Gender diversity in compensation committees and CEO pay: evidence from China

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Abstract

Purpose – The purpose of this paper is to address whether gender diversity on compensation committees ensures objective determination of CEOs' compensation.

Design/methodology/approach – The authors use a sample of companies listed in China from 2006 to 2015. The authors use pooled ordinary least square regression as the baseline methodology, and two-stage least square regression and propensity score matching to control for endogeneity.

Findings – The authors find evidence that gender-diverse compensation committees limit CEOs' total cash compensation and strengthen the link between CEO pay and firm performance, but only independent female directors have a significant impact, indicating that the monitoring effect outweighs the executive effect. Moreover, compensation committees with a critical mass of female directors have more impact on CEOs' total pay and the link between CEO pay and firm performance than do committees with a single female director. Finally, gender-diverse compensation committees are more effective in setting CEOs' compensation in state-controlled firms, where agency issues are more severe.

Practical implications – Female directors can improve firm-level governance by monitoring management actions, such as setting CEOs' compensation. The study contributes to the debate on gender diversity in the boardroom, finding a positive economic effect. The study sheds light on China's diversity practices at the director level and provides empirical guidance to China's regulatory bodies.

Originality/value – The authors extend earlier studies by providing the first empirical evidence that gender-diverse compensation committees strengthen the link between CEO pay and firm performance; that independent female directors are more effective in the monitoring role than executive female directors; that compensation committees with a critical mass of female directors are more effective in setting CEOs' pay than are committees with a single female director; and that the influence of gender-diverse compensation committees on CEOs' pay varies by type of ownership.

Keywords China, Gender diversity, CEO compensation, Compensation committee, Pay-performance relationship

Paper type Research paper

1. Introduction

The recent corporate scandals and financial crises around the globe have raised a question concerning whether things would have been different if more women had been on corporate boards (Adams and Funk, 2012). The empirical studies that have shown that women make more cautious decisions than men do suggest that the answer may be yes (Levi *et al.*, 2014). For example, female directors are tougher monitors (Adams and Ferreira, 2009), demand strong audits (Gul *et al.*, 2008), increase accounting conservatism and earnings quality (García-Sánchez *et al.*, 2017), and add perspectives and experiences that enhance the quality of board decisions and improve firms' legitimacy practices (Hillman *et al.*, 2007). Similarly, the corporate governance literature suggests that gender diversity can affect

boards' and their sub-committees' efficiency (see Konrad *et al.*, 2008; Adams and Ferreira, 2009; Nielsen and Huse, 2010; Aldamen *et al.*, 2016). It is no wonder that policymakers around the globe are encouraging and even mandating that women make up certain proportions of corporate boards.

As most corporate decisions are made at board sub-committee level, rather than at the board level, it is appropriate to focus on the composition of board sub-committees (Kesner, 1988). The committees that are most relevant to accounting and corporate governance are the compensation and audit committees. The board audit committee facilitates the financial reporting process, while the compensation committee uses accounting numbers to set top managers' compensation contracts. Thus, both committees play important roles in the firm-governance process.

Prior studies have focused on the role of gender diversity on the audit committee. For example, using data from Spanish listed firms, Pucheta-Martínez *et al.* (2016) found that the presence of women on audit committees reduces the chances of audit qualifications and increases the likelihood of transparency. Using data from 624 Australian companies for 2011, Aldamen *et al.* (2016) reported that gender-diverse audit committees influence external audit quality. Other studies have also explored the association between audit committee gender diversity and its functioning (see e.g. Srinidhi *et al.*, 2011; Thiruvadi and Huang, 2011). However, little is known about the question concerning whether the presence of women directors on the compensation committee improves the committee's objectivity. The majority of previous studies focused on how the proportion of independent directors on the compensation committee affects the executives' compensation (e.g. Anderson and Bizjak, 2003; Capezio *et al.*, 2011; Gregory-Smith, 2012; Conyon, 2014; Kent *et al.*, 2016). In addition, some studies have examined the determinants of gender diversity on the compensation committee (e.g. Adams and Ferreira, 2009; Strobl *et al.*, 2016). However, the specific influence of a gender-diverse compensation committee on the CEO's total pay and the link between the CEOs pay and firm performance has been largely overlooked. To date, only one study has investigated the direct influence of a gender-diverse compensation committee on CEOs' total pay. Bugeja *et al.* (2016) examined the direct influence of gender-diverse compensation committees on CEOs' total pay in US listed firms and found that compensation committees with at least one female director are negatively associated with CEOs' total pay. They concluded that the presence of women directors on compensation committees improves these committees' objectivity. However, based on their evidence, it is too early to make such a conclusion because the question concerning whether gender-diverse compensation committees design optimal contracts for top managers that can strengthen the relationship between CEOs' pay and firm performance remains unexplored. The main objective of the compensation committee is to design optimal contracts for executives in which their pay is linked with firm performance. Therefore, in the spirit of studies that have investigated the influence of the relationship between compensation committees' independence and CEOs' pay on firm performance relationship (e.g. Capezio *et al.*, 2011; Kent *et al.*, 2016), we investigate the influence of gender-diverse compensation committees on the relationship between CEOs' pay and firm performance.

