京都大学経営管理大学院
企業金融研究奨励賞（みずほ証券寄附講座）

2021年度 受賞論文

論文タイトル：**Gender-Induced Attribution Bias in CEO Turnover**

希望審査領域：**Governance**

Highlights

- I define gender-induced attribution bias in the boardroom as the tendency of boards to attribute poor performance of female executives more to intractable intrinsic factors.
- Gender-induced attribution bias ultimately causes turnover-performance sensitivity of female CEOs to be significantly higher than that of their male counterparts.
- Gender bias in CEO turnover-performance sensitivity can only be triggered by extremely poor (rather than slightly poor) firm-specific performance (rather than systematic industry performance).
- Due to legitimacy concerns, gender bias in CEO turnover-performance sensitivity only exists in firms with high gender diversity in the upper echelons.
- After surviving the attribution bias early in their careers, turnover-performance sensitivity of female CEOs becomes indistinguishable from that of their male counterparts.

Gender-Induced Attribution Bias in CEO Turnover

Mingze Ma

Abstract

I study gender inequality in forced CEO turnover decisions. Using a large sample of Chinese public companies from 2010 to 2019, I document that on average there is no significant gender difference in the likelihood of forced CEO turnover, whereas the turnover-performance sensitivity of female CEOs is significantly higher than that of their male counterparts. The results support my hypothesis that in the trade-off between pressures of corporate social responsibility and long-standing gender stereotypes of leadership, boards tend to utilize the juncture of performance declines to implicitly express gender bias through the attribution process. I refer to this tendency as the gender-induced attribution bias. In further exploration, I observe that such attribution bias only affects female underperformers and is only triggered by extremely poor firm-specific performance. I also find that gender diversity in upper echelons and CEO tenure moderate the attribution process while the co-option of directors does not. In addition, I find no evidence that the results are driven by potential endogeneity issues, the glass cliff phenomenon, or gender differences in the qualifications and experience of CEOs.

JEL classification: G34; J16; J71; M14

Keywords: CEO turnover; Gender bias; Attribution; Firm performance; Corporate social responsibility

1. Introduction

Women have long been at a disadvantage in leadership positions. In 2020, only 7.4% of Fortune 500 companies have a female CEO (Catalyst, 2021), and according to the Gender Diversity Index 2020 reported by European Women on Boards (EWOB, 2020), of the 668 companies from 18 European countries, only 42 (6.3%) possess a female CEO. Likewise, in my dataset of Chinese companies from 2010 to 2019, this percentage is only 6.0% on average. The underrepresentation of women has made advancing gender equality and diversity within corporate upper echelons an imperative agenda for government and society. The most emblematic attempt is the Norwegian gender quota law enacted in 2003 that requires companies to have at least 40% female representation on their boards. In China, albeit not as explicit, the Outline for the Development of Women (2011–2020), promulgated in 2011, also highlights the importance of women's participation in management and decision-making. Against this backdrop, there has been a proliferation of research on top executive gender.

Three strands constitute the vast majority of previous studies. Some studies explore the determinants of the gender composition of top management teams or boards of directors (e.g., Ryan and Haslam, 2005; Farrell and Hersch, 2005; Hillman et al., 2007), and as a consequence of appointing female executives, numerous studies examine the impact of gender diversity in upper echelons on firms' strategic activities including M&A (e.g., Huang and Kisgen, 2013; Levi et al., 2014), risk-taking (e.g., Faccio et al., 2016), dividend payments (e.g., Chen et al., 2017), financial reporting (e.g., Francis et al., 2015), and innovation (e.g., Griffin et al., 2021), as well as its ultimate effect on firm performance (e.g., Adams and Ferreira, 2009; Dezsö and Ross, 2012). Other relevant studies highlight gender differences among top executives in terms of promotion (e.g., Ohlott et al., 1994; Field et al., 2020), compensation (e.g., Bugeja et al., 2012), and access to information (e.g., Inci et al., 2017), however, very few studies in this area focus on the gender bias experienced by female leaders at the end of their careers, that is, when they are departing, and the methodologies employed are also more or less inadequate. Therefore, in order to provide new evidence for this neglected issue, I focus on female CEOs and ask the following research question: Is there any overt or covert gender bias from the board of directors with regard to forced CEO turnover?

Given that the emphasis on gender equality and the condemnation of overt gender discrimination in today's society inhibit the manifestation of gender bias in the boardroom, I first hypothesize that there is no significant gender difference in the average probability of forced CEO turnover. However, role congruity theory (Eagly and Karau, 2002) states that long-standing stereotypes about the incongruity between leadership roles and female gender roles perpetuate ingrained gender prejudice against female leaders. In the trade-off between corporate social responsibility (CSR) pressures and the compulsion to express gender prejudice, poor performance under female CEOs' leadership provides an opportunity for boards to "legitimately" expose gender bias without concerning too much about public opinion. Furthermore, in accordance with Swim and Sanna (1996), such bias is more likely to be manifested indirectly through the attribution process, that is, compared with male CEOs, boards tend to attribute poor performance of female CEOs more to intractable intrinsic factors such as lack of competence. In addition, this process may be further reinforced by confirmation bias, a general social-psychological tendency to selectively gather corroborative evidence while neglecting counterarguments. I name this misattribution the gender-induced attribution bias and propose my key hypothesis that boards' attribution bias against female executives renders the risk of forced turnover for female CEOs more sensitive to performance declines than that for their male counterparts.

The regression results obtained using a large sample of Chinese listed companies from 2010 to 2019 support the hypothesis: The turnover-performance sensitivity of female CEOs is significantly higher than that of their male counterparts, and a one standard deviation decline in industry-adjusted ROA increases the probability of forced turnover for female CEOs on average by 4.12% compared with only 0.86% for male CEOs. Nevertheless, addressing joint-endogeneity issues has always been a challenge for research on corporate governance. In my case, I may omit some time-invariant or time-varying unobservable factors that affect both CEO appointments and the risk of forced departures, or female CEOs may self-select into firms that are systematically different from others. To mitigate potential endogeneity concerns, I first control for firm fixed effects. Then, I utilize an instrumental variables approach to achieve identification. Specifically, I define the top management team gender diversity within the industry and the average number of female top managers in local public companies as two instrumental variables (IVs) and apply these IVs to both a two-stage treatment effects model and a seemingly unrelated bivariate probit model. Finally, I also employ a propensity score matching (PSM) approach and re-estimate the likelihood of forced CEO turnover using the post-matched subsample. With these methods, I still find that the probability of forced departures for female CEOs is more sensitive to firm performance, indicating that the results are unlikely to be driven by potential omitted variable bias or self-selection effects. In addition, I also perform a series of checks to ensure the robustness of the results, such as using alternative classifications of CEO turnover, alternative performance measures, and an alternative empirical specification, the Cox model. The results remain robust in all checks.

Given that the baseline results reveal only a linear approximation of the relationship between CEO gender and turnover-performance sensitivity, I further explore possible mechanisms behind the gender-induced attribution bias in CEO turnover in an attempt to open the black box of the board's decision-making process. First, by dividing the sample based on performance levels, I examine the alternative explanation that higher turnover-performance sensitivity may be the result of outperforming female CEOs benefiting from greater protection granted by boards. Moreover, by estimating the probability of appointing a female CEO, I also test another alternative explanation—the glass cliff phenomenon (Ryan and Haslam, 2007)—that firms tend to appoint female CEOs when confronting precarious conditions of high risk and low performance. The results reject these two alternative explanations and support the existence of the gender-induced attribution bias: Gender differences in turnover-performance sensitivity emerge only in cases of poor performance and are not attributable to gender differences in CEO appointments. Second, I investigate the severity of the attribution bias by introducing dummy variables indicating performance range and proxy variables for systematic industry performance, respectively. The results are optimistic: The performance threshold for the gender-induced attribution bias is below that for forced turnover decisions, and the misattribution cannot be triggered by poor industry performance resulting from exogenous shocks. Third, I explore moderators of the attribution bias through subsample analyses. Specifically, by partitioning the sample based on gender diversity in firms' upper echelons, I find that attribution bias only exist in subsamples with high gender diversity, supporting the theory of legitimacy concerns while rejecting the similarity-attraction paradigm. By segmenting the sample based on the proportion of co-opted directors and CEO tenure, respectively, I find that reciprocity from co-option does not eliminate and even appears to exacerbate gender disparities in forced turnover risk, while the gender-induced attribution bias gradually recedes as CEO tenure increases. Finally, I also test whether my results are driven by the dearth of qualifications and experience of female CEOs by adding proxies for CEOs' human and social capital.

Results of the logit regression and regressions after PSM rebut this possibility.

Overall, the results corroborate the existence of boards' attribution bias against female CEOs when considering CEO replacement. Nonetheless, the activation of this misattribution is contingent. The probability of forced turnover for female CEOs increases disproportionately only when firm-specific performance (rather than systematic industry performance) is extremely poor (rather than slightly poor), suggesting that female CEOs have sufficient room to eschew boards' attribution bias. Additionally, I also find that this gender-induced attribution bias is moderated by gender diversity in firms' upper echelons as well as CEOtenure.

This paper contributes to the literature in the following ways. First, this study extends the literature on organizational demography and corporate governance and supplements the paucity of research on gender differences in executive turnover. Moreover, since I choose China, the world's largest developing economy plagued by traditional gender stereotypes, as the sample, this paper may also inspire research on gender differences in other emerging economies with severe sexism, such as India. Second, by decomposing gender prejudice into overt gender discrimination and covert bias expressed through the attribution process, this study develops a theoretical framework of how boards expose entrenched gender prejudice in today's society that emphasizes gender equality and provides evidence for the existence of gender-induced attribution bias in the boardroom by analyzing the impact of CEO gender on turnover-performance sensitivity, which is different from limited previous studies considering only the direct effect of CEO gender on the likelihood of turnover (e.g., Hill et al., 2015; Elsaid and Ursel, 2018). Third, compared to related studies with limited attention to endogeneity issues (e.g., Cook and Glass, 2013; Gupta et al., 2020), my paper employs multiple approaches to address possible omitted variable bias and self-selection bias, thereby ameliorating the methodology. Finally, this study also explores possible mechanisms behind the gender-induced attribution bias in CEO turnover from multiple perspectives, contributing to uncovering the internal dynamics of boards' decision-making.

The remainder of this paper is organized as follows. Section 2 reviews theories of gender bias and develops the hypothesis. Section 3 describes the sample selection, methodology, and descriptive statistics. Section 4 presents the baseline results, addresses endogeneity issues, and checks for robustness. Section 5 explores possible mechanisms behind the gender-induced attribution bias. Section 6 concludes.

2. Theory and Hypothesis

In recent years, with the growing importance of CSR and the emphasis society places on eliminating gender bias, gender equality and diversity have evolved into signals that indicate corporate compliance with social norms and ethical codes, constituting an overarching source of organizational and social legitimacy (Naumovska et al., 2020). As an organizational hierarchy with the highest social visibility, gender parity within a firm's upper echelons (i.e., top management team and board of directors) is particularly critical. Unbiased treatment of female executives demonstrates isomorphism with other firms, accelerating the enhancement of social acceptance and the establishment of goodwill, and thus facilitating effective mobilization of external resources (Mitra et al., 2021), while under the scrutiny of social media, CSR rating agencies, and the general public, firms that manifest overt gender prejudice are likely to sustain an unquantifiable loss of legitimacy, and compared with a transitory stock price fluctuation, the negative ramifications of such loss may be singularly profound. In terms of forced CEO departures, unwarranted and impulsive dismissals of female CEOs may attract unwanted social attention and moral condemnation to firms, hindering the execution of strategic activities (Hill et al., 2015). Therefore, I argue that under external pressures of CSR, there is no gender difference in the overall probability of forced CEO turnover.

Although CSR pressures curb the exposure of gender discrimination in firms' upper echelons, long-standing stereotypes about female gender roles render gender prejudice in leadership positions deep-seated and difficult to eradicate. Eagly and Karau's (2002) role congruity theory states that perceived incongruities between leadership roles and female gender roles induce bias against female leaders. Specifically, according to gender role theory (Eagly, 1987), expectations for the behavioral patterns of members of society depend to some extent on their gender. Men are expected to possess more agentic traits like assertiveness, competitiveness, and dominance, qualities that are construed as requisites for the traditional leadership role. In contrast, the expected communal social roles of women, including altruism, collaboration, and emotionalism, are not perceived as attributes necessary for a successful leader. Such inconsistency reduces the access of women to leadership positions, and for female leaders who have broken the "glass ceiling," they may encounter more obstacles to success than their male counterparts. Furthermore, in comparison with the androgynous middle management level with more socially complex elements, gender prejudice is more rampant at the highly male-dominated top management level (Eagly and Karau, 2002). In terms of forced CEO turnover, due to the trade-off between CSR pressures and gender bias against female leaders, boards may deliberately await the emergence of additional evidential support when attempting to unfairly fire female CEOs (Hill et al., 2015). As a result, I believe that once firms are given the opportunity to legitimately expose their gender prejudice, the career prospects of female CEOs will be much more precarious than those of their male counterparts.

The most typical example of such an opportunity is the decline in firm performance. Poor firm performance under female CEOs' leadership will serve as boards' corroboration of gender stereotypes, thus deepening gender prejudice caused by role incongruity. The obligation to perform the monitoring function in the context of poor performance provides a "justified" channel for boards to manifest gender prejudice without undue concern for CSR pressures, that is, attributing poor performance of female CEOs more to intrinsic factors such as lack of ability and skills than that of male CEOs. I name this misattribution the gender-induced attribution bias.

A variety of previous studies have provided support for such attribution bias. Status characteristics theory (Berger et al., 1972) proposes that the social inferiority of female groups makes perceivers adopt more stringent standards to evaluate female behavior, rendering it necessary for women to perform better than men in order to be considered equally competent. By the same token, Eagly and Karau (2002) suggest that the assessment of women's potential for leadership is less favorable than that of men, and Hill et al. (2015) argue that women endure more scrutiny and criticism. The most direct evidence is given by Swim and Sanna (1996). They contend that given the repugnance to overt sexism in today's society, prejudice is more likely to be expressed indirectly through the attribution process. By meta-analysis, they find that in comparison with men, evaluators tend to attribute women's successes more to unstable causes like luck, while attributing women's failures more to irreconcilable stable factors such as inability. Furthermore, a meta-analysis by Eagly et al. (1992) reveals that the denigration of female performance is most severe in traditionally masculine leadership positions including CEO. Consequently, I argue that in terms of CEO replacement, the gender-induced attribution bias in the boardroom will, given the same level of performance, expose female CEOs to a higher risk of forced turnover than their male counterparts.

Moreover, confirmation bias, a ubiquitous social-psychological tendency, further reinforces this attribution bias. Specifically, the disregard of counterarguments is a widespread weakness in human cognition (Nickerson, 1998). After forming the stereotype that women are incompetent in leadership roles, boards are prone to selectively gather and assign disproportionate weight to evidence supporting this belief (e.g., poor performance of female CEOs), while intentionally discounting adverse arguments (e.g., environmental factors beyond individual control) even if they may be more compelling. With regard to neutral or ambiguous information, the proclivity for adhering to stereotypical convictions may also cause it to be misinterpreted as corroborative evidence (Anderson et al., 1980). Thus, confirmation bias accelerates the formation of attribution bias against female CEOs in the context of poor firm performance and gives it an insurmountable inertia, further exacerbating the risk of forced turnover.

