** [8.23]	<i>Female interaction</i>	0.063* [1.76]
GDP growth	-0.232 [-1.50]	-0.023 [-1.13]	-0.046 [-1.56]		
Control variables	yes	yes	yes	Control variables	yes
Industry FE	yes	yes	yes	Industry FE	yes
Year FE	yes	yes	yes	Year FE	yes
N	16024	16024	16024	N	16024
<i>F</i> test of excluded instruments	200.84***	262.84***	210.25***		
Kleibergen-Paap Wald rk <i>F</i> statistic			44.92**		
Hansen <i>J</i> statistic			0.24		
Wald χ^2 test of endogeneity			3.40		
Panel B: 2SLS estimation for earnings management					
	<i>1st stage</i>			<i>2nd stage</i>	
	[1]	[2]	[3]		[4]
	Female top manager	%Female directors	Female interaction		Earnings management
Regional trend in %female executives (a)	1.429*** [22.71]	0.035*** [6.95]	0.057*** [5.28]	<i>Female top manager</i>	-0.057 [-0.96]
Regional trend in %female directors (b)	0.405*** [7.15]	0.704*** [47.06]	0.171*** [9.15]	<i>%Female directors</i>	-0.165 [-1.21]
a × b	-1.007*** [-5.20]	-0.109*** [-3.24]	0.557*** [7.54]	<i>Female interaction</i>	0.577* [1.67]
GDP growth	-0.199 [-1.27]	-0.017 [-0.82]	-0.033 [-1.08]		
Control variables	yes	yes	yes	Control variables	yes
Industry FE	yes	yes	yes	Industry FE	yes
Year FE	yes	yes	yes	Year FE	yes
N	13831	13831	13831	N	13831
<i>F</i> test of excluded instruments	202.55***	228.43***	191.10***		
Kleibergen-Paap Wald rk <i>F</i> statistic			38.41**		
Hansen <i>J</i> statistic			0.10		
Wald χ^2 test of endogeneity			3.04		

Table 5 Determinants of gender in appointments

This table presents regression results for the determinants of gender in CEO, CFO and board director appointments. The dependent variable *Female CEO (CFO)* is a dummy variable equal to 1 if a female CEO (CFO) is appointed in a year, and 0 otherwise. *#Female directors* is the total number of female directors appointed to the board in a year. All independent variables are lagged by one year relative to the dependent variable, except the departure variables. *Female CEO departure (Female CFO departure)* is equal to 1 if the dismissed CEO (CFO) is female, and 0 otherwise. *#Female director departures (#Male director departures)* is the number of female (male) directors departing the board. Intercepts are included but not reported. Cluster-robust *t/z*-statistics are reported in brackets. ***, ** and * indicate statistical significance at the 1%, 5% and 10% levels, respectively.

<i>Model:</i>	<i>Probit</i>	<i>Probit</i>	<i>Poisson</i>	<i>Linear Probability Model with Firm Fixed Effects</i>	<i>Linear Probability Model with Firm Fixed Effects</i>	<i>Poisson with Firm Fixed Effects</i>
	[1]	[2]	[3]	[4]	[5]	[6]
Dependent variable =	Female CEO	Female CFO	#Female directors	Female CEO	Female CFO	#Female directors
ROA (lag)	-0.737** [-2.51]	-0.318 [-1.50]	-0.905*** [-4.16]	-0.030* [-1.70]	-0.013 [-0.49]	-0.570** [-2.23]
Ln(Board size) (lag)	-0.208 [-1.40]	0.176** [2.19]	-1.002*** [-10.57]	-0.004 [-0.74]	0.034*** [2.99]	-2.756*** [-17.27]
%Independent directors (lag)	-0.043 [-0.10]	0.209 [0.84]	-2.332*** [-7.78]	-0.016 [-1.26]	-0.005 [-0.17]	-3.105*** [-7.91]
Ln(Management size) (lag)	0.007 [0.07]	0.030 [0.55]	-0.092 [-1.55]	0.005 [1.14]	-0.003 [-0.38]	-0.084 [-0.88]
Ln(1+Compensation) (lag)	0.026 [0.53]	-0.062*** [-3.18]	0.032 [1.21]	0.002 [1.36]	-0.004 [-1.33]	0.042 [0.88]
Institutional ownership (lag)	-0.063 [-0.38]	-0.051 [-0.49]	0.042 [0.44]	-0.003 [-0.49]	-0.011 [-0.90]	-0.010 [-0.07]
Stock return volatility (lag)	1.147 [1.55]	0.659 [1.60]	-0.140 [-0.31]	0.033 [1.24]	0.048 [1.18]	0.534 [1.05]
Ln(Assets) (lag)	-0.124*** [-3.47]	-0.057*** [-3.23]	-0.056*** [-2.72]	-0.007** [-2.29]	-0.005 [-1.31]	-0.072 [-1.52]
%Female directors (lag)	1.283*** [5.57]	0.501*** [3.21]		0.003 [0.17]	-0.008 [-0.33]	
%Female executives (lag)			0.879*** [7.87]			-0.023 [-0.12]
Female CEO departure	0.992*** [7.33]			0.040* [1.65]		
Female CFO departure		1.389*** [22.40]			0.251*** [11.74]	
#Female director departures			0.302*** [9.18]			0.128*** [3.39]
#Male director departures			0.195*** [19.38]			0.281*** [21.58]
Industry FE	yes	yes	yes	no	no	no
Year FE	yes	yes	yes	yes	yes	yes
N	17291	17336	17336	17291	17336	17336