Our study has three conceptual and empirical contributions. First, in alignment with the managerial power theory (Bebchuk *et al.*, 2002), we investigate the unexplored question whether the presence of female directors on compensation committees improves the committees objectivity in designing the optimal outcome-based incentive contracts for CEOs. Therefore, this study not only explores the direct impact of gender-diverse compensation committees on CEOs' pay, but also considers the interactions that may result from women's monitoring role in the incentive alignment mechanism. Second, following the critical mass theory we investigate whether the impact of a higher percentage (critical mass)

of women on compensation committees is more pronounced than that of a single woman (token), as single woman on a compensation committee may be treated as a token by other committee members, limiting her impact on the CEO pay-setting decision. Our results support the critical mass theory assumption by finding the evidence that compensation committees that have a critical mass of female directors are more effective in setting their CEOs' pay than are those that have a single female director. However, in a departure from the critical mass theory's assumption, we find that having a single woman on the compensation committee improves the committee's objectivity but having a critical mass of women on the committee improves the committee's effectiveness.

Third, we extend the literature beyond developed countries by providing the first empirical evidence from the largest developing country in the world, China. We consider China's unique institutional factors while investigating the governance role of gender-diverse compensation committees on CEO pay because the most promising corporate governance research should focus on understanding the institutional context in which the governance occurs (e.g. Davis, 2005). CEO compensation and corporate governance researchers have generally overlooked institutional factors, focusing instead on economic theories and the behavioral perspective (Judge *et al.*, 2008). Even the majority of boardroom gender-diversity studies have overlooked institutional factors when examining the effect of gender diversity on firm performance or firm governance. Few studies that have considered institutional factors' influence on corporate governance were conducted primarily in cross-country setting (e.g. VanEssen *et al.*, 2012, 2013). These studies have concluded that institutional factors (e.g. legal systems, government rules and regulations, and corporate governance codes) affect cross-country differences in corporate governance and CEO compensation designs. In addition, Conyon and Murphy (2000) and Firth *et al.* (2007) contended that CEOs' compensation varies from country to country because of differences in contextual factors like culture, ownership structure, governance, and regulatory framework. Our study complements these studies by investigating how within-country institutional variations influence the governance role of women directors in designing CEOs' pay contracts. China's business environment is unique because of its diverse ownership structure, which influences firms' institutional environment, the degree of shareholder protection, and the effectiveness of corporate governance mechanisms (Shleifer and Vishny, 1997). Therefore, we contribute to the institutional theory by providing the novel empirical evidence that the effect of gender-diverse compensation committees on CEOs' pay and the link between CEOs pay and firm performance varies by type of ownership, as we find that gender-diverse compensation committees are more effective in setting CEOs' compensation in state-controlled firms, where agency issues are more severe than they are in non-state-controlled firms.

In addition, unlike the developed countries corporate governance structure is weak in China. For example, the codes of best corporate governance in developed countries (e.g. Australia, the UK, the USA) stipulate that all members of compensation committee should be independent, but such is not the case in China, where there is a blend of executive and independent female directors on compensation committees. So this provides us the unique opportunity to investigate whether the executive and independent female directors have same governance role in setting the CEO compensation. We find that only independent female directors on compensation committees restrict the CEO total pay, while also strengthening the link between CEO pay and firm performance. This finding contributes to the literature and provides new insights into the debate concerning whether independent female directors are more effective monitors than are executive female directors. Previous studies that have investigated the influence of female directors on firms' corporate governance have largely overlooked the question concerning whether executive and independent women directors are equally effective monitors (see Gul *et al.*, 2008; Adams and Ferreira, 2009; Nielsen and Huse, 2010; Gul *et al.*, 2011; Aldamen *et al.*, 2016).