Synthesizing the aforementioned theories, I propose the following hypothesis:

Hypothesis: On average, there is no significant gender difference in the probability of forced CEO turnover, however, the turnover-performance sensitivity of female CEOs is significantly higher than that of their male counterparts.

3. Sample, data, and methodology

3.1. Sample and data

My sample consists of all firms listed in China's Shanghai and Shenzhen Stock Exchanges for the period 2010 to 2019, except financial and utility firms. I choose Chinese firms as the sample for three reasons. First, as the largest emerging economy in the world, China has non-negligible economic impact and academic value. Second, through institutional reforms, Chinese firms have accomplished the transition to a market-oriented corporate governance system, including a higher level of privatization, a more active takeover market, and a more effective board of directors. In such context, corporate CEOs are more likely to be disciplined for poor performance. Finally, gender inequality has long been an important social issue in China, especially at the senior executive level[1]. I start the sample period in 2010 to eliminate the impact of the global financial crisis during 2007–2009, and the sample period ends in 2019 due to the availability of data. I exclude financial and utility firms since the stringent regulations they face make financial information and board functions different from those of other firms. Data are obtained from the China Stock Market and Accounting Research (CSMAR) database. After excluding observations with missing values, I finally end up with an unbalanced panel of 3,166 firms and 17,774 firm-year observations.

Following You and Du (2012), I identify individuals with the title of General Manager or Chief Executive Officer as CEOs. Interim CEOs and co-CEOs are removed to ensure that each firm has only one observation for a given fiscal year (Wang et al., 2015). A CEO turnover event is identified if the CEO disclosed at the end of the current year is different from the CEO at the end of the prior year. Death events are not included. A total of 3,035 CEO departures are identified, with a turnover rate of 17.08%. The CSMAR extracts the reasons for CEO turnover from firms' annual reports. However, as boards tend to whitewash CEO departures, distinguishing between forced and voluntary CEO turnover remains difficult. My following classification combines and modifies the methods of Chang and Wong

[1] In 2020, only 16.8% of legislators, senior officials, and top managers in China are women, one-fifth of the number for their male counterparts (World Economic Forum, 2020).

(2009), Pi and Lowe (2011), and You and Du (2012): First, I consider all CEO turnover due to dismissal or change in governance structure to be forced, and all turnover due to health, change in controlling shareholders, legal disputes, or completion of acting duties to be voluntary; Second, for CEO turnover where the stated reason is retirement, a forced turnover is identified if the departing CEO is less than 60 years old, voluntary otherwise; Finally, for CEO turnover due to change of job, contract expiration, resignation, personal reasons, or no reason given, I trace the trajectory of the CEO after her departure and classify a turnover as voluntary if the CEO: (a) remains as or gets promoted to the chairperson of the board or (b) becomes the CEO or chairperson of another firm with a larger size, forced otherwise. A comparison among different classification methods are shown in Appendix A. Of the 3,035 CEO departures, 2,322 are classified as forced, with a rate of 76.51%. This rate is similar to that in Pi and Lowe (2011) for the period 1997–2006 (73.66%), while higher than the rate in You and Du (2012) for the relatively short period 2005–2008 (61.90%), which is probably due to the noise from the financial crisis. In addition, note that forced CEO turnover accounts for a much larger percentage of total CEO turnover in China than in the United States[2]. I infer that inefficient managerial contracts and the extremely high status of chairpersons limit the power of senior management in China, enabling boards to fire CEOs at a low cost. In subsequent regression analysis, I will provide multiple evidence for the validity of my classification.

3.2. *Empirical models and variables*

I employ the following linear probability model (LPM) and logit model to examine the impact of performance and CEO gender on forced CEO turnover decisions:

$$\text{Prob}(\textit{ForcedTurnover}_{i,t}) = \alpha_0+\alpha_1 \textit{ROA\_IndAdj}_{i,t-1}+\alpha_2 \textit{Female}_{i,t-1}+\alpha_3 \textit{ROA\_IndAdj}_{i,t-1}\times \textit{Female}_{i,t-1}+\boldsymbol{X}_{i,t-1}'\mathbf{A}+\lambda_t+\lambda_j+\varepsilon_{i,t}, \quad (1)$$

$$\ln[\text{Prob}(\textit{ForcedTurnover}_{i,t})/(1-\text{Prob}(\textit{ForcedTurnover}_{i,t}))] = \beta_0+\beta_1 \textit{ROA\_IndAdj}_{i,t-1}+\beta_2 \textit{Female}_{i,t-1}+\beta_3 \textit{ROA\_IndAdj}_{i,t-1}\times \textit{Female}_{i,t-1}+\boldsymbol{X}_{i,t-1}'\mathbf{B}+\lambda_t+\lambda_j. \quad (2)$$

The dependent variable, *ForcedTurnover*, is an indicator variable that equals one if the CEO is forced out, zero otherwise. Return on assets (ROA) is used to proxy a firm's operating performance. I employ operating performance rather than stock market performance for two reasons. First, in China, stock prices are highly sensitive to inside information and regulatory environment and thus cannot accurately reflect CEO performance (Fan et al., 2007). Second, unlike operating performance, market performance also contains the expectation of future CEO changes (Hermalin and Weisbach, 1998). I assume that the board relies on relative performance evaluation to assess the CEO and sets industry performance as a benchmark (Jenter and Kanaan, 2015). Therefore, the key variable of interest, *ROA_IndAdj*, is defined as the ROA adjusted by the mean ROA of industry peers. Industries are defined according to the Guidelines for the Industry Classification of Listed Companies issued by the China Securities Regulatory Commission (CSRC). Specifically, for manufacturing industries, I use two-digit industry codes, while for other industries, one-digit codes are used. This procedure ensures both a sufficient number of firms in each industry to

[2] Jenter and Kanaan (2015) reported the rate of 26.00% in the United States for the period 1993-2009 (875 cases of forced turnover and 2,490 cases of voluntary turnover).

prevent oligopolistic industries from biasing relative performance evaluation[3], and a similar nature of firms within the same industry. Another variable of interest, *Female*, is a dummy variable with value one if the CEO is female and zero otherwise. I include the interaction term between *ROA_IndAdj* and *Female* to test the effect of the gender-induced attribution bias.

Vector ***X*** consists of three types of control variables, i.e., firm characteristics, governance characteristics, and CEO characteristics. For firm characteristics, I define *FirmSize* as the logarithmic transformation of total assets. *Leverage* is used to capture financial risk while *Volatility* is a proxy for market uncertainty. In light of Fich and Shivdasani (2006), I use *CapitalExpenditure* and *R&DIntensity* to measure a firm's growth opportunity[4] . For governance characteristics, I first control for the intensity and effectiveness of board monitoring by including *BoardSize*, *Independence*, *BoardMeeting*, and *Committee*. Given the crucial governance role of controlling shareholders in Chinese firms, I use *SOE*, a dummy variable that equals one if the firm is controlled by the government and zero otherwise, to capture the nature of the controlling shareholder. I also introduce the Herfindahl index (*Herfindahl5*) to control for ownership concentration. With regard to CEO characteristics, following the convention of previous studies, I first control for potential misclassification of CEO turnover by adding *RetireAge*, a binary variable with value one if the CEO is over 55 years old and zero otherwise. Given that powerful CEOs are less likely to be fired, I employ four proxy variables to control for CEOs' managerial hegemony and entrenchment. In line with previous studies, I first control for *Tenure* and *Duality*. Since powerful CEOs can undermine board monitoring by involving in director selection process, the third proxy, *NominatingCommittee*, is used to indicate whether or not the CEO also takes up a position on the nominating committee (Shivdasani and Yermack, 1999; Guo and Masulis, 2015). *Blockholder*, an indicator variable that is equal to one if the CEO holds more than 5% of the firm's outstanding shares and zero otherwise (Jenter and Kanaan, 2015), is the last proxy, in concert with the viewpoint that managerial ownership is a reflection of power. In addition, I also include year and industry fixed effects (λ_t and λ_j, respectively) to capture overall time trends and industry impact. All explanatory variables are lagged by one year to circumvent noise from CEO successors. Standard errors are clustered at the firm level to address the influence of within-firm serial correlation (Petersen, 2009). Detailed variable definitions are shown in AppendixB.

The main advantage of the LPM is that the coefficient estimates can be interpreted directly as marginal effects. However, since the binary nature of the dependent variable is neglected, the coefficient estimates in LPM are no longer consistent and the error term also suffers from heteroskedasticity, whereas the logit model addresses these drawbacks at the cost of intuitiveness. In subsequent sections, I will use logit model as the primary model while using LPM as a supplement when necessary.

3.3. Descriptive statistics

Before moving on to the regression analysis, I first provide an overview of the dataset. Panel A of Table 1 reports the distribution of firm-year observations. As noted above, the total CEO turnover rate is 17.08% and the rate of forced turnover (13.06%) is considerably higher than that of voluntary turnover (4.01%), which is diametrically

[3] In oligopolistic industries, actions of a CEO may have impact on her industry peers, and thus it is optimal for the board to make CEO retention decisions based on both firm-specific performance and the endogenous part of industry performance. If this is the case, then it is improper to assume that the board filters industry performance completely. See Jenter and Kanaan (2015) for moredetails.

[4] As mentioned above, I do not use Tobin's Q as a measure of growth opportunity on account of information opacity in Chinese stock markets.

opposed to the situation in the United States. The vast majority of firms are still dominated by men, with only 6.03% of observations having a female CEO, similar to the percentage in the United States for the period 1994-2003 (6.22%) reported by Huang and Kisgen (2013). This suggests that women are still struggling to break the glass ceiling in order to reach senior management levels.

In Panel B and C, I conduct two sets of univariate analyses by dividing the sample based on forced CEO turnover and CEO gender, respectively. Panel B shows that firms with forced CEO turnover significantly underperform those that do not experience such changes, indicating that accounting performance is a criterion by which the board evaluates the CEO. There are also other systematic differences between firms undergoing forced CEO turnover and those that retain their incumbent CEOs, e.g., firms with forced CEO turnover have larger size, larger boards with more frequent meetings, and are more likely to be controlled by the government, etc. In addition, old CEOs with weak power are also likely to be dismissed. In Panel C, consistent with my hypothesis, I find no significant difference in the frequency of forced CEO turnover between female- and male-led firms. Panel C also reports systematic differences between firms with and without female CEOs, e.g., non-state-owned firms with smaller size, lower R&D investment, and smaller but more independent boards tend to appoint women as CEOs. Moreover, female CEOs are less likely to serve as board chairs or nominating committee members simultaneously but hold a larger share of their firms' stock.

[Insert Table 1 about here]

In Panel D of Table 1, I partition the sample based on performance and CEO gender and calculate the corresponding frequency of forced CEO turnover for each subsample. As performance rises from the lowest quartile to the highest, the rate of forced CEO turnover declines significantly in both male- and female-dominated firms. However, the decline for female CEOs is almost as twice as that for their male counterparts (15.48% versus 8.06%), indicating that female CEO departures are more sensitive to performance, aligning with my hypothesis of the gender-induced attribution bias. Hold performance range constant, the fact that male CEOs are significantly less likely to be fired than female CEOs ($p < 0.1$) when performance is below the first quartile is also reconciled with the presence of attribution bias in the boardroom, whereas the opposite becomes true when performance lies between the first and second quartiles ($p < 0.05$). Given that test of means can only provide *prima facie* evidence, in the next section, I will employ multiple regression analysis for further exploration.

4. CEO gender and turnover-performance sensitivity

4.1. Baseline results

The first two columns of Table 2 report the baseline results of the multiple regression analysis. The results for LPM in column (1) are consistent with my expectations: The coefficients of both *ROA_IndAdj* and its interaction term with *Female* are significantly negative, suggesting that the turnover-performance sensitivity of female CEOs is higher than that of their male counterparts, while *Female* has an insignificant coefficient, indicating that, on average, boards do not discriminate against women without a specific reason when making CEO turnover decisions. However, since *ForcedTurnover* is a dichotomous dependent variable, the results of LPM have limited credibility.

In column (2), I present the estimation of the logit model. Similarly, *ROA_IndAdj* is negatively associated with forced CEO turnover at the 5% significance level while the coefficient of *Female* is negative but not significant. In nonlinear models like logit and probit, the interaction effect of an interaction term is neither equal to its coefficient estimate nor to the marginal effect usually computed by taking the partial derivative with respect to the whole interaction term, and the corresponding standard error and z-statistic are also no longer correct[5] (Ai and Norton, 2003). Therefore, for the interaction term between *ROA_IndAdj* and *Female*, I compute its correct interaction effect and standard error following Norton et al. (2004). Consistent with the LPM, the calculated interaction effect is significantly negative, providing evidence for the attribution bias induced by CEO gender. This effect is nontrivial in terms of economic magnitude: The average turnover-performance sensitivity of female CEOs is 4.76 ((0.067+0.252)/0.067) times higher than that of male CEOs, and as *ROA_IndAdj* decreases by one standard deviation (0.129), on average, the probability of forced turnover rises by 4.12% ((0.067+0.252)×0.129) for female CEOs, while increasing by only 0.86% (0.067×0.129) for their male counterparts.

[Insert Table 2 about here]

As for the control variables in column (2), I find that firms with smaller size, higher leverage, and scarcer growth opportunities (i.e., lower capital expenditure or R&D intensity) are more likely to experience CEO replacement. Among board characteristics, only *BoardMeeting* has a significant positive association with the likelihood of forced turnover, indicating that the frequency of meetings is a valid proxy for the intensity of board oversight. State-owned enterprises and firms with dispersed ownership are more likely to fire their CEOs, suggesting that ownership structure affects the initiative of shareholders to participate in governance. The positive coefficient of *RetireAge* captures the potential misclassification of CEO departures. In addition, the negative and sizable coefficient estimates of *Duality* and *Blockholder* as well as the weakly negative coefficient of *NominatingCommittee* ($p = 0.13$) are in line with the theory of managerial entrenchment, denoting that powerful CEOs are less likely to be replaced.

4.2. Endogeneity concerns

Prudence is warranted in studies on the role of boards of directors due to joint-endogeneity issues, i.e., the interplay between the composition of boards or top management teams and the actions they take (Adams et al., 2010). In my case, the main sources of endogeneity are omitted variables (Adams and Ferreira, 2009; Coles et al., 2014) and self-selection (Huang and Kisgen, 2013; Field et al., 2020). Some time-invariant or time-varying unobservable variables (e.g., corporate culture and environmental munificence, respectively) that may affect both CEO selection and the probability of forced turnover will generate omitted variable bias. Moreover, female CEOs may self-select into firms that are systematically different from others, resulting in self-selection bias. For instance, if female CEOs do not regard board monitoring as a threat like male CEOs do, then more female CEOs will enter firms with a more vigilant board, and thus the results may be driven by such self-selection effect rather than the hypothesized attribution bias in the boardroom. In the following subsections, I will employ different approaches to address these endogeneity issues.