Table 6 Female interaction, pressure on women to perform and firm profitability

This table examines whether ROA is associated with the pressure on women to perform. *New female top manager* is equal to 1 if either a female CEO or a female CFO is appointed to the position in a given year, and 0 otherwise. *Incumbent female top manager* is equal to 1 if both the female CEO and the female CFO hold their positions for more than one year, and 0 otherwise. Intercepts are included but not reported. Cluster-robust *t*-statistics are reported in brackets. ***, ** and * indicate statistical significance at the 1%, 5% and 10% levels, respectively.

<i>Dependent variable = ROA</i>	OLS		Firm Fixed Effects	
	[1]	[2]	[3]	[4]
New female top manager	-0.011** [-2.05]	-0.010** [-2.08]	-0.006 [-1.10]	-0.005 [-0.88]
Incumbent female top manager	0.000 [0.14]	0.001 [0.22]	0.004 [1.03]	0.005 [1.28]
%Female directors (a)	-0.017 [-1.49]		-0.001 [-0.09]	
New female top manager × a	0.067** [2.27]		0.069** [2.22]	
Incumbent female top manager × a	0.027 [1.58]		0.013 [0.60]	
%Other female directors (b)		-0.017 [-1.50]		-0.002 [-0.15]
New female top manager × b		0.073** [2.26]		0.071** [2.20]
Incumbent female top manager × b		0.029 [1.51]		0.007 [0.29]
Control variables	yes	yes	yes	yes
Industry FE	yes	yes	no	no
Year FE	yes	yes	yes	yes
R ²	0.094	0.094	0.362	0.362
N	17565	17565	17565	17565

Table 7 Female interaction, pressure on women to perform and earnings management

This table examines whether earnings management is associated with female interaction given the different levels of performance pressure as proxied by past corporate performance. The sample is split into quartiles based on lagged ROA. *New female top manager* is equal to 1 if either a female CEO or a female CFO is appointed to the position in a given year, and 0 otherwise. *Incumbent female top manager* is equal to 1 if both the female CEO and the female CFO hold their positions for more than one year, and 0 otherwise. Intercepts are included but not reported. Cluster-robust *t*-statistics are reported in brackets. ***, ** and * indicate statistical significance at the 1%, 5% and 10% levels, respectively.