Furthermore, the significance of our study stretches beyond bridging the literature gap because we consider the recent rising trend in the world markets toward voluntary or mandatory female representation on corporate boards. Some countries (e.g. Australia, Canada, Pakistan, and the UK) recommend female participation on corporate boards as part of best practices in corporate governance (see Aldamen *et al.*, 2016), while some countries from Europe (e.g. Belgium, France, Italy, Norway, and Spain) and Asia (e.g. India, Malaysia, and the UAE) have imposed quotas for the proportion of female directors on corporate boards (Deloitte, 2013). Given this increased attention, clarifying the role of the female in corporate governance process at the board and committees levels will provide empirical evidence to world markets about the effectiveness of women in these groups.

2. Institutional background

In 2001, the biochemical company Yin Guang Xia, dubbed "China's Enron," underwent a scandal, and China's regulatory bodies implemented several reforms to strengthen the corporate governance structure of public listed companies. In 2002, as a result of these continuous reforms, the first Code of Corporate Governance for Chinese firms was jointly issued by the Chinese Securities Regulation Committee (CSRC) and the Chinese National Economic and Trade Commission. This code, a salient example of China's adopting the Anglo-Saxon model of corporate governance, recommends that public listed companies adopt sound governance practices, such as having more independent directors, separating the CEO and chairperson positions, having a remuneration committee, and increasing disclosures about the firm's internal controls. However, the code does not require the listed companies to maintain gender diversity in their boardrooms. Even so, the number of firms that have at least one female director on their boards has increased from 62.02 percent in 2006 to 75.31 percent in 2015 (Table I).

The early CSRC (1998) regulations did not require public listed companies to disclose complete information about their top managements' pay, but some companies did so voluntarily. However, in 2001, the CSRC required that companies disclose the compensation of the top three highest-paid managers and all board members, although it did not require that each individual's pay be disclosed separately. Then, in 2006, disclosing separately each of the top managers' and the board members' total pay became mandatory (where total pay includes salary, bonus, stipends, and other benefits) (CSRC, 2005). These new regulations also provided the framework for public listed companies to introduce equity incentives to their top management and made disclosure of these incentives mandatory. However, unlike the USA and other developed countries, equity compensation, such as stock options, remains rare in China (Conyon and He, 2012).

Unlike the Anglo-Saxon standard, the ownership structure in China is highly concentrated. Most firms have a single dominant shareholder with the power to control the firm's operations, including control over the CEO's appointment and compensation. In the USA, such is not often the case, as ownership concentration is low and ownership diffusion is very high. In Anglo-Saxon firms, it is rare that a single investor owns more than 10 percent of a company's shares. Moreover, in China, state-owned firms are common, although China is reforming from its traditional economy to a modern economy and, as a result, state-owned firms are transitioning into private firms. For example, the percentage of state-affiliated firms decreased from 65.50 percent in 2006 to 35.28 percent in 2015 (Table II).

3. Literature review and hypotheses development

3.1 Female directors and board effectiveness

It is difficult to measure and observe the dynamics of gender diversity in the boardroom because most information about board decision making does not have to be disclosed publically.