[5] In my logit model, the usually computed marginal effect is $\partial F(\cdot)/\partial(ROA\_IndAdj \times Female) = f(\cdot)\beta_3$, where $F()$ and $f()$ are the cumulative distribution function and probability density function of the logistic distribution, respectively, and $\cdot$ refers to the right-hand side of Equation (2). In contrast, the correct interaction effect is the discrete difference (with respect to *Female*) of the partial derivative (with respect to *ROA_IndAdj*), i.e., $\Delta(\partial F(\cdot)/\partial ROA\_IndAdj)/\Delta Female = \Delta[f(\cdot)(\beta_1+\beta_3 Female)]/\Delta Female = f(\cdot)|_{Female=1}(\beta_1+\beta_3) - f(\cdot)|_{Female=0}\beta_1$.

4.2.1. Control for firm fixed effects

I first deal with firm-specific time-invariant unobservable factors by controlling for firm fixed effects. For a short panel, controlling for a large number of firm fixed effects in the logit model may cause the incidental parameters problem, rendering coefficient estimates inconsistent[6]. In contrast, firm fixed effects can be simply included in the LPM (Cornelli et al., 2013).

Column (3) of Table 2 presents the results of the LPM with firm fixed effects. The interaction term between *ROA_IndAdj* and *Female* remains negatively related to forced CEO turnover at the 5% significance level, with economic magnitude similar to that in the logit model, suggesting that the results of interest are not driven by omitted time-invariant variables. The coefficient of *ROA_IndAdj* is still negative but becomes less significant ($p = 0.27$), indicating that the negative association between performance and CEO replacement decisions in male-led firms stems, at least in part, from firm fixed effects. In addition, consistent with Masulis et al. (2012), several firm and governance characteristics lose their explanatory power in the fixed effects model due to their slow-changing nature. Again, on account of the shortcomings of the LPM in estimating binary variables, I interpret the above results with caution.

4.2.2. Two-stage treatment effects model

In order to address the potential self-selection bias, I first implement a two-stage treatment effects model (Maddala, 1983; Oliver et al., 2018; Field et al., 2020). Specifically, in the first stage, I estimate the following probit model:

$$\text{Prob}(Female_{i,t}) = \Phi(\gamma_0+\boldsymbol{Z}_{i,t-1}'\boldsymbol{\Gamma}+\boldsymbol{IV}_{i,t-1}'\boldsymbol{\Pi}+\lambda_t+\lambda_j). \tag{3}$$

Φ() is the cumulative distribution function of the standard normal distribution. Vector ***Z*** consists of variables associated with the presence of female CEOs that overlap with those in the second stage, including *ROA_IndAdj*, *FirmSize*, *Leverage*, *R&DIntensity*, *BoardSize*, *Independence*, *BoardMeeting*, *SOE*, *Tenure*, *Duality*, and *Blockholder*, all defined as above. ***IV*** is a vector of instrumental variables excluded from the second stage that should be highly correlated with the presence of female CEOs and can indirectly influence forced CEO turnover through this channel only. As an analogue of that in Liu et al. (2014), my first IV is the top management team gender diversity within the industry (*IndustryTMTGD*). I believe that this variable reflects attitudes towards female senior managers at the industry level (and is thus positively associated with the presence of female CEOs) while is not related to firm-specific channels that affect CEO replacement. I follow Mitra et al. (2021) and design the second IV as the average number of female senior managers in other public companies within a 100-kilometer radius (*LocalFemaleTopManager*). I argue that this variable is positively correlated with *Female* since it mirrors the local supply of female top managers. For the exclusion restriction, first, given that competition among local firms in the same industry for talented women may affect the frequency of CEO changes, I define an alternative IV by excluding firms with the same three-digit industry code (Knyazeva et al., 2013). Second, I use two approaches in the second stage to deal with the possibility that the local supply of female leaders affects the likelihood of CEO turnover by influencing overall regional characteristics: introducing provincial GDP to control for the level of regional economic

[6] Conditional maximum likelihood approach with given sufficient statistics (Chamberlain, 1980) can be used to control for firm fixed effects in the logit model. However, in this model, only firms that have experienced within-group variation in the dependent variable can contribute to the estimation of the coefficients, thus employing this model will result in the loss of firm observations with no forced CEO turnover throughout the sample period, reducing the sample size (Mobbs, 2013) and meanwhile leading to sample selection bias.

development or adding province dummies to capture average regional effects.

In the second stage, I estimate the probability of forced CEO turnover using a probit model with the same variables as in Equation (2) and the inverse Mills ratio (*IMR*) estimated from the first stage[7] that can capture self-selection effects attributable to both measurable and unobservable factors (Field et al., 2020).

Table 3 reports the regression results. The control variables are not tabulated for brevity. Columns (1) and (2) present the baseline results of the first and second stages, respectively. In columns (3) and (4), I modify the second IV (i.e., *LocalFemaleTopManager*) by excluding firms in the same industry. Provincial GDP is controlled in column (5) while in column (6) I add province dummies instead. The results of the first stage in columns (1) and (3) denote that both *IndustryTMTGD* and *LocalFemaleTopManager* are positively correlated with the presence of female CEOs, indicating that the IVs are not weak instruments. In the other four columns showing the results of the second stage, the interaction effects between *ROA_IndAdj* and *Female* are all negative and highly significant ($p < 0.05$) and the coefficients of *IMR* are all insignificant, which jointly suggest that the self-selection effect of female CEOs is relatively weak and insufficient to drive the results. In addition, in column (5), *ProvinceGDP* is inversely related to forced CEO turnover, indicating that firms located in advanced provinces tend to have a more stable top management team.

[Insert Table 3 about here]

[Insert Table 4 about here]

4.2.3. Seemingly unrelated bivariate probit model

Seemingly unrelated bivariate probit model is an alternative approach to deal with self-selection bias (Cornelli et al., 2013; Mobbs, 2013). Unlike the two-stage treatment effects model, this model simultaneously estimates the following equations by the maximum likelihood method:

$$Female_{i,t}^{*} = \theta_0 + \boldsymbol{Z}_{i,t-1}'\boldsymbol{\Theta} + \boldsymbol{IV}_{i,t-1}'\mathbf{Y} + \lambda_t + \lambda_j + \omega_{1(i,t)}, \quad (4)$$

$$ForcedTurnover_{i,t}^{*} = \xi_0 + \xi_1 ROA\_IndAdj_{i,t-1} + \xi_2 Female_{i,t-1} + \xi_3 ROA\_IndAdj_{i,t-1} \times Female_{i,t-1} + \boldsymbol{X}_{i,t-1}'\boldsymbol{\Xi} + \lambda_t + \lambda_j + \omega_{2(i,t)}. \quad (5)$$

$Female^{*}$ and $ForcedTurnover^{*}$ are unobserved latent variables that satisfy: (a) $Female = 1$ if $Female^{*} > 0$, 0 otherwise; and (b) $ForcedTurnover = 1$ if $ForcedTurnover^{*} > 0$, 0 otherwise. ω_1 and ω_2 jointly follow a standardized bivariate normal distribution with correlation coefficient ρ (i.e., $(\omega_1, \omega_2) \sim N(0, 0, 1, 1, \rho)$). Therefore, the estimate of ρ reflects the correlation between the two error terms in Equation (4) and (5), i.e., the endogenous self-selection effect. The IVs in the selection equation (4) is used to identify the outcome equation (5). All variables are defined as above.

The results are presented in Table 4. As in the two-stage treatment effects model, I report the baseline results in columns (1) and (2), modify the second IV in columns (3) and (4), control provincial GDP in columns (5) and (6), and add province dummies in columns (7) and (8). Similar to the results of the treatment effects model, the coefficients of the key interaction term are still significantly negative in all four pairs of estimations[8]. The Wald tests of $\rho = 0$ indicate that the null hypothesis cannot be rejected at the 10% significance level, further demonstrating the

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[7] $IMR = \begin{cases} \varphi(\cdot)/\Phi(\cdot), & \text{if } Female = 1 \\ (-\varphi(\cdot))/(1-\Phi(\cdot)), & \text{if } Female = 0 \end{cases}$, where Φ() and φ() are the cumulative distribution function and probability density function of the standard normal distribution, respectively, and · refers to the expression in the parenthesis on the right-hand side of Equation (3).

[8] Since the method of Norton et al. (2004) cannot be applied to the bivariate probit model, I cannot derive correct estimates of the interaction effects, and thus I interpret the results with caution.

limited impact of self-selection bias.

4.2.4. Propensity score matching

I also apply a propensity score matching approach to cope with the self-selection effect (Rosenbaum and Rubin, 1983). However, unlike the treatment effects model and bivariate probit model, PSM only mitigates the self-selection bias by enhancing the similarity of observable characteristics and cannot deal with selection effects ascribed to unobservable factors.

Specifically, I first run a logit regression of *Female* on vector ***W*** for each sample year, where ***W*** includes all variables in vectors ***Z*** and ***IV*** as well as industry dummies, except replacing industry-adjusted ROA with actual ROA (*ROA*). Moreover, in light of Hillman et al. (2007), I further control for *TobinsQ* and *FirmAge*. I also include *TMTGD*, the gender composition of the top managerment team (excluding the CEO), expecting it to gauge attitudes towards female top managers at the firm level. Detailed variable definitions are shown in Appendix B. Next, in the second stage, I match female-led firms (i.e., the treatment group) with their male-led counterparts (i.e., the control group) in the same year based on the predicted probability (i.e., the propensity score) from the logit regression, and then re-estimate the probability of forced CEO turnover using the post-matched subsample and Equation (2). Given the low proportion of firms with female CEOs (6.03%), in order to ensure the large-sample asymptotic properties of the coefficient estimates and to attenuate the amplification of standard errors caused by multicollinearity, I employ a one-to-three nearest neighbor matching with replacement[9]. For robustness reasons, I also perform a one-to-three matching with a caliper of 0.001 and a one-to-one nearest neighbor matching without replacement.

[Insert Table 5 about here]

I conduct the following two diagnostic tests to verify the validity of my matching procedure (Chen et al., 2017; Shoham et al., 2020; Atif et al., 2021): First, I run the logit regression of *Female* on ***W*** for the pre-matched and post-matched samples separately and then compare their results. As shown in columns (1) and (2) of Panel A in Table 5, all coefficients significant in the pre-matched sample become highly insignificant in the post-matched sample, suggesting that the matched observable characteristics no longer have explanatory power for CEO gender. Second, in Panel B of Table 5, I perform t-tests of mean differences between the treatment and control groups for the pre- and post-matched samples separately. The results indicate that, on average, the differences in terms of observable characteristics between firms with and without female CEOs are trivial and indistinguishable after the matching procedure.

Panel C of Table 5 reports the regression results using the post-matched subsample. In column (1) I employ the one-to-three nearest neighbor matching with replacement, while in columns (2) and (3) I implement the one-to-three matching with a caliper of 0.001 and one-to-one pair matching without replacement, respectively. The interaction effects in the first two columns are significantly negative. In contrast, when I use the one-to-one matching approach, the interaction effect is still negative but becomes weakly significant ($p = 0.11$), perhaps because the smaller sample size increases its standard error. Overall, the results after PSM show little contradiction with my hypothesis.

Overall, I find no evidence that potential endogeneity drives higher turnover-performance sensitivity of female

[9] Actually, even in terms of the similarity between the post-matched treatment and control groups, the quality of one-to-three nearest neighbor matching is also superior to other matching methods employed.

CEOs, further supporting the hypothesis that the gender-induced attribution bias in the boardroom causes female CEOs to face a more precarious situation in case of poor performance.

4.3. *Robustness checks*

In this section, I conduct a variety of checks to ensure the robustness of the results. First, in order to demonstrate the validity of my modified classification method for CEO turnover, in columns (1) and (2) of Panel A in Table 6, I rerun the logit model using indicators of total turnover and voluntary turnover as dependent variables, respectively. Similar to the results using *ForcedTurnover*, in column (1), where I focus on total turnover, the coefficients of both accounting performance and its interaction term with CEO gender are significantly negative, whereas such disciplinary effect of poor performance vanishes when I investigate voluntary departures (column (2)), suggesting that my classification effectively separates forced and voluntary CEO turnover. In addition, to corroborate that the results are not the artifact of a particular classification, I replicate the logit model using alternative definitions of forced turnover: Given that a chairperson with a dual role may not voluntarily relinquish her CEO position, in column (3) of Panel A, I reclassify the termination of a CEO who continues holding the position of the board chair as forced turnover, while in column (4), I wield an age-based algorithm and define the departure of a CEO under 55 years of age as forced turnover[10] (Peters and Wagner, 2014). The main results remain robust in both columns. In unreported results, perturbations of the modified classification method also do not qualitatively change the coefficient estimates. Second, instead of lagging performance uniformly by one year, I follow Huson et al. (2001) and use a time- adjusted performance measure. Specifically, if a forced turnover event occurs in the first half of the year, I use the industry-adjusted ROA for the previous year, while if a forced departure is announced in the second half of the year, the performance for the current year is used. The unreported results do not show substantial changes.

Third, in Panel B of Table 6, I re-estimate the logit model using alternative performance measures. Given that, intuitively, boards may be inclined to regard the performance of industry peers with larger size and higher visibility as benchmarks, in column (1), I replace *ROA_IndAdj* with *ROA_VWIndAdj*, the value-weighted industry-adjusted ROA (Jenter and Kanaan, 2015). Since ROA based on net income is susceptible to earnings manipulation, in column (2), I use earnings before interest and tax (EBIT) as the numerator (*EBIT/Asset_IndAdj*). As another type of benchmark, in column (3), I consider performance forecasts rather than industry performance as a surrogate proxy for boards' performance expectations (Farrell and Whidbee, 2003; Puffer and Weintrop, 1991) and define *EPSForecastError* as the deviation rate between actual and forecasted earnings per share (EPS)[11]. In column (4), I use a dynamic performance measure rather than the static ones. Specifically, following Huson et al. (2001), I operationalize *ΔROA_IndAdj* as the annual growth rate of industry-adjusted ROA[12]. Similar to the baseline results, the probability of forced turnover is sensitive to performance for both male and female CEOs in all four columns, with a significantly higher sensitivity for female CEOs. To my surprise, the coefficient of *Female* becomes significant in columns (1) and (3). Nonetheless, given that only these two columns among all regression analyses exhibit such a

[10] Consistent with Peters and Wagner (2014), the classification with a threshold of 55 years old yields the closest forced turnover rate to that obtained from my reason-based classification (13.37% and 13.06%, respectively), further confirming the reliability of my classification method.

[11] Since some firms' forecasted EPS is extremely small, using it as the denominator may yield outliers and thus bias the estimates. Therefore, I winsorize *EPSForecastError* at the 1st and 99th percentiles.

[12] For the same reason as in Footnote 11, *ΔROA_IndAdj* is winsorized at the 1st and 99th percentiles to alleviate the impact of extremely small denominators.

relationship, I infer that it is due to the inability of these two performance measures to effectively separate the attribution bias from the overall effect of CEO gender.

[Insert Table 6 about here]

Fourth, I recalculate industry-adjusted ROA using alternative industry classifications based on three- and one-digit industry codes separately. The unreported results using newly generated variables show that the main outcomes are not sensitive to different industry classifications[13].