<i>Dependent variable = Earnings management</i>								
Panel A: OLS								
Lagged ROA	Q1		Q2		Q3		Q4	
	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]
New female top manager	-0.178*	-0.165	0.008	0.026	0.005	0.042	-0.357	-0.255
	[-1.77]	[-1.58]	[0.35]	[1.14]	[0.12]	[0.61]	[-0.72]	[-0.58]
Incumbent female top manager	0.114	0.072	0.015	0.014	0.004	-0.005	-0.036	0.028
	[1.01]	[0.79]	[0.80]	[0.93]	[0.26]	[-0.37]	[-0.74]	[1.07]
%Female directors (a)	-0.295		0.030		-0.043		0.004	
	[-1.27]		[0.78]		[-0.99]		[0.02]	
New female top manager × a	0.820**		0.025		0.147		1.471	
	[2.09]		[0.18]		[1.27]		[0.77]	
Incumbent female top manager × a	0.068		-0.024		0.106		0.635	
	[0.30]		[-0.37]		[0.75]		[1.05]	
%Other female directors (b)		-0.293		0.030		-0.042		-0.008
		[-1.26]		[0.77]		[-0.97]		[-0.05]
New female top manager × b		0.856**		-0.133		-0.153		0.993
		[2.08]		[-1.30]		[-0.46]		[0.52]
Incumbent female top manager × b		0.365		-0.013		0.212		0.250
		[1.37]		[-0.17]		[0.95]		[0.91]
Control variables	yes	yes	yes	yes	yes	yes	yes	yes
Industry FE	yes	yes	yes	yes	yes	yes	yes	yes
Year FE	yes	yes	yes	yes	yes	yes	yes	yes
R ²	0.012	0.012	0.045	0.045	0.013	0.014	0.010	0.007
N	3830	3830	3802	3802	3834	3834	3784	3784
Panel B: Firm fixed effects								
Lagged ROA	Q1		Q2		Q3		Q4	
	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]
New female top manager	-0.235	-0.287	0.020	0.031	0.019	0.030	0.303	0.361
	[-1.20]	[-1.27]	[0.87]	[1.21]	[0.60]	[0.95]	[1.12]	[1.14]
Incumbent female top manager	-0.010	-0.069	0.008	0.000	0.027	0.026	0.135	0.137
	[-0.04]	[-0.33]	[0.44]	[0.02]	[1.05]	[1.07]	[1.49]	[1.40]
%Female directors (a)	-1.768		-0.078		0.069		0.357	
	[-1.36]		[-1.00]		[0.63]		[1.33]	
New female top manager × a	1.176*		0.047		-0.128		-1.418	
	[1.77]		[0.27]		[-0.77]		[-1.50]	
Incumbent female top manager × a	1.110		0.023		-0.131		-0.370	
	[1.19]		[0.22]		[-0.96]		[-1.00]	
%Other female directors (b)		-1.717		-0.076		0.067		0.340
		[-1.38]		[-0.96]		[0.62]		[1.33]
New female top manager × b		1.493*		-0.060		-0.243		-2.237
		[1.75]		[-0.41]		[-1.16]		[-1.42]
Incumbent female top manager × b		1.453		0.083		-0.142		-0.370
		[1.19]		[0.75]		[-1.03]		[-0.79]
Control variables	yes	yes	yes	yes	yes	yes	yes	yes
Industry FE	no	no	no	no	no	no	no	no
Year FE	yes	yes	yes	yes	yes	yes	yes	yes
R ²	0.171	0.171	0.374	0.374	0.538	0.538	0.774	0.776
N	3830	3830	3802	3802	3834	3834	3784	3784

Table 8 Short-term market reaction to appointments of female top managers

This table examines the stock market reaction to the announcements of female CEO and CFO appointments. The sample in Panel A (Panel B) includes all CEO appointments (CFO appointments) with gender changes. The dependent variable is CAR estimated over a two- or three-day event window (day 0 is the appointment announcement date). *Female CEO appointment* (*Female CFO appointment*) is a dummy variable equal to 1 if the newly appointed CEO (CFO) is female, and 0 otherwise. Intercepts are included but not reported. Cluster-robust *t*-statistics are reported in brackets. ***, ** and * indicate statistical significance at the 1%, 5% and 10% levels, respectively.

<i>Panel A: Female CEO appointments</i>				
	CAR(0, 1)		CAR(-1, 1)	
	[1]	[2]	[3]	[4]
Female CEO appointment	0.031*	0.029*	0.023	0.029*
	[1.79]	[1.93]	[1.25]	[1.78]
%Female directors (a)	0.147**		0.118**	
	[2.59]		[1.99]	
Female CEO appointment × a	-0.187**		-0.128	
	[-2.17]		[-1.38]	
%Other female directors (b)		0.146**		0.131**
		[2.37]		[2.09]
Female CEO appointment × b		-0.208**		-0.185*
		[-2.28]		[-1.87]
Control variables	yes	yes	yes	yes
Industry FE	yes	yes	yes	yes
Year FE	yes	yes	yes	yes
R ²	0.177	0.176	0.166	0.173
N	224	224	224	224
<i>Panel B: Female CFO appointments</i>				
	CAR(0, 1)		CAR(-1, 1)	
	[1]	[2]	[3]	[4]
Female CFO appointment	0.024	0.022	0.043**	0.039**
	[1.41]	[1.35]	[2.44]	[2.31]
%Female directors (a)	0.138*		0.150*	
	[1.88]		[1.69]	
Female CFO appointment × a	-0.161**		-0.202**	
	[-2.01]		[-2.18]	
%Other female directors (b)		0.140		0.150
		[1.40]		[1.28]
Female CFO appointment × b		-0.171*		-0.205*
		[-1.68]		[-1.76]
Control variables	yes	yes	yes	yes
Industry FE	yes	yes	yes	yes
Year FE	yes	yes	yes	yes
R ²	0.196	0.184	0.255	0.243
N	89	89	89	89

Table 9 Long-term market reaction to appointments of female top managers

This table presents the long-term B&H returns over (0, 245 days), (0, 490 days) and (0, 735 days) post CEO and CFO appointments. In Panel A, treatment firms are firms in which a female CEO is appointed to replace a male CEO, and control firms are firms with a constant male CEO. In Panel B, treatment firms are firms in which a female CFO is appointed to replace a male CFO, and control firms are firms with a constant male CFO. Treatment and control firms are matched based on market capitalisation, %Female directors, market-to-book ratio and year. Paired *t*-tests are used to generate the *t*-statistics for the difference in means, where ***, ** and * indicate statistical significance at the 1%, 5% and 10% levels, respectively.