Variable	Description
Pay	Equals the log of the CEO's total cash compensation
CFD	Equals 1 if there is at least one the female director on the compensation committee, and 0 otherwise
CFN	Equals the number female directors on the compensation committee
CFP	Equals the proportion of female directors on the compensation committee
CFBI	Equals the Blau index, which is measured as $1-\sum_{i=1}^{n} P_i^2$, where P_i is the proportion of each category and n is the number of categories. In our case, n is 2 and the categories are "male" and "female"
CFSI	Equals the Shannon index, which is measured as $-\sum_{i=1}^{n} P_i \ln P_i$, where P_i is the proportion of each category and n is the number of categories. In our case, n is 2 and the categories are "male" and "female"
CFID	Equals 1 if there is at least one independent female director on the compensation committee, and 0 otherwise
CFIP	Equals the proportion of independent female directors on the compensation committee
CFED	Equals 1 if there is at least one executive female director on the compensation committee, and 0 otherwise
CFEP	Equals the proportion of independent female directors on the compensation committee
CFT	Equals 1 if there is only one woman on the compensation committee, and 0 otherwise
CFCM	Equals 1 if the compensation committee is at least 50 percent female directors, and 0 otherwise
ROA	Equals net profit divided by total assets
Dual(+)	Equals 1 if the CEO is also the chairperson of the board, and 0 otherwise
CTenure(+)	Equals the number of years the CEO has served as the company's CEO
CEOH(±)	Equals the percentage of common shares of the company held by the CEO
BSize(±)	Equals the number of directors on the board
Bind(±)	Equals the proportion of independent directors on the board
CSize(±)	Equals to total number of directors on compensation committee
CInd(±)	Equals the proportion of independent directors on the compensation committee
CPres(±)	Equals 1 if the CEO is also a member of the compensation committee, and 0 otherwise
InstH(±)	Equals the percentage of shares held by institutions
SOE(−)	Equals 1 if the firm is affiliated with the central or local government, and 0 otherwise
Age(+)	Equals the number of years the firm has been listed on the stock exchange
Lev(+)	Equals total debt divided by total assets
Fsize(+)	Equals the natural log of total sales
Fgrow(+)	Equals the current year's assets minus the previous year's assets, divided by the current year's assets
GrowOp(+)	Equals the book value of shareholders' equity, divided by the shares' market value

Note: The expected direction of the control variables included in this table is based on the CEO compensation literature (i.e. see Bugeja *et al.*, 2016; Strobl *et al.*, 2016; Core *et al.*, 1999, 2008; Conyon, 2014; Kent *et al.*, 2016; Gregory-Smith, 2012; Anderson and Bizjak, 2003, among others)

Table I.
Description of
variables

As a result, researchers have focused on differences in the characteristics of each boardroom, including gender diversity. These studies show that female directors' qualities tend to differ from those of men and can benefit the company in several ways. Woman tends to communicate effectively, and their participation in group decision making may result in better solutions (Wood *et al.*, 1985). Women tend to have superior decision-making capabilities because they tend to feel less constrained by rules, regulations, and other traditional ways of operating that dominate the normative reasoning of their male counterparts' decision making (Bart and McQueen, 2013). Women tend to like engaging in participative decision making, rather than making decisions solo (Mano-Negrin and Sheaffer, 2004). Bart and McQueen (2013) found that female directors pay due attention to the interests of various stakeholders and make fair decisions in the context of competing interests. These characteristics promote good corporate governance. As a result, Gul *et al.* (2011) suggested that gender-diverse boardrooms can serve as a partial remedy to weak governance.

Table II.
Descriptive statistics (average/mean of each variable in each year and for panel data)