Fifth, I mitigate the influence of outliers by winsorizing the performance measures at the 1st and 99th percentiles. The untabulated results remain robust.

Sixth, as an alternative empirical specification, I run the following Cox proportional hazards (PH) model (Cox, 1972) to estimate forced turnover risk:

$$h_i(t, \boldsymbol{V}) = \lambda_0(t)\exp(\boldsymbol{V}_i'\boldsymbol{\eta}), \tag{6}$$

where $h_i(t, \boldsymbol{V})$ is the turnover hazard of CEO i at tenure t (month), $\lambda_0(t)$ is the baseline hazard at tenure t, and vector $\boldsymbol{V}$ refers to the same covariates as those in Equation (2), except *Tenure*. The most important assumption of the Cox PH model is the proportional hazard assumption, i.e., the baseline hazard hinges only on survival time t and is independent of individual characteristics $\boldsymbol{V}$, while the ratio of hazard functions of different individuals depends only on $\boldsymbol{V}$ and is independent of t. Under this assumption, the Cox PH model is able to execute partial likelihood estimation of coefficients $\boldsymbol{\eta}$ without assuming a functional form for the baseline hazard. In comparison with the logit model, the Cox PH model, which is widely applied to studies on CEO replacement (Fahlenbrach et al., 2011; Jenter and Kanaan, 2015; Elsaid and Ursel, 2018), flexibly handles the effect of CEO tenure on forced turnover risk and, more importantly, fully takes into account the right-censored nature of the forced turnover data[14].

Column (1) of Panel C in Table 6 reports the regression results of the Cox PH model. Similar to the logit model, the significantly negative coefficients of *ROA_IndAdj* and its interaction term with *Female* suggest that as performance declines, CEOs, especially female CEOs, face a more precarious situation in terms of their career continuity. Based on the reported hazard ratios, I find that given a one standard deviation drop in *ROA_IndAdj* (0.129), the increase in forced turnover risk for female CEOs is 1.31 ($1/0.123^{0.129}$) times greater than that for their male counterparts[15].

However, the Schoenfeld residuals test (presented in Appendix C) shows that five covariates (i.e., *Volatility*, *R&DIntensity*, *BoardMeeting*, *SOE*, and *Blockholder*) reject the proportional hazard assumption at the 5% significance level, and therefore my model setup may be inappropriate. In order to cope with this issue, in column (2) of Panel C, I estimate a Cox model with time-varying coefficients (TVCs) by adding the interaction terms between these problematic covariates and tenure t. As a simple but disruptive treatment, I also directly exclude these covariates

[13] It is worth noting that the coefficient of *ROA_IndAdj* is no longer significant in the regression based on three-digit industry codes, indicating that boards do take the impact of oligopoly into account when implementing relative performance evaluation, and also validating the soundness of the industry classification used in the main models.

[14] It is impossible to observe the potential probability of future departures for CEOs who are still in office at the end of the sample period. The logit model treats these observations equally (*ForcedTurnover* = 0), while the Cox model determines the contribution of different observations to the likelihood function based on CEO tenure.

[15] The hazard ratio of covariate v is $HR_v = h_i(t, V)|_{v=v_0+1}/h_j(t, V)|_{v=v_0} = \exp(\eta_v)$, thus $HR_{ROA\_IndAdj\times Female} = \exp(\eta_{ROA\_IndAdj\times Female})$. Assume that the drop in *ROA_IndAdj* is $-\Delta ROA\_IndAdj$, then the ratio between the increase in forced turnover risk for female and male CEOs is $\exp[-(\eta_{ROA\_IndAdj}+\eta_{ROA\_IndAdj\times Female})\Delta ROA\_IndAdj]/\exp(-\eta_{ROA\_IndAdj}\Delta ROA\_IndAdj)$. Based on the exponential algorithm, this expression is equal to $1/HR_{ROA\_IndAdj\times Female}^{\Delta ROA\_IndAdj}$.

in column (3). The main results remain robust in both columns.

5. Gender-induced attribution bias: possible mechanisms

Opening the black box of the board's decision-making process has long been an important but difficult challenge in corporate governance research. In the above analysis, I only reveal that boards are biased by CEO gender when relying on relative performance evaluation to make turnover decisions, whereas the details and driving forces within this process are still poorly understood. In this section, I attempt to explore possible mechanisms behind the gender-induced attribution bias in CEO turnover from multiple perspectives.

5.1. More sanctions for female underperformers or more protection for female outperformers?

First, the significantly negative interaction effect between firm performance and female CEOs may also imply that boards grant more protection to female outperformers, which negates the hypothesis of the gender-induced attribution bias under poor performance conditions. To rule out this alternative explanation, I partition the sample based on whether *ROA_IndAdj* is greater or less than zero and estimate the probability of forced CEO turnover separately for each subsample. If female CEOs fall victim to the attribution bias due to poor performance, then I will observe a significantly negative interaction effect only in the subsample of underperformers.

[Insert Table 7 about here]

The results in Table 7 support the existence of the gender-induced attribution bias: In the subsample of underperformers (column (1)), the interaction effect is negative at the 1% significance level and the coefficient of *ROA_IndAdj* is negative but weakly significant ($p = 0.17$), while in the subsample of outperformers (column (2)), the coefficients of both *ROA_IndAdj* and its interaction term with *Female* become highly insignificant. This suggests that boards tend to impose more sanctions on underperforming female CEOs than on male CEOs but do not provide more protection for female outperformers[16].

However, the above results also point to another alternative explanation: the glass cliff phenomenon, which states that women are more likely to be appointed to leadership positions when firms confront precarious conditions of high risk and low performance (Ryan and Haslam, 2007). Although antithetical results have been obtained in relevant literature[17], if this is the case, the results are perhaps a product of the right-skewed performance distribution of female-led firms and thus do not reflect the attribution bias of the board.

In subsections 4.2.2 to 4.2.4, the fact that firm performance has no significant impact on the presence of female CEOs has already provided preliminary evidence to refute the glass cliff explanation. Nevertheless, in order to examine this explanation more directly, I identify 2,955 cases of CEO appointment between 2010 and 2019 and

[16] The results are in stark contrast to those of Gupta et al. (2020), which find that the dismissal-performance sensitivity is higher for male than for female CEOs in high-performing firms, while there is no substantial difference between the two in poorly performing firms. However, my results appear to be more in line with the traditional model of CEO turnover, which assumes that the board will consider dismissing the CEO only if performance falls below a certain threshold, while the likelihood of forced turnover is unsusceptible to changes in performance when performance is above that threshold.

[17] Cook and Glass (2014) and Elsaid and Ursel (2018) find that firms in precarious conditions are more likely to designate women as CEOs, while Bechtoldt et al. (2019), using firms in Germany and the United Kingdom as a sample and focusing on the appointment of female directors, obtain no evidence in favor of the glass cliff phenomenon.

define *FemaleAppointment* as a dummy variable that equals one if the CEO successor is female and zero otherwise. Then, I run a logit regression of *FemaleAppointment* on lagged firm performance and the same control variables as in vector ***W***[18]. In untabulated results, for both actual and industry-adjusted ROA, neither their one-year lagged value nor two-year average of lagged values exhibit a significant negative association with the probability of female CEO appointment, and the two-year average of lagged values of industry-adjusted ROA is even positively correlated with *FemaleAppointment* at the 10% significance level. Overall, the glass cliff phenomenon is unlikely to explain the results.

5.2. Nonlinear effects: performance threshold for gender-induced attribution bias

In subsection 5.1, I corroborate that the gender-induced attribution bias in CEO turnover only impinges on female underperformers. Consequently, there must be a performance threshold for the attribution bias when boards evaluate female CEOs, i.e., boards will disproportionately attribute poor performance to female CEOs only if performance is below this threshold. In this subsection, I attempt to locate this threshold and analyze its relative position to the performance threshold for CEO turnover decisions.

To model such nonlinear effects, following Guo and Masulis (2015), I divide firms into ten groups based on deciles of industry-adjusted ROA and define *Decilei* ($i > 1$) as a dummy variable indicating that firm performance lies between the (i-1)th and ith deciles, while *Decile1* signifies that performance lies below the lowest decile. Then, I run a logit model of *ForcedTurnover* on *Decile1* to *Decile9* and their interaction terms with *Female*, with the same control variables as in Equation (2).

[Insert Table 8 about here]

Column (1) of Table 8 reports the logit regression results. It shows that the coefficients of the first four performance dummies are positive and statistically significant, while subsequent performance indicators all become trivial in economic magnitude and highly insignificant, suggesting that, on average, the performance threshold for CEO turnover decisions lies between the fourth and fifth performance deciles. In contrast, only the coefficients of the first two interaction terms are significantly positive, indicating that, on average, the performance threshold for the gender-induced attribution bias lies between the second and third deciles, lower than that for CEO turnover. Since the method of Norton et al. (2004) is not applicable to logit models with multiple interaction terms, I cannot derive correct estimates of the interaction effects. Therefore, I present the results of the LPM in column (2) of Table 8 as a comparison. The second interaction term (*Decile2* × *Female*) becomes weakly significant but still statistically acceptable ($p = 0.104$), and none of the coefficients of other key variables change substantially. I also plot the above nonlinear relationship based on the results of the LPM, presented in Fig. 1.

Overall, the above results demonstrate that, on average, the performance thresholds for forced turnover decisions are indistinguishable for female and male CEOs and that female CEOs suffer from negative attribution bias only when performance is extremely poor (below the performance threshold for forced departures), suggesting that female

[18] I do not control for year and industry dummies since some years and industries have never experienced female CEO appointments throughout the sample period, in which case controlling for year and industry fixed effects in the logit model will cause the incidental parameters problem. In addition, I use heteroskedasticity-robust standard errors (White, 1980) instead of standard errors clustered at the firm level since only a small fraction of firms have multi-year observations and thus serial correlation among within-firm observations is unlikely to affect the regression results.

CEOs have sufficient room to eschew the attribution bias from the board.

[Insert Figure 1 about here]

5.3. Are female CEOs blamed more for exogenous performance shocks?

In the preceding analysis, I posit that boards can completely filter out exogenous industry performance regardless of CEO gender when assessing CEO performance, i.e., employing the strong-form relative performance evaluation. However, given the information asymmetry, environmental complexity, and the limited ability of directors, boards may mistakenly use poor industry performance beyond CEOs' control as a basis for forced turnover decisions (Jenter and Kanaan, 2015), and if this is the case, such forced departures driven by exogenous performance shocks may also be influenced by the gender-induced attribution bias.

To explore this issue, following Jenter and Kanaan (2015), I conduct an OLS regression of firm performance (*ROA*) on the average performance of industry peers (*ROA_Peers*) and utilize the fitted values of the regression (*ROA_Systematic*) as a proxy for systematic industry performance, while using the regression residuals (*ROA_Idiosyncratic*) to gauge firm-specific performance[19]. I then perform a logit regression of *ForcedTurnover* on these two performance components and their interaction terms with *Female*, with the same control variables as in Equation (2). In addition, given that the intensity of the response to exogenous performance shocks may vary across industries, I also use the fitted values and residuals from industry-specific OLS regressions as alternative measures[20].

[Insert Table 9 about here]

Column (1) of Table 9 reports the logit regression results of forced turnover probability after decomposing ROA by a common beta. As in subsection 5.2, since multiple interaction terms are included in the logit regression, the results of the LPM are presented in column (2) as a comparison. Consistent with my original assumption of strong-form performance evaluation, in both columns, neither systematic industry ROA nor its interaction term with CEO gender has a significant effect on the likelihood of forced CEO departures, while idiosyncratic firm performance and its corresponding interaction term are significantly and inversely related to *ForcedTurnover*. However, after taking industry heterogeneity into account, congruous with Jenter and Kanaan (2015), the results in columns (3) and (4) show that, apart from firm-specific performance, industry peer performance is also highly negatively correlated with the probability of forced CEO turnover, suggesting that boards do not fully filter exogenous performance changes when implementing performance evaluations. In contrast, the interaction term between *ROA_Systematic* and *Female* remains insignificant, indicating that boards' attribution bias against female CEOs is only triggered by egregious firm-specific performance, while CEOs are treated equally regardless of gender with respect to the turnover risk caused by exogenous performance collapse.

Similar to subsection 5.2, the above results also imply that female CEOs have adequate room to avoid the attribution bias from the board since they do not have to be concerned about being blamed more for performance shocks beyond their control.

[19] In unreported regressions, I also simply use *ROA_Peers* and *ROA_IndAdj* as systematic industry performance and firm-specific performance, respectively. All results remain similar and robust.

[20] In order to ensure the large-sample asymptotic properties of the coefficient estimates, I exclude industries with less than 30 observations.

5.4. Effects of gender diversity: legitimacy concerns or similarity-attraction?

In this subsection, I explore the effect of the interaction between CEO gender and another gender characteristic in firms' upper echelons, gender diversity, on the gender-induced attribution bias. I focus on two main possible mechanisms: legitimacy concerns and similarity-attraction.

As an overarching part of CSR, gender diversity in upper echelons undertakes the role of providing organizational and social legitimacy for firms, which demonstrates to social media and the public the firms' adherence to social norms and ethical codes and facilitates the accumulation of social approbation and goodwill, and thus guarantees the smooth implementation of strategic decisions. Therefore, thoughtlessly terminating women (Naumovska et al., 2020) or dissenting against female candidates (Mitra et al., 2021) will deprive firms of critical legitimacy resources. Combining such legitimacy concerns with the increasing marginal costs of replacing female executives (Naumovska et al., 2020), I argue that when the gender diversity of a firm's top hierarchy is high, the legitimacy loss of firing the female CEO is relatively small and the predisposition of the board to engage in misattribution is heightened, whereas when the gender diversity is low, dismissing female CEOs may precipitate a severe loss of legitimacy, and as a consequence of such CSR pressure, boards may feel compelled to revise their evaluation of female CEOs to make it more impartial.

In contrast, from a social psychological perspective, the similarity-attraction paradigm proposes a diametrically opposed mechanism, stating that individuals who are similar in demographic characteristics (e.g., gender) tend to share similar beliefs and cognitive schemas, which will stimulate the attraction of each other (Byrne, 1961). Such attraction between CEOs and directors may predispose boards to attribute superior performance to outstanding competence of CEOs, while ascribing poor performance to environmental factors beyond their control (Westphal and Zajac, 1995). As a result, contrary to legitimacy theory, under the similarity-attraction paradigm, I argue that boards' support for and unbiased evaluation of female CEOs will increase with board gender diversity, while male-dominated boards are more likely to exhibit the gender-induced attribution bias.

In order to examine the legitimacy concerns, the total gender diversity of the top management team and board of directors is used as a proxy for the legitimacy benefits from female leaders. The sample is then divided into two subsamples based on whether the total gender diversity is above or below its industry-year median, and the probability of forced CEO turnover is estimated separately for the two subsamples[21]. If the board contemplates the loss of legitimacy when making turnover decisions, the coefficient of the interaction term between firm performance and CEO gender will be significantly negative only in the subsample of firms with high total gender diversity. To investigate the similarity-attraction paradigm, I utilize board gender diversity as a surrogate for gender similarity between directors and female CEOs, and then partition the sample into two subsamples based on whether the board gender diversity is above or below its industry-year median, and finally estimate the probability of forced CEO replacement for the two subsamples separately. If female directors are inclined to favorably appraise female CEOs, the interaction effect will be significantly negative only in the subsample of firms with low board gender diversity.