<i>Panel A: B&H returns post female CEO appointments</i>						
<i>Post-matching mean difference</i>	Obs	Treatment firms	Matched control firms	Difference	<i>t</i> -statistic	(<i>p</i> -value)
Market capitalisation (in CNY millions)	173	3,690	3,580	105	1.560	(0.121)
%Female directors	173	0.180	0.180	0.000	0.397	(0.692)
Market-to-book ratio	173	3.680	3.190	0.490	1.441	(0.151)
<i>Mean B&H return</i>	Obs	Treatment firms	Matched control firms	Difference	<i>t</i> -statistic	(<i>p</i> -value)
(0, 245 days)	173	0.137	0.245	-0.108**	-2.396	(0.018)
(0, 490 days)	173	0.337	0.412	-0.074	-0.879	(0.381)
(0, 735 days)	173	0.574	0.513	0.060	0.561	(0.576)
<i>Panel B: B&H returns post female CFO appointments</i>						
<i>Post-matching mean difference</i>	Obs	Treatment firms	Matched control firms	Difference	<i>t</i> -statistic	(<i>p</i> -value)
Market capitalisation (in CNY millions)	31	6,285	5,516	769	1.332	(0.193)
%Female directors	31	0.148	0.149	-0.001	-0.941	(0.354)
Market-to-book ratio	31	4.239	3.554	0.686	0.605	(0.550)
<i>Mean B&H return</i>	Obs	Treatment firms	Matched control firms	Difference	<i>t</i> -statistic	(<i>p</i> -value)
(0, 245 days)	31	-0.078	-0.055	-0.023	-0.366	(0.717)
(0, 490 days)	31	-0.146	-0.023	-0.123	-1.126	(0.269)
(0, 735 days)	31	-0.071	-0.037	-0.034	-0.303	(0.764)

Table 10 Female director death and disruption in female interaction

This table examines the stock market reaction to the disruption in female interaction due to female directors' sudden deaths. The sample includes all sudden death announcements for board directors. *Female director death* is a dummy variable equal to 1 if the deceased director is female, and 0 otherwise. The dependent variable is CAR estimated over a two- or three-day event window (day 0 is the director death announcement date). Intercepts are included but not reported. Cluster-robust *t*-statistics are reported in brackets. ***, ** and * indicate statistical significance at the 1%, 5% and 10% levels, respectively.

Dependent variable =	CAR(0, 1)	CAR(-1, 1)
	[1]	[2]
Female top manager	0.007 [0.45]	0.010 [0.58]
Female director death	-0.064** [-2.20]	-0.055* [-1.80]
Female top manager × Female director death	0.070** [2.27]	0.086** [2.52]
Control variables	yes	yes
Industry FE	yes	yes
Year FE	yes	yes
R ²	0.420	0.396
N	60	60

Appendix 1 Variable definitions

Variable	Description
ROA	EBIT divided by total assets
Female top manager	1 if a firm has a female CEO or a female CFO, and 0 otherwise
%Female directors	the number of female directors divided by the number of directors on the board
%Other female directors	the number of female directors, excluding those who are also the CEO or CFO of the firm, divided by the total number of directors on the board
Earnings management	the value of discretionary accruals calculated based on Dechow and Dichev's (2002) model
Ln(Board size)	the natural logarithm of the number of directors on the board
%Independent directors	the proportion of independent directors on the board
Ln(Management size)	the natural logarithm of the number of managers in the top management team
Leverage	total debt divided by total assets
Ln(1+Sales growth)	the natural logarithm of one plus the annual growth rate in total sales
Ln(Assets)	the natural logarithm of total assets
Ln(Firm age)	the natural logarithm of the number of years of stock listing
Cash	total cash divided by total assets
R&D	research and development expenses divided by total assets
Capital expenditure	capital expenditures divided by total assets
Government ownership	the proportion of shares held by government
Institutional ownership	the proportion of shares held by bank trusts, insurance companies, investment companies, independent investment advisors, pension funds and other institutional investors
Managerial ownership	the proportion of shares held by top management
Industry dummy	dummies based on the 2-digit Global Industry Classification Standard (GICS) codes