Variable/Year	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	Panel
Companies	1,319	1,440	1,520	1,665	2,043	2,280	2,392	2,464	2,523	2,625	20,271
CEO compensation (RMB)	266,497	365,268	401,283	435,441	509,710	571,231	596,410	638,315	675,478	725,914	550,805
Panel A: CEO characteristics variables											
%Firm with *CEO* duality	13.27	15.76	16.64	19.1	23.54	26.49	26.59	27.64	30.32	30.48	24.37
Average *CEOH* (%)	0.55	1.34	1.63	2.55	4.43	4.92	4.72	4.87	5.21	5.2	3.98
CTenure (years)	1.44	1.44	1.45	1.55	1.53	1.49	3.87	4.15	4.14	4.04	2.78
Panel B: board-structure variables											
Average *Bsize*	9.59	9.61	9.91	9.73	9.64	9.77	10.01	10.32	10.65	10.38	10.03
Average proportion of *ID* (%)	35.17	35.87	36.71	36.85	36.76	37.14	37.33	38.06	39.74	38.72	37.49
%Firm with *FD*	62.02	62.99	64.67	65.11	67.6	69.65	71.07	72.24	74.67	75.31	69.57
%Firm with *IFD*	34.27	36.39	37.3	38.26	39.94	42.06	44.44	46.19	50.38	50.4	43.17
%Firm with *EFD*	42.38	41.74	43.82	44.02	45.42	47.89	49.41	50.45	51.57	52.46	47.76
%Firm with female CEO	4.17	4.79	5.2	5.41	6.02	6.49	6.4	6.29	5.83	5.68	5.76
%Firm with *FD* as board chair	4.32	4.03	3.82	3.72	4.06	4.17	4.01	4.14	4.24	4.5	4.12
Average proportion of *FD* (%)	9.87	10.25	10.4	11	11.62	12.45	12.78	13.02	13.57	14.15	12.24
Average proportion of *IFD* (%)	4.14	4.47	4.51	4.85	5.11	5.45	5.65	5.9	6.43	6.62	5.49
Average proportion of *EFD* (%)	5.73	5.78	5.89	6.16	6.52	7	7.13	7.12	7.14	7.53	6.75
Panel C: compensation committee structure variables											
Number companies with *CC*	526	804	1,081	1,195	1,494	1,743	1,941	2,169	2,226	2,267	15,446
% companies with *CC*	39.88	55.83	71.12	71.77	73.13	76.45	81.15	88.03	88.23	86.36	762
Average size of *CC*	3.64	3.61	3.61	3.57	3.52	3.47	3.45	3.42	3.38	3.34	3.46
Average proportion of *ID* on *CC* (%)	63.94	64.2	64.82	65.3	66.19	66.02	66.5	66.74	66.71	66.99	66.13
Presence of CEO on *CC* (%)	26.24	27.24	26.09	26.78	26.31	26.39	26.84	27.11	29.07	28.1	27.22
%Firms chaired by *FD*	8.56	9.83	9.9	10.13	11.18	11.13	11.8	13.05	14.6	15.57	12.32
%Firms with *FD* on *CC*	31.75	35.2	35.71	37.74	37.75	39.47	40.13	40.71	42.45	44.82	39.89
%Firms with *IFD* on *CC*	22.81	26	26.27	27.03	28.98	30.18	31.43	31.95	33.29	35.38	30.69
%Firms with *EFD* on *CC*	12.36	12.81	12.77	14.23	12.45	13.83	13.34	14.2	14.65	15	13.83

(continued)

Variable/Year	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	Panel
Proportion of *FD* on CC (%)	10.52	11.62	11.63	12.34	12.69	13.78	14.24	14.94	15.9	16.8	14.16
Proportion *IFD* on CC (%)	6.86	7.94	8.02	8.3	9.11	9.69	10.28	10.74	11.52	12.29	10.09
Proportion *EFD* on CC (%)	3.65	3.68	3.61	4.04	3.57	4.09	3.96	4.2	4.39	4.51	4.07
Panel D: ownership structure variables											
%*SOE*	65.5	61.74	60.46	56.64	48.26	43.42	41.35	39.94	37.89	35.28	46.6
Average *InstH* (%)	9.28	9.4	9.47	8.14	7.91	6.89	6.21	6.81	6.4	6.24	7.29
Panel E: firm performance measure											
Average *ROA*	0.035	0.050	0.029	0.035	0.050	0.044	0.036	0.037	0.005	0.035	0.036

Notes: Where *SOE* is the state-owned enterprises, *CEOH* is the percentage of shares owned by CEO, *CTenure* is the CEO tenure in firm, *InstH* is the percentage of shares owned by institutions, *Bsize* is the board size, *ID* is the independent directors, *FD* is the female directors, *IFD* is the independent female directors, *EFD* is the executive female directors, and *CC* is the compensation committee

Table II.

Similarly, prior studies have shown that female directors are more active in monitoring activities than men are. Adams and Ferreira (2009) documented that female directors have fewer attendance issues than men do, that women participate in monitoring committees more than men do, that CEO turnover sensitivity to stock returns is high in firms that have more female directors, and that women directors demand more audit effort and managerial accountability. Nielsen and Huse (2010) reported that a higher proportion of women on boards is associated with better strategic control, while Adams and Funk (2012) found that female directors are more security oriented, less traditional, and less power-oriented than men are. Konrad *et al.* (2008) documented that female directors ask tougher questions than male directors do, and in many instances, only female directors voted no on CEO pay issues. In addition, the presence of women on boards and audit committees reduces earnings management (Qi and Tian, 2012) and improves earnings quality (Srinidhi *et al.*, 2011). Women are also more conscientious