[21] I do not employ the triple interaction term between firm performance, CEO gender, and gender diversity for two reasons. First, models with triple interaction terms are overly complex and the regression results are confusing and difficult to interpret. Second, due to the small proportion of female CEOs, collinearity between the triple and double interaction terms is extremely severe, which affects the statistical inferences to a large extent.

[Insert Table 10 about here]

The results in Table 10 support the argument of legitimacy concerns and refute the similarity-attraction paradigm: In subsamples with low gender diversity (columns (2) and (4)), the presence of female CEOs has no significant moderating effect on turnover-performance sensitivity, while this interaction effect is negative and statistically significant in subsamples with high gender diversity (columns (1) and (3)). Moreover, the fact that both statistical significance and economic magnitude of the interaction effect in the subsample with high total gender diversity (column (1)) are higher than those in the subsample with high board gender diversity (column (3)) provides additional evidence for the legitimacy theory, suggesting that the board will weigh total legitimacy resources embedded in female top managers and directors as a whole when deciding whether to dismiss a female CEO, rather than focusing solely on gender diversity within the board.

In addition, note that the coefficient of *ROA_IndAdj* is significantly negative only in subsamples with low gender diversity (columns (2) and (4)), which resonates with the view of Sidhu et al. (2020) that even in highly gender-diverse boards, female directors are still tokens with restricted influence in decision-making and thus replacing male directors with female ones essentially diminishes heterogeneity within the "old boys' club" with dominant power, resulting in less effective board monitoring. These results also rebut an alternative explanation for the interaction effect that female directors are effective monitors and their representation on boards generally increases turnover-performance sensitivity regardless of CEO gender.

Another alternative explanation is that directors are more aware of CEOs of the same gender and are therefore more sensitive to their performance. However, if this is the case, then the turnover-performance sensitivity of female CEOs should be lower than that of their male counterparts in subsamples with low gender diversity (i.e., coefficients of the interaction terms are significantly positive), whereas the insignificant interaction effects in columns (2) and (4) reject this explanation.

Overall, the above results indicate that female senior managers and directors only serve as tokens providing legitimacy resources for firms. Their presence not only fails to safeguard female CEOs, but rather attenuates the legitimacy pressure boards face when considering terminating female CEOs, thus provoking the gender-induced attribution bias.

5.5. Effects of co-option and tenure: reciprocity, bargaining power, and managerial entrenchment

Being involved in the selection process of new directors, namely co-option, is the primary tactic by which the CEO controls the board's decision-making (Hermalin and Weisbach, 1998; Shivdasani and Yermack, 1999). Co-option enables the CEO to establish informal reciprocal relationships with directors, thereby undermining board independence and impairing the effectiveness of board oversight (Coles et al., 2014; Cassell et al., 2018). In China's collectivist society, such informal ties (also known as *guanxi*) have replaced individual competence as the most decisive factor in a CEO's career success (Luo, 2007). Therefore, I argue that reciprocity with board members due to co-option will shield female CEOs from unfair attribution bias when they underperform.

To test this proposition, I first define directors appointed after the CEO as co-opted directors and divide the sample into two subsamples based on whether the proportion of co-opted directors is above or below its industry-year median, and then estimate the likelihood of forced CEO turnover for the two subsamples separately. Furthermore, since independent directors bear the primary responsibility for monitoring the management, the sample is also partitioned based on the proportion of co-opted independent directors to total independent directors. If reciprocity between directors and female CEOs can counteract bias in the boardroom, I expect the coefficient of the interaction term to be significantly negative only in subsamples with low co-option.

The results in Panel A of Table 11 appear to conform to my expectations: In subsamples with high co-option (columns (1) and (3)), I do not observe a significant interaction effect between firm performance and CEO gender on forced departures, while the interaction effect is significantly negative in columns (2) and (4), where firms are characterized by a majority of co-opted directors or independent directors. However, the coefficient of *ROA_IndAdj* is significantly negative only in subsamples with high co-option, which is the exact opposite of the weakening effect of co-option on turnover-performance sensitivity found by Coles et al. (2014) and is theoretically implausible. I infer that the strong positive correlation between co-option and CEO tenure causes the results to incorporate the effects of these two factors.

Hence, in order to remove the effect of CEO tenure, following Coles et al. (2014), I perform an OLS regression of the proportion of co-opted directors (or independent directors) on CEO tenure and treat the regression residuals as the degree of co-option independent of CEO tenure, where the logarithmic transformation of monthly tenure plus one is used as the independent variable to mitigate the impact of the right-skewed distribution of tenure. Then, I divide the sample based on whether the residual is greater or less than zero and replicate the logit model of forced turnover probability for the two subsamples separately.

Panel B of Table 11 shows that the results become consistent with previous research after ruling out the effect of CEO tenure: *ROA_IndAdj* is significantly and negatively associated with forced CEO replacement only in subsamples with low co-option (columns (2) and (4)), indicating that the reciprocal relationship between CEOs and board members established by co-option reduces the effectiveness of board monitoring. Interestingly, the interaction effect is negative and statistically significant in all four columns, suggesting that after removing the effect of CEO tenure, reciprocity from co-option does not eliminate boards' attribution bias towards female CEOs. Actually, as a byproduct of board ineffectiveness, although the economic magnitude of the interaction effect is much lower in subsamples with high co-option, from the perspective of the ratio between the average turnover-performance sensitivity of female CEOs and that of their male counterparts, co-option even exacerbates gender inequality in turnover risk[22]. I explain this phenomenon using arguments from Inci et al. (2017) that gender stereotypes about leadership render female executives less effective in developing informal networks than male executives. Thus, given the same degree of co-option, the strength of reciprocity between co-opted directors and female CEOs will be lower than that of male CEOs.

[Insert Table 11 about here]

Given substantial discrepancies between the results in Panel A and B, it is enlightening to examine the effect of CEO tenure on the gender-induced attribution bias. Therefore, in the first two columns of Panel C, I segment the

[22] The ratio is 5.21 ((0.048+0.202)/0.048) in the subsample with a high proportion of co-opted directors, while in the subsample with a low proportion of co-opted directors, the ratio is 4.95 ((0.105+0.415)/0.105). When I focus on co-opted independent directors, the corresponding ratios are 6.09 ((0.033+0.168)/0.033) and 5.51 ((0.117+0.528)/0.117), respectively.

sample on the basis of whether CEO tenure is above or below its industry-year median and re-estimate the logit model of forced CEO turnover for the two subsamples separately. Similar to the results in Panel A, CEO gender has no significant effect on turnover-performance sensitivity in the subsample of long-tenured CEOs (column (1)), while in the subsample of CEOs with short tenure (column (2)), the interaction effect is negative and highly significant at the 1% level.

A questionable result is that the coefficient of *ROA_IndAdj* is significantly negative only in the subsample of long-tenured CEOs. I infer that it is because the board requires sufficient performance data to frame the assessment of a new CEO, and the significantly positive coefficient of *Tenure* in column (2) coincides with my conjecture. Hence, in the last two columns of Panel C, I exclude observations of new CEOs with less than one year of service and regroup the sample. Consistent with my inference, the coefficients of *ROA_IndAdj* and *Tenure* are negative and statistically significant in both subsamples after filtering the noise of new CEOs, while the interaction effect between CEO gender and firm performance does not change substantially. The relatively stable turnover-performance sensitivity throughout a CEO's tenure is inconsistent with Hermalin and Weisbach's (1998) model assuming constant CEO ability[23] but is aligned with Jenter and Lewellen's (2021) results that reflect changing CEO ability, indicating that the quality of CEO-firm match varies with changes in the firm or its environment, and thus even long-tenured CEOs are unlikely to accumulate sufficient bargaining power to suppress turnover-performance sensitivity. Moreover, the negative coefficient of CEO tenure is in agreement with the theory of managerial entrenchment, suggesting that over time, CEOs gradually take steps to consolidate their hegemony[24].

Combining the above results, I propose two possible explanations for differences between the interaction effect in subsamples of CEOs with long and short tenure: First, as a female CEO's tenure increases, the board accumulates more information about her prior performance, which prompts the board to depend more on explicit historical performance under similar conditions rather than ambiguous gender stereotypes when diagnosing the quality of CEO-firm match[25]. Second, while co-option is not an attractive choice, the managerial entrenchment mechanisms that female CEOs develop over time may include other tactics to counteract the attribution bias from boards.

Overall, the results in this subsection reveal that female CEOs' involvement in the selection of board members does diminish board oversight but cannot eliminate (and even exacerbates) the gender-induced attribution bias in the boardroom. On the other hand, after surviving the attribution bias early in their careers, female CEOs are evaluated as fairly as their male counterparts when boards consider turnover decisions.

5.6. Effects of human and social capital: are female CEOs bad resource providers?

The traditional model of CEO turnover argues that turnover decisions are not only dependent on CEOs' performance but also adjusted for costs of replacing incumbent CEOs. As the position that best demonstrates personal competence and prestige, CEOs provide critical resources for firms to reduce their environmental dependence (Pfeffer and Salancik, 1978), whereas such a resource-provisioning role is not always reflected in firm performance. I thus

[23] In Hermalin and Weisbach's (1998) model, as CEO tenure increases, a more precise assessment of CEO ability by the board strengthens the CEO's bargaining power and thus reduces the need for board monitoring, rendering forced turnover impervious to future performance changes.

[24] The negative relationship between CEO tenure and the likelihood of forced departures also demonstrate that my modified classification method for CEO turnover effectively segregates voluntary departures that increase with tenure.

[25] This explanation is in line with the view of Eagly et al. (1992) that the effect of gender on the evaluation of leaders diminishes as the amount of other information available about the leaders increases.

expect that, holding performance constant, inferior resource providers face higher turnover risk. In subsection 5.4, I have discussed the particular role of female CEOs as legitimacy providers. Nonetheless, if female CEOs, in general, are inferior to their male counterparts in the provision of other human and social capital, then the results may merely reflect the poor resource-provisioning role of female CEOs instead of the biased attribution fromboards.

I examine this alternative explanation by additionally controlling for CEOs' human and social capital. For human capital, I control for indicators of a CEO's executive experience, financial expertise, overseas background, and academic background. With regard to social capital, the number of outside directorships is used to gauge a CEO's reputation and two dummy variables are utilized to proxy for a CEO's social connections. *ShareholderConnection* takes a value of one if the CEO holds concurrent positions in shareholder parties and zero otherwise. *PoliticalConnection* is equal to one if the CEO is a former or current government official or member of National People's Congress (NPC) or the Chinese People's Political Consultative Conference (CPPCC), zero otherwise (Ma et al., 2013). Detailed variable definitions are shown in Appendix B.

[Insert Table 12 about here]

In column (1) of Table 12, I add the above variables to the logit model. The coefficients of the key independent variables are similar to the baseline results, suggesting that differences in human and social capital of CEOs do not drive the outcomes. Regarding unreported human and social capital controls, social connection is the only factor that the board weighs when deliberating CEO turnover decisions. Connections with shareholders lower the risk of forced departures, corresponding with the dominant status of controlling shareholders in Chinese firms. Political ties likewise enhance CEOs' immunity to forced turnover, indicating that political action is an overarching avenue for firms to minimize environmental contingencies (Hillman et al., 2009). In the rest of Table 12, I replicate the PSM approach in subsection 4.2.4 with the above human and social capital controls as additional matching criteria and re-estimate the probability of forced turnover for the post-matched subsamples. As reported in columns (2) to (4), the main results remain robust[26].

6. Conclusion

This study, motivated by growing social concerns about corporate gender equality and a lack of understanding of gender differences in turnover events, investigates the role of CEO gender in boards' turnover decision-making process. I provide new and robust evidence that, in the trade-off between CSR pressures and the tendency to express gender prejudice, boards prefer to obliquely manifest gender bias through the attribution process, that is, disproportionately attributing poor performance of female CEOs to intractable intrinsic causes such as lack of ability, resulting in the probability of forced turnover for female CEOs being more sensitive to performance declines compared with their male counterparts. I also highlight the importance of addressing endogeneity issues and demonstrate that the results are unlikely to be biased by potential omitted variables or self-selection effects.

Further, this study explores possible mechanisms behind the gender-induced attribution bias. I confirm that the results are not attributable to greater protection for female outperformers or the glass cliff phenomenon. An optimistic

[26] In column (4), where I employ a one-to-one nearest neighbor matching without replacement, the interaction effect is weakly significant but still statistically acceptable ($p = 0.11$).

result is that this attribution bias can only be triggered by egregious firm-specific performance, suggesting that in most cases the performance of female CEOs can be unbiasedly evaluated. For possible moderators, I observe that in consonance with legitimacy theory, gender differences in turnover-performance sensitivity only exist in firms with high gender diversity in upper echelons, indicating that the presence of other female executives not only fails to shield female CEOs, but rather alleviates the legitimacy pressure faced by boards and exacerbates their attribution bias against female leaders. CEO tenure is another moderator I found. After surviving the attribution bias early in their careers, the turnover-performance sensitivity of female CEOs becomes indistinguishable from that of their male counterparts. In contrast, involvement in the director selection process only weakens board monitoring but cannot eliminate such bias. In addition, I also reject another possible explanation that gender differences in CEOs' human and social capital drive the results.

This paper contributes to the neglected topic of gender bias in executive turnover and ameliorates both the theoretical framework and methodology. Nevertheless, regression analysis based on archival data still has insurmountable limitations in revealing the internal details of boards' attribution process. Perhaps the future research agenda should focus on gathering original survey data and exploring specific micro-foundations of the gender-induced attribution bias in CEO turnover.

Acknowledgements

I thank Asli Colpan and Soulida Louangphachaleun for their constructive comments.

Appendix A. Comparison of classification methods for CEO turnover

This table shows a comparison of different classification methods for CEO turnover in China between this research and three prior studies. (a) refers to remaining as or getting promoted to the chairperson of the board; (b) refers to becoming the CEO or chairperson of another firm with a larger size.

Reasons for departure	Chang and Wong (2009), You and Du (2012)	Pi and Lowe (2011)	Modified classification
Dismissal	Voluntary if (a) or (b)	Forced	Forced
Change in governance structure	Voluntary	Forced	Forced
Health	Voluntary	Voluntary	Voluntary
Change in controlling shareholders	Voluntary	Forced	Voluntary
Legal disputes	Voluntary	Voluntary	Voluntary
Completion of acting duties	Voluntary if (a) or (b)	Voluntary	Voluntary
Retirement	Voluntary if (a) or (b)	Voluntary	Voluntary if (a) or (b)
Change of job	Voluntary if (a) or (b)	Voluntary if (a) or (b)	Voluntary if (a) or (b)
Contract expiration	Voluntary if (a) or (b)	Voluntary if (a) or (b)	Voluntary if (a) or (b)
Resignation	Voluntary if (a) or (b)	Forced	Voluntary if (a) or (b)
Personal reasons	Voluntary if (a) or (b)	Voluntary if (a) or (b)	Voluntary if (a) or (b)
No reason given	Voluntary if (a) or (b)	Forced	Voluntary if (a) or (b)

Appendix B. Variable definitions

Variables	Definition
Dependent variables	
ForcedTurnover	Dummy variable that equals 1 if the CEO is forced out, 0 otherwise.
FemaleAppointment	Dummy variable that equals 1 if the CEO successor is female, 0 otherwise.

Variables of interest	
ROA_IndAdj	ROA of the firm subtracted by the average ROA of other firms in the same industry.
ROA_VWIndAdj	ROA of the firm subtracted by the market-value-weighted ROA of other firms in the same industry.
EBIT/Asset_IndAdj	EBIT divided by total assets then subtracted by the average of this ratio for other firms in the same industry.
EPSForecastError	Actual EPS subtracted by forecasted EPS then divided by the absolute value of forecasted EPS, winsorized at the 1st and 99th percentiles.
ΔROA_IndAdj	Difference between the industry-adjusted ROA of the current and prior year divided by the absolute value of prior year's industry-adjusted ROA, winsorized at the 1st and 99th percentiles.
Decilei	Dummy variable that indicates performance range. For i > 1, it equals 1 if industry-adjusted ROA lies between the (i-1)th and ith deciles, 0 otherwise. For i = 1, it equals 1 if industry-adjusted ROA lies below the lowest decile, 0otherwise.
ROA_Peers	Average ROA of other firms in the same industry.
ROA_Systematic	Fitted values of the regression of ROA on the average ROA of other firms in the same industry.
ROA_Idiosyncratic	Residuals of the regression of ROA on the average ROA of other firms in the same industry.
Female	Dummy variable that equals 1 if the CEO is female, 0 otherwise.
Instrumental Variables	
IndustryTMTGD	Proportion of female top managers in the focal firm's industry.
LocalFemaleTopManager	Number of female top managers in public firms within a 100km radius of the focal firm's headquarters divided by the number of public firms in this area.
Control variables	
Firm characteristics	
FirmSize	Natural logarithm of total assets.
Leverage	Book value of total debt divided by the book value of total assets.
Volatility	Standard deviation of monthly stock returns during the fiscal year.
CapitalExpenditure	Capital expenditure divided by total assets.
R&DIntensity	R&D expenditure divided by total assets.
ROA	Return on assets, i.e., the ratio of net income to total assets.
TobinsQ	Total assets plus the market value of equity minus the book value of equity then divided by total assets.
FirmAge	Number of years since the firm was founded.
TMTGD	Number of female top managers divided by the total number of top managers, excluding the CEO.
Governance characteristics	
BoardSize	Natural logarithm of the number of directors.
Independence	Number of independent directors divided by the total number of directors.
BoardMeeting	Natural logarithm of the number of board meetings.
Committee	Number of board committees.
SOE	Dummy variable that equals 1 if the firm is controlled by the government.
Herfindahl5	Sum of the squared proportion of shares held by each top 5 shareholders.
CEO characteristics	
RetireAge	Dummy variable that equals 1 if the CEO is over 55 years old, 0 otherwise.
Tenure	Number of months that the CEO has been in office divided by 12.
Duality	Dummy variable that equals 1 if the CEO is also the chairperson of the board, 0 otherwise.
NominatingCommittee	Dummy variable that equals 1 if the CEO is also a member of the nominating committee, 0 otherwise.
Blockholder	Dummy variable that equals 1 if the CEO holds more than 5% of the firm's outstanding shares, 0 otherwise.
ExecutiveExperience	Dummy variable that equals 1 if the CEO has served as a top executive prior to the appointment, 0 otherwise.
FinancialExpertise	Dummy variable that equals 1 if the CEO has worked in financial institutions, 0 otherwise.

Overseas	Dummy variable that equals 1 if the CEO has studied or worked overseas, 0 otherwise.
Academic	Dummy variable that equals 1 if the CEO has worked in universities or research institutions, 0 otherwise.
OutsideDirectorship	Number of outside directorships held by the CEO.
ShareholderConnection	Dummy variable that equals 1 if the CEO holds concurrent positions in shareholder parties, 0 otherwise.
PoliticalConnection	Dummy variable that equals 1 if the CEO is a former or current government official or member of the National People's Congress (NPC) or the Chinese People's Political Consultative Conference (CPPCC), 0 otherwise.
Other controls	
ProvinceGDP	Natural logarithm of provincial GDP.

Appendix C. Schoenfeld residuals test

This table reports chi-square statistics and corresponding *p*-values of the Schoenfeld residuals test for the proportional hazard assumption. If the proportional hazard assumption holds, the Schoenfeld residuals should not show a regular variation with survival time t. As a rule of thumb, 0.05 is chosen as the threshold for the *p*-value.

	χ^2	$p > \chi^2$
ROA_IndAdj	2.90	0.09
Female	0.77	0.38
ROA_IndAdj×Female	0.24	0.62
FirmSize	0.08	0.78
Leverage	1.55	0.21
Volatility	4.50	0.03
CapitalExpenditure	2.07	0.15
R&DIntensity	11.48	0.00
BoardSize	2.87	0.09
Independence	0.19	0.66
Committee	0.19	0.67
BoardMeeting	10.47	0.00
SOE	20.55	0.00
Herfindahl5	0.89	0.35
RetireAge	0.09	0.77
Duality	0.21	0.64
NominatingCommittee	0.86	0.35
Blockholder	11.19	0.00

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Table 1
Descriptive statistics.
This table shows an overview of the dataset. Panel A reports the distribution of firm-year observations. Panels B and C present the results of the univariate analyses by forced CEO turnover and CEO gender, respectively. Panel D reports the frequency of forced CEO turnover by performance and CEO gender and the results of corresponding t-tests. Variable definitions are presented in Appendix B. T-statistics for mean differences and z-statistics corresponding to the Wilcoxon rank-sum tests for median differences are displayed in parentheses. Asterisks denote significance levels of 1% (***), 5% (**), and 10% (*).

Panel A: Distribution of observations

	No turnover	Turnover	Total	Forced turnover	Voluntary turnover
Male CEO	13,833	2,869	16,702	2,194	675
	77.83%	16.14%	93.97%	12.34%	3.80%
Female CEO	906	166	1,072	128	38
	5.10%	0.93%	6.03%	0.72%	0.21%
Total	14,739	3,035	17,774	2,322	713
	82.92%	17.08%	100.00%	13.06%	4.01%

Panel B: Univariate analysis by forced CEO turnover

	ForcedTurnover=1		*ForcedTurnover*=0		Differences	
	Mean	Median	Mean	Median	Mean	Median
ROA_IndAdj	-0.021	-0.010	0.002	0.003	-0.023***	-0.013***
					(-8.02)	(-12.82)
Female	0.055	0	0.061	0	-0.006	0
					(-1.13)	(-1.13)
FirmSize	22.141	21.957	21.951	21.764	0.190***	0.194***
					(6.74)	(7.13)
Leverage	0.457	0.453	0.395	0.379	0.063***	0.074***
					(12.97)	(12.80)
Volatility	0.139	0.120	0.144	0.118	-0.006*	0.002
					(-1.70)	(0.52)
CapitalExpenditure	0.048	0.033	0.055	0.040	-0.007***	-0.007***
					(-6.45)	(-8.03)
R&DIntensity	0.018	0.014	0.022	0.018	-0.004***	-0.004***
					(-7.63)	(-10.77)
BoardSize	2.142	2.197	2.131	2.197	0.011**	0***
					(2.52)	(3.38)
Independence	0.373	0.333	0.374	0.333	-0.001	0
					(-1.20)	(-1.55)
Committee	3.879	4	3.887	4	-0.008	0
					(-0.94)	(-1.38)
BoardMeeting	2.233	2.197	2.198	2.197	0.035***	0***
					(4.24)	(3.78)
SOE	0.405	0	0.307	0	0.098***	0***
					(9.43)	(9.41)
Herfindahl5	0.161	0.131	0.165	0.139	-0.004*	-0.008***
					(-1.69)	(-3.09)
RetireAge	0.179	0	0.140	0	0.039***	0***
					(5.02)	(5.02)
Tenure	3.698	2.833	3.793	3	-0.094	-0.167
					(-1.38)	(-1.19)
Duality	0.169	0	0.315	0	-0.296***	0***
					(-14.45)	(-14.37)
NominatingCommittee	0.240	0	0.286	0	-0.047***	0***

					(-4.66)	(-4.66)
Blockholder	0.190	0	0.337	0	-0.148***	0***
					(-14.32)	(-14.24)

Panel C: Univariate analysis by CEO gender

	Female=1		*Female*=0		Differences	
	Mean	Median	Mean	Median	Mean	Median
ForcedTurnover	0.119	0	0.131	0	-0.012	0
					(-1.13)	(-1.13)
ROA_IndAdj	0.002	0.006	-0.001	0.001	0.003	0.004***
					(0.67)	(2.86)
FirmSize	21.688	21.547	21.994	21.801	-0.306***	-0.254***
					(-7.69)	(-7.83)
Leverage	0.361	0.341	0.406	0.390	-0.044***	-0.049***
					(-6.46)	(-6.47)
Volatility	0.154	0.120	0.143	0.118	0.011**	0.001
					(2.48)	(0.08)
CapitalExpenditure	0.055	0.040	0.054	0.039	0.002	0.001
					(1.00)	(0.39)
R&DIntensity	0.020	0.016	0.021	0.018	-0.002***	-0.001**
					(-2.59)	(-2.26)
BoardSize	2.068	2.197	2.137	2.197	-0.068***	0***
					(-11.07)	(-11.04)
Independence	0.387	0.375	0.373	0.333	0.014***	0.042***
					(7.97)	(8.09)
Committee	3.886	4	3.886	4	0.001	0
					(0.05)	(0.73)
BoardMeeting	2.187	2.197	2.204	2.197	-0.016	0
					(-1.37)	(-0.41)
SOE	0.192	0	0.328	0	-0.136***	0***
					(-9.27)	(-9.25)
Herfindahl5	0.171	0.146	0.164	0.137	0.007**	0.008**
					(2.01)	(2.41)
RetireAge	0.143	0	0.145	0	-0.002	0
					(-0.22)	(-0.22)
Tenure	3.822	3.167	3.778	3	0.045	0.167
					(0.46)	(1.49)
Duality	0.253	0	0.299	0	-0.046***	0***
					(-3.21)	(-3.21)
NominatingCommittee	0.252	0	0.282	0	-0.030**	0**
					(-2.14)	(-2.14)
Blockholder	0.376	0	0.216	0	0.160***	0***
					(4.19)	(4.19)

Panel D: Frequency of forced CEO turnover by performance and CEO gender

	Performance quartile				Differences
	1	2	3	4	(1 − 4)
Male CEO	17.77%	13.84%	11.16%	9.71%	8.06%***
					(10.76)
Female CEO	22.41%	8.37%	11.55%	6.93%	15.48%***
					(5.33)
Differences	-4.63%*	5.47%**	-0.39%	2.78%	
(Male − Female)	(-1.82)	(2.46)	(-0.20)	(1.59)	

Table 2
Baseline models and linear probability model with firm fixed effects.
Columns (1) and (2) of this table report the baseline results of the linear probability model and logit model, respectively. Column (3) shows the results of the linear probability model with firm fixed effects. The dependent variable is *ForcedTurnover*. Variable definitions are presented in Appendix B. Standard errors clustered at the firm level (Petersen, 2009) are displayed in parentheses. In column (2), average marginal effects of the logit model are shown in brackets, and the average interaction effect as well as its corresponding standard error computed according to Norton et al. (2004) are reported following the interaction term. Asterisks denote significance levels of 1% (***), 5% (**), and 10% (*).

	(1)	(2)	(3)
	LPM	Logit	LPM with FE
ROA_IndAdj	-0.072**	-0.607**	-0.028
	(0.028)	(0.286)	(0.026)
		[-0.067]	
Female	-0.009	-0.105	-0.014
	(0.010)	(0.101)	(0.025)
		[-0.012]	
ROA_IndAdj×Female	-0.344***	-2.481***	-0.270**
	(0.114)	(0.931)	(0.108)
		[-0.272]	
Average interaction effect		**-0.252****	
		(0.102)	
FirmSize	-0.010***	-0.081***	-0.024***
	(0.003)	(0.023)	(0.009)
		[-0.009]	
Leverage	0.088***	0.650***	0.005
	(0.017)	(0.145)	(0.030)
		[0.071]	
Volatility	-0.010	-0.094	0.009
	(0.012)	(0.161)	(0.017)
		[-0.010]	
CapitalExpenditure	-0.162***	-1.604***	-0.105
	(0.049)	(0.534)	(0.075)
		[-0.176]	
R&DIntensity	-0.540***	-7.611***	-0.243
	(0.147)	(2.027)	(0.210)
		[-0.836]	
BoardSize	-0.017	-0.145	-0.039
	(0.017)	(0.145)	(0.037)
		[-0.016]	
Independence	0.004	0.040	0.008
	(0.055)	(0.494)	(0.101)
		[0.004]	
Committee	-0.006	-0.070	-0.002
	(0.006)	(0.054)	(0.014)
		[-0.008]	
BoardMeeting	0.020***	0.175***	0.010
	(0.007)	(0.064)	(0.010)
		[0.019]	
SOE	0.012*	0.103*	0.018
	(0.007)	(0.057)	(0.046)
		[0.011]	
Herfindahl5	-0.057**	-0.518**	0.060
	(0.024)	(0.221)	(0.087)
		[-0.057]	
RetireAge	0.045***	0.382***	0.040***
	(0.007)	(0.059)	(0.012)
		[0.042]	

Tenure	0.000	0.005	0.033***
	(0.001)	(0.008)	(0.001)
		[0.001]	
Duality	-0.054***	-0.588***	-0.099***
	(0.006)	(0.067)	(0.013)
		[-0.065]	
NominatingCommittee	-0.010*	-0.082	-0.020**
	(0.006)	(0.054)	(0.010)
		[-0.009]	
Blockholder	-0.041***	-0.439***	-0.023*
	(0.006)	(0.063)	(0.012)
		[-0.048]	
Constant	0.330***	-0.262	0.604***
	(0.075)	(0.647)	(0.222)
Year dummies	Yes	Yes	Yes
Industry dummies	Yes	Yes	No
Firm fixed effects	No	No	Yes
Observations	17,774	17,774	17,774
R^2	0.031		0.058
Pseudo R^2		0.042	

Table 3
Two-stage treatment effects model.
This table shows the results of the two-stage treatment effects model. Control variables are not tabulated for brevity. The baseline results are reported in columns (1) and (2). In columns (3) and (4), the variable *LocalFemaleTopManager* is modified by excluding firms with the same three-digit industry code (Knyazeva et al., 2013). Provincial GDP and province dummies are added in columns (5) and (6), respectively. The dependent variable in columns (1) and (3) is *Female*, while in the other four columns, the dependent variable is *ForcedTurnover*. Variable definitions are presented in Appendix B. Standard errors clustered at the firm level (Petersen, 2009) are displayed in parentheses. Average marginal effects are shown in brackets, and the average interaction effect as well as its corresponding standard error computed according to Norton et al. (2004) are reported following the interaction term. Asterisks denote significance levels of 1% (***), 5% (**), and 10% (*).

	(1)	(2)	(3)	(4)	(5)	(6)
	Baseline results		Exclude regional industry competition		Control for regional effects	
	First stage	Second stage	First stage	Second stage	Second stage	Second stage
IndustryTMTGD	4.412*		4.426*			
	(2.389)		(2.389)			
	[0.502]		[0.504]			
LocalFemaleTopManager	0.221*		0.223*			
	(0.125)		(0.122)			
	[0.025]		[0.025]			
ROA_IndAdj	-0.020	-0.306**	-0.023	-0.298**	-0.300**	-0.302**
	(0.181)	(0.136)	(0.182)	(0.136)	(0.135)	(0.134)
	[-0.002]	[-0.062]	[-0.003]	[-0.061]	[-0.061]	[-0.061]
Female		0.513		0.541	0.538	0.536
		(0.515)		(0.517)	(0.517)	(0.519)
		[0.104]		[0.110]	[0.109]	[0.109]
ROA_IndAdj×Female		-1.497***		-1.503***	-1.489***	-1.501***
		(0.485)		(0.485)	(0.488)	(0.485)
		[-0.305]		[-0.306]	[-0.303]	[-0.304]
Average interaction effect		**-0.486****		**-0.496****	**-0.491****	**-0.492****
		(0.232)		**(0.231)**	**(0.231)**	**(0.232)**
ProvinceGDP					-0.039**	
					(0.019)	
					[-0.008]	
IMR		-0.276		-0.290	-0.288	-0.288
		(0.248)		(0.249)	(0.249)	(0.250)
		[-0.056]		[-0.059]	[-0.059]	[-0.058]
Control variables	Yes	Yes	Yes	Yes	Yes	Yes
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes
Industry dummies	Yes	Yes	Yes	Yes	Yes	Yes
Province dummies	No	No	No	No	No	Yes
Observations	17,618	17,618	17,604	17,604	17,604	17,604
Pseudo R^2	0.054	0.042	0.054	0.042	0.043	0.045

Table 4

Seemingly unrelated bivariate probit model.

This table shows the results of the seemingly unrelated bivariate probit model. Control variables are not tabulated for brevity. The baseline results are reported in columns (1) and (2). In columns (3) and (4), the variable *LocalFemaleTopManager* is modified by excluding firms with the same three-digit industry code (Knyazeva et al., 2013). Provincial GDP is controlled in columns (5) and (6), while in columns (7) and (8), it is replaced by province dummies. The dependent variable in columns (1), (3), (5), and (7) is *Female*, while in the other four columns, the dependent variable is *ForcedTurnover*. Variable definitions are presented in Appendix B. Standard errors clustered at the firm level (Petersen, 2009) are displayed in parentheses. Estimates of the correlation coefficient ρ between the two error terms and their corresponding Wald tests are reported at the end of the table. Asterisks denote significance levels of 1% (***), 5% (**), and 10% (*).

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Baseline results		Exclude regional industry competition		Control for regional effects			
	DV: *Female*	DV: *ForcedTurnover*	DV: *Female*	DV: *ForcedTurnover*	DV: *Female*	DV: *ForcedTurnover*	DV: *Female*	DV: *ForcedTurnover*
IndustryTMTGD	4.526*		4.540*		4.549*		4.536*	
	(2.376)		(2.374)		(2.377)		(2.376)	
LocalFemaleTopManager	0.212*		0.216*		0.216*		0.218*	
	(0.124)		(0.121)		(0.121)		(0.121)	
ROA_IndAdj	-0.025	-0.303**	-0.028	-0.295**	-0.028	-0.296**	-0.029	-0.299**
	(0.171)	(0.135)	(0.171)	(0.135)	(0.172)	(0.134)	(0.172)	(0.133)
Female		0.662		0.690		0.674		0.638
		(0.558)		(0.549)		(0.550)		(0.544)
ROA_IndAdj×Female		-1.416***		-1.415***		-1.404***		-1.423***
		(0.479)		(0.478)		(0.482)		(0.480)
ProvinceGDP						-0.038**		
						(0.019)		
Control variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Province dummies	No	No	No	No	No	No	No	Yes
ρ	-0.329		-0.341		-0.334		-0.319	
	(0.235)		(0.231)		(0.232)		(0.230)	
χ^2 for Wald test of ρ=0	1.678		1.854		1.775		1.661	
p-value for Wald test of ρ=0	0.195		0.173		0.183		0.197	
Observations	17,618		17,604		17,604		17,604	

Table 5
Propensity score matching.
This table shows two diagnostic tests for PSM and the regression results for the post-matched subsample. Panel A compares the logit regression results of female CEO representation for the pre- and post-matched samples. Panel B conducts t-tests for mean differences between the treatment and control groups in the pre- and post-matched samples separately. The three columns of Panel C report the logit regression results of forced CEO turnover probability for the post-matched subsamples after using three different matching approaches, respectively. The dependent variable in Panel A is *Female*, while in Panel C, the dependent variable is *ForcedTurnover*. Variable definitions are presented in Appendix B. Standard errors clustered at the firm level (Petersen, 2009) are displayed in parentheses. Asterisks denote significance levels of 1% (***), 5% (**), and 10% (*). In Panel C, where the control variables are not tabulated for brevity, average marginal effects are shown in brackets, and the average interaction effect as well as its corresponding standard error computed according to Norton et al. (2004) are reported following the interaction term.

Panel A: Diagnostic logit regression

	(1)	(2)
	DV: *Female*	
	Pre-matched	Post-matched
FirmSize	-0.132***	0.000
	(0.043)	(0.048)
Leverage	-0.422**	0.026
	(0.212)	(0.238)
ROA	-0.009	0.149
	(0.433)	(0.382)
TobinsQ	0.004	0.013
	(0.017)	(0.028)
R&DIntensity	-7.064***	0.953
	(2.258)	(2.581)
FirmAge	0.025***	0.002
	(0.007)	(0.007)
BoardSize	-1.057***	-0.147
	(0.196)	(0.231)
Independence	2.318***	0.736
	(0.634)	(0.751)
BoardMeeting	-0.096	0.018
	(0.097)	(0.109)
TMTGD	0.456***	0.155
	(0.170)	(0.187)
SOE	-0.654***	-0.047
	(0.093)	(0.110)
Tenure	0.016	0.007
	(0.011)	(0.012)
Duality	-0.651***	-0.059
	(0.092)	(0.097)
Blockholder	0.228***	0.056
	(0.083)	(0.089)
IndustryTMTGD	7.230*	7.124
	(4.365)	(5.717)
LocalFemaleTopManager	0.467***	0.050
	(0.155)	(0.156)
Constant	0.944	-1.893
	(1.141)	(1.382)
Year dummies	Yes	Yes
Industry dummies	Yes	Yes
Observations	17,139	3,643
Pseudo R^2	0.056	0.003

Panel B: Diagnostic t-tests for mean differences

	Pre-matched	Post-matched

	Treatment group	Control group	Differences	Treatment group	Control group	Differences
FirmSize	21.682	21.982	-0.300***	21.682	21.687	-0.005
Leverage	0.360	0.404	-0.044***	0.360	0.360	-0.001
ROA	0.042	0.038	0.003	0.042	0.038	0.004
TobinsQ	2.219	2.128	0.091*	2.219	2.202	0.017
R&DIntensity	0.020	0.022	-0.002***	0.020	0.020	0.000
FirmAge	15.982	15.707	0.275	15.982	16.131	-0.149
BoardSize	2.069	2.136	-0.067***	2.069	2.074	-0.005
Independence	0.387	0.373	0.014***	0.387	0.386	0.002
BoardMeeting	2.186	2.201	-0.015	2.186	2.187	-0.001
TMTGD	0.208	0.173	0.036***	0.208	0.207	0.001
SOE	0.187	0.321	-0.134***	0.187	0.186	0.001
Tenure	3.838	3.800	0.038	3.838	3.753	0.085
Duality	0.255	0.302	-0.047***	0.255	0.248	0.007
Blockholder	0.378	0.317	0.060***	0.378	0.368	0.010
IndustryTMTGD	0.154	0.149	0.004***	0.154	0.154	-0.000
LocalFemaleTopManager	1.108	1.085	0.023***	1.108	1.109	-0.001
Observations	1,032	16,107		1,023	2,620	

Panel C: Regression analysis after PSM

	(1)	(2)	(3)
	One-to-three	One-to-three with 0.001 caliper	One-to-one
ROA_IndAdj	-0.378	-0.376	-0.794
	(0.404)	(0.419)	(0.627)
	[-0.040]	[-0.040]	[-0.082]
Female	-0.173	-0.161	-0.221
	(0.118)	(0.122)	(0.142)
	[-0.018]	[-0.017]	[-0.023]
ROA_IndAdj×Female	-2.622**	-2.208*	-2.430**
	(1.068)	(1.182)	(1.154)
	[-0.280]	[-0.235]	[-0.252]
Average interaction effect	**-0.251****	**-0.212***	**-0.221**
	(0.122)	**(0.128)**	**(0.134)**
Control variables	Yes	Yes	Yes
Year dummies	Yes	Yes	Yes
Industry dummies	Yes	Yes	Yes
Observations	3,643	3,327	2,046
Pseudo R^2	0.065	0.068	0.083

Table 6
Robustness checks.
This table shows the results of the main robustness checks. Control variables are not tabulated for brevity. Panels A and B report the logit regression results of forced CEO turnover probability obtained using alternative classifications of turnover and alternative performance measures, respectively. Columns (1) to (3) of Panel C present three different Cox models estimating the risk of forced CEO turnover. Variable definitions are presented in Appendix B. Standard errors clustered at the firm level (Petersen, 2009) are displayed in parentheses. Asterisks denote significance levels of 1% (***), 5% (**), and 10% (*). In Panels A and B, average marginal effects are shown in brackets, and the average interaction effect as well as its corresponding standard error computed according to Norton et al. (2004) are reported following the interaction term, while in brackets of Panel C, hazard ratios are reported.

Panel A: Alternative classifications of CEO turnover

	(1)	(2)	(3)	(4)
	Total turnover	Voluntary turnover	Include retained chairpersons	Age-based algorithm
ROA_IndAdj	-0.679**	-0.336	-0.631**	-0.787***
	(0.274)	(0.315)	(0.278)	(0.302)
	[-0.093]	[-0.013]	[-0.077]	[-0.089]
Female	-0.081	-0.006	-0.068	-0.104
	(0.090)	(0.190)	(0.094)	(0.098)
	[-0.011]	[-0.000]	[-0.008]	[-0.012]
ROA_IndAdj×Female	-2.639***	-1.447	-2.108**	-2.761***
	(0.854)	(1.281)	(0.886)	(0.867)
	[-0.363]	[-0.054]	[-0.258]	[-0.313]
Average interaction effect	**-0.342***	**-0.054**	**-0.245**	**-0.289***
	(0.117)	**(0.050)**	**(0.109)**	**(0.099)**
Control variables	Yes	Yes	Yes	Yes
Year dummies	Yes	Yes	Yes	Yes
Industry dummies	Yes	Yes	Yes	Yes
Observations	17,774	17,774	17,774	17,774
Pseudo R^2	0.029	0.073	0.025	0.026

Panel B: Alternative performance measures

	(1)	(2)	(3)	(4)
	ROA_VWIndAdj	*EBIT/Asset_IndAdj*	*EPSForecastError*	*ΔROA_IndAdj*
Performance	-0.855**	-0.576**	-0.191***	-0.011***
	(0.365)	(0.282)	(0.028)	(0.003)
	[-0.093]	[-0.063]	[-0.020]	[-0.001]
Female	-0.181*	-0.112	-0.270**	-0.065
	(0.108)	(0.101)	(0.131)	(0.103)
	[-0.020]	[-0.012]	[-0.029]	[-0.007]
Performance×*Female*	-3.725***	-2.696***	-0.302**	-0.021*
	(1.224)	(0.926)	(0.131)	(0.011)
	[-0.404]	[-0.296]	[-0.032]	[-0.002]
Average interaction effect	**-0.362***	**-0.274***	**-0.028**	**-0.002***
	(0.131)	**(0.103)**	**(0.013)**	**(0.001)**
Control variables	Yes	Yes	Yes	Yes
Year dummies	Yes	Yes	Yes	Yes
Industry dummies	Yes	Yes	Yes	Yes
Observations	17,295	17,774	16,301	16,257
Pseudo R^2	0.042	0.042	0.047	0.038

Panel C: Cox model

	(1)	(2)	(3)
	Cox PH	Cox with TVC	Cox PH with reduced covariates
ROA_IndAdj	-0.688***	-0.653***	-0.519***
	(0.174)	(0.180)	(0.159)

	[0.502]	[0.520]	[0.595]
Female	-0.086	-0.075	-0.128
	(0.093)	(0.092)	(0.093)
	[0.917]	[0.928]	[0.880]
ROA_IndAdj×*Female*	-2.092***	-2.020***	-2.322***
	(0.435)	(0.490)	(0.388)
	[0.123]	[0.133]	[0.098]
Volatility×t		0.024***	
		(0.005)	
		[1.024]	
R&DIntensity×t		0.094**	
		(0.039)	
		[1.099]	
BoardMeeting×t		-0.005***	
		(0.001)	
		[0.995]	
SOE×t		0.004***	
		(0.001)	
		[1.004]	
Blockholder×t		0.009***	
		(0.002)	
		[1.009]	
Control variables	Yes	Yes	Reduced
Year dummies	Yes	Yes	Yes
Industry dummies	Yes	Yes	Yes
Observations	17,167	17,167	17,167
Pseudo R^2	0.022	0.024	0.017

Table 7
CEO gender and turnover-performance sensitivity: underperformers versus outperformers.
Columns (1) and (2) of this table report the logit regression results of forced CEO turnover probability for the subsamples of underperformers and outperformers, respectively. The sample is partitioned based on whether industry-adjusted ROA is greater or less than zero. Control variables are not tabulated for brevity. Variable definitions are presented in Appendix B. Standard errors clustered at the firm level (Petersen, 2009) are displayed in parentheses. Average marginal effects are shown in brackets, and the average interaction effect as well as its corresponding standard error computed according to Norton et al. (2004) are reported following the interaction term. Asterisks denote significance levels of 1% (***), 5% (**), and 10% (*).

	(1)	(2)
	Underperformers	Outperformers
ROA_IndAdj	-0.397	-0.060
	(0.289)	(0.352)
	[-0.052]	[-0.005]
Female	-0.204	0.070
	(0.154)	(0.237)
	[-0.027]	[0.006]
ROA_IndAdj×Female	-2.572***	-4.085
	(0.941)	(4.392)
	[-0.336]	[-0.365]
Average interaction effect	**-0.317*****	**-0.337**
	(0.124)	**(0.373)**
Control variables	Yes	Yes
Year dummies	Yes	Yes
Industry dummies	Yes	Yes
Observations	8,567	9,207
Pseudo R^2	0.035	0.051

Table 8
Performance thresholds for gender-induced attribution bias and forced turnover decisions.
This table analyzes the nonlinear relationship between CEO gender and turnover-performance sensitivity utilizing performance deciles. Columns (1) and (2) report the regression results of the logit and linear probability models, respectively. Control variables and performance indicators above performance thresholds are not tabulated for brevity. Variable definitions are presented in Appendix B. Standard errors clustered at the firm level (Petersen, 2009) are displayed in parentheses. Average marginal effects of the logit model are shown in brackets. Asterisks denote significance levels of 1% (***), 5% (**), and 10% (*).

	(1)	(2)
	Logit	LPM
Decile1	0.685***	0.083***
	(0.118)	(0.014)
	[0.075]	
……	……	……
Decile4	0.282**	0.026**
	(0.110)	(0.011)
	[0.031]	
Decile5	0.127	0.009
	(0.116)	(0.011)
	[0.014]	
……	……	……
Decile1×Female	0.886**	0.100**
	(0.412)	(0.045)
	[0.097]	
Decile2×Female	0.776*	0.081
	(0.450)	(0.050)
	[0.085]	
Decile3×Female	0.139	-0.002
	(0.475)	(0.040)
	[0.015]	
……	……	……
Control variables	Yes	Yes
Year dummies	Yes	Yes
Industry dummies	Yes	Yes
Observations	17,774	17,774
R^2		0.035
Pseudo R^2	0.047	

Table 9
CEO gender, exogenous performance shocks, and forced turnover.
This table reports the regression results of forced CEO turnover probability after decomposing firm performance into systematic and idiosyncratic components by the OLS regressions of firm performance on the average performance of industry peers. In columns (1) and (2), a common beta is used in the first stage, while in columns (3) and (4), industry-specific OLS regressions are performed. Columns (1) and (3) report the logit regression results in the second stage while in columns (2) and (4), the results of the linear probability model are presented. Control variables are not tabulated for brevity. Variable definitions are presented in Appendix B. Standard errors clustered at the firm level (Petersen, 2009) are displayed in parentheses. Average marginal effects of the logit model are shown in brackets. Asterisks denote significance levels of 1% (***), 5% (**), and 10% (*).

	(1)	(2)	(3)	(4)
	Common beta in the first stage		Industry-specific betas in the first stage	
	Logit	LPM	Logit	LPM
ROA_Systematic	-1.074	-0.264	-5.667***	-0.789***
	(6.024)	(0.585)	(2.159)	(0.285)
	[-0.118]		[-0.622]	
ROA_Systematic×Female	-10.284	-1.201	-3.092	-0.339
	(22.959)	(2.040)	(5.203)	(0.607)
	[-1.129]		[-0.339]	
ROA_Idiosyncratic	-0.736**	-0.089**	-0.717**	-0.086**
	(0.343)	(0.036)	(0.336)	(0.035)
	[-0.081]		[-0.079]	
ROA_Idiosyncratic×Female	-3.111**	-0.449***	-3.112**	-0.439***
	(1.441)	(0.118)	(1.491)	(0.140)
	[-0.342]		[-0.342]	
Female	0.284	0.038	0.009	0.005
	(0.884)	(0.079)	(0.224)	(0.025)
	[0.031]		[0.001]	
Control variables	Yes	Yes	Yes	Yes
Year dummies	Yes	Yes	Yes	Yes
Industry dummies	Yes	Yes	Yes	Yes
Observations	17,774	17,774	17,745	17,745
R^2		0.032		0.032
Pseudo R^2	0.042		0.043	

Table 10
Effects of gender diversity on gender-induced attribution bias.
This table analyzes the effects of gender diversity in firms' upper echelons on the relationship between CEO gender and turnover-performance sensitivity. In columns (1) and (2), the sample is partitioned based on whether the total gender diversity of the top management team and board of directors is above or below its industry-year median, while in columns (3) and (4), board gender diversity is used as the criterion for sample division. Logit regression results of forced turnover probability are reported. Control variables are not tabulated for brevity. Variable definitions are presented in Appendix B. Standard errors clustered at the firm level (Petersen, 2009) are displayed in parentheses. Average marginal effects are shown in brackets, and the average interaction effect as well as its corresponding standard error computed according to Norton et al. (2004) are reported following the interaction term. Asterisks denote significance levels of 1% (***), 5% (**), and 10% (*).

	(1)	(2)	(3)	(4)
	High total gender diversity	Low total gender diversity	High board gender diversity	Low board gender diversity
ROA_IndAdj	-0.235	-0.890***	-0.388	-0.690**
	(0.395)	(0.301)	(0.643)	(0.279)
	[-0.025]	[-0.099]	[-0.040]	[-0.079]
Female	-0.034	-0.238	-0.130	-0.102
	(0.129)	(0.165)	(0.143)	(0.142)
	[-0.004]	[-0.026]	[-0.013]	[-0.012]
ROA_IndAdj×Female	-2.977***	-1.423	-2.591**	-2.404
	(1.120)	(1.383)	(1.104)	(1.557)
	[-0.321]	[-0.158]	[-0.269]	[-0.275]
Average interaction effect	**-0.314****	**-0.120**	**-0.245****	**-0.256**
	(0.129)	**(0.139)**	**(0.119)**	**(0.175)**
Control variables	Yes	Yes	Yes	Yes
Year dummies	Yes	Yes	Yes	Yes
Industry dummies	Yes	Yes	Yes	Yes
Observations	8,593	9,181	8,270	9,504
Pseudo R^2	0.055	0.037	0.054	0.038

Table 11
Effects of co-option and tenure on gender-induced attribution bias.
This table analyzes the effects of co-option and CEO tenure on the relationship between CEO gender and turnover-performance sensitivity. In Panel A, the sample is partitioned based on whether the proportion of co-opted directors (or independent directors) is above or below its industry-year median. In Panel B, the effects of CEO tenure are removed by performing an OLS regression of the proportion of co-opted directors (or independent directors) on log-transformed tenure and using whether the regression residual is greater or less than zero as a criterion for sample division. In columns (1) and (2) of Panel C, the sample is segmented on the basis of whether CEO tenure is above or below its industry-year median, while in columns (3) and (4), the sample is regrouped after excluding observations of new CEOs with tenure of less than one year. Logit regression results of forced turnover probability are reported. Control variables are not tabulated for brevity. Variable definitions are presented in Appendix B. Standard errors clustered at the firm level (Petersen, 2009) are displayed in parentheses. Average marginal effects are shown in brackets, and the average interaction effect as well as its corresponding standard error computed according to Norton et al. (2004) are reported following the interaction term. Asterisks denote significance levels of 1% (***), 5% (**), and 10% (*).

Panel A: Effects of co-option

	(1)	(2)	(3)	(4)
	High co-opted boards	Low co-opted boards	High co-opted independent boards	Low co-opted independent boards
ROA_IndAdj	-1.334***	-0.216	-0.933**	-0.579*
	(0.452)	(0.324)	(0.473)	(0.347)
	[-0.151]	[-0.023]	[-0.099]	[-0.065]
Female	-0.366**	0.118	-0.292*	0.022
	(0.153)	(0.132)	(0.159)	(0.129)
	[-0.041]	[0.012]	[-0.031]	[0.002]
ROA_IndAdj×Female	-1.339	-3.128**	-1.313	-2.946**
	(1.728)	(1.233)	(1.783)	(1.203)
	[-0.152]	[-0.329]	[-0.139]	[-0.329]
Average interaction effect	**-0.085**	**-0.358****	**-0.096**	**-0.337****
	(0.161)	**(0.150)**	**(0.161)**	**(0.146)**
Control variables	Yes	Yes	Yes	Yes
Year dummies	Yes	Yes	Yes	Yes
Industry dummies	Yes	Yes	Yes	Yes
Observations	8,625	9,149	8,092	9,682
Pseudo R^2	0.049	0.050	0.047	0.051

Panel B: Remove the effects of tenure

	(1)	(2)	(3)	(4)
	High co-opted boards	Low co-opted boards	High co-opted independent boards	Low co-opted independent boards
ROA_IndAdj	-0.405	-1.040***	-0.306	-1.050***
	(0.345)	(0.396)	(0.353)	(0.382)
	[-0.048]	[-0.105]	[-0.033]	[-0.117]
Female	-0.170	-0.097	-0.128	-0.118
	(0.149)	(0.138)	(0.144)	(0.145)
	[-0.020]	[-0.010]	[-0.014]	[-0.013]
ROA_IndAdj×Female	-1.934**	-4.444***	-1.713**	-5.168***
	(0.835)	(1.592)	(0.839)	(1.746)
	[-0.228]	[-0.449]	[-0.185]	[-0.574]
Average interaction effect	**-0.202****	**-0.415*****	**-0.168***	**-0.528*****
	(0.098)	**(0.164)**	**(0.090)**	**(0.198)**
Control variables	Yes	Yes	Yes	Yes
Year dummies	Yes	Yes	Yes	Yes
Industry dummies	Yes	Yes	Yes	Yes
Observations	8,666	9,108	9,423	8,351
Pseudo R^2	0.033	0.060	0.034	0.060

Panel C: Effects of tenure

	(1)	(2)	(3)	(4)
	All CEOs		Exclude new CEOs	
	Long tenure	Short tenure	Long tenure	Short tenure
ROA_IndAdj	-1.959***	-0.232	-1.857***	-1.035**
	(0.504)	(0.303)	(0.537)	(0.411)
	[-0.205]	[-0.026]	[-0.192]	[-0.134]
Female	-0.257*	-0.023	-0.183	-0.142
	(0.152)	(0.137)	(0.166)	(0.145)
	[-0.027]	[-0.003]	[-0.019]	[-0.018]
ROA_IndAdj×Female	-0.782	-3.272***	-1.017	-5.061***
	(1.839)	(1.184)	(2.100)	(1.786)
	[-0.082]	[-0.368]	[-0.105]	[-0.656]
Average interaction effect	**-0.035**	**-0.367*****	**-0.071**	**-0.591*****
	(0.169)	**(0.145)**	**(0.199)**	**(0.228)**
Tenure	-0.029**	0.180***	-0.026*	-0.385***
	(0.013)	(0.035)	(0.015)	(0.044)
	[-0.003]	[0.020]	[-0.003]	[-0.050]
Control variables	Yes	Yes	Yes	Yes
Year dummies	Yes	Yes	Yes	Yes
Industry dummies	Yes	Yes	Yes	Yes
Observations	8,702	9,072	7,172	7,458
Pseudo R^2	0.060	0.045	0.056	0.084

Table 12

Effects of human and social capital on gender-induced attribution bias.

This table shows the relationship between CEO gender and turnover-performance sensitivity after additionally controlling for CEOs' human and social capital. Column (1) reports the logit regression results of forced CEO turnover probability for the full sample. Columns (2) to (4) present the logit regression results for the post-matched subsamples after propensity score matching, using three different matching approaches, respectively. Human and social capital controls and other control variables are not tabulated for brevity. Variable definitions are presented in Appendix B. Standard errors clustered at the firm level (Petersen, 2009) are displayed in parentheses. Average marginal effects are shown in brackets, and the average interaction effect as well as its corresponding standard error computed according to Norton et al. (2004) are reported following the interaction term. Asterisks denote significance levels of 1% (***), 5% (**), and 10%(*).

	(1)	(2)	(3)	(4)
	Logit	One-to-three PSM	One-to-three PSM with 0.001 caliper	One-to-one PSM
ROA_IndAdj	-0.955***	-1.211*	-1.006	-0.828
	(0.272)	(0.668)	(0.693)	(0.985)
	[-0.101]	[-0.118]	[-0.098]	[-0.080]
Female	-0.125	-0.144	-0.138	-0.214
	(0.108)	(0.129)	(0.133)	(0.149)
	[-0.013]	[-0.014]	[-0.013]	[-0.021]
ROA_IndAdj×Female	-2.204**	-3.058**	-2.833**	-3.461**
	(1.086)	(1.310)	(1.317)	(1.451)
	[-0.233]	[-0.298]	[-0.275]	[-0.335]
Average interaction effect	**-0.208***	**-0.265***	**-0.247***	**-0.298**
	(0.113)	**(0.145)**	**(0.143)**	**(0.177)**
Human and social capital controls	Yes	Yes	Yes	Yes
Other controls	Yes	Yes	Yes	Yes
Year dummies	Yes	Yes	Yes	Yes
Industry dummies	Yes	Yes	Yes	Yes
Observations	17,242	3,448	3,112	1,966
Pseudo R^2	0.043	0.067	0.070	0.079

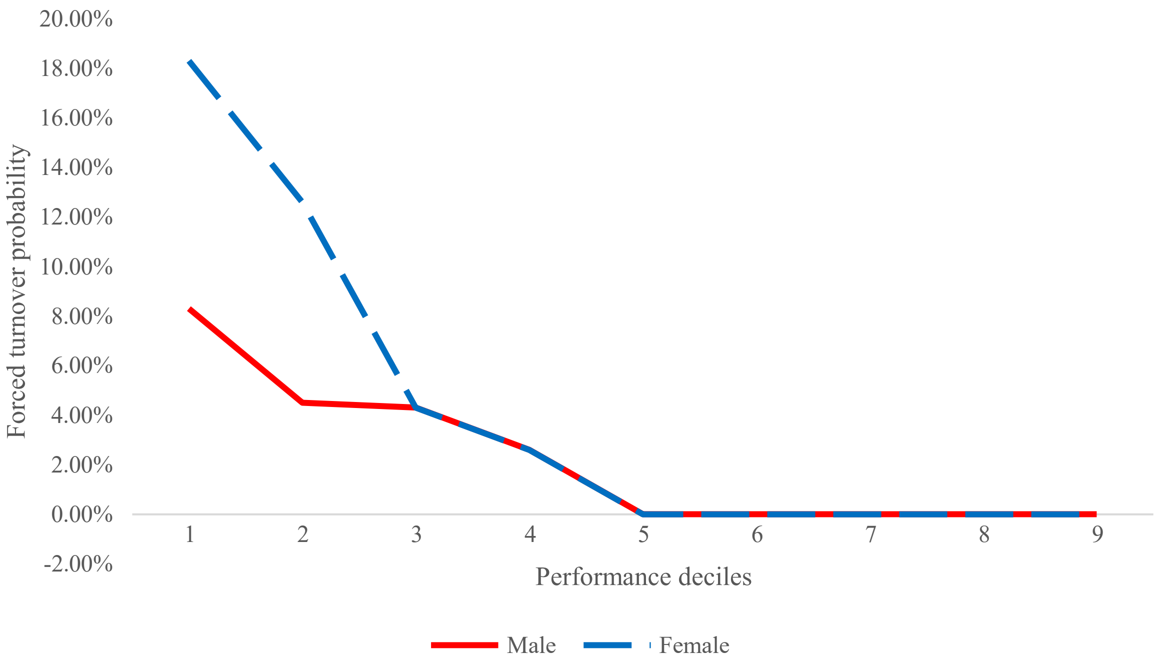

Fig. 1. Performance thresholds for gender-induced attribution bias and forced turnover decisions.
This figure illustrates the nonlinear relationship between firm performance and forced turnover probability for male and female CEOs, based on column (2) of Table 8. The x-axis represents indicators of performance range, i.e., *Decilei*. The y-axis represents the change in forced turnover probability relative to that for the highest performance range, *Decile10*, all else equal. Coefficient estimates that are not statistically significant at the 10% level are regarded as zero, except *Decile2×Female*, which has a *p*-value of 0.104 and is treated as non-zero.

Preference for color: in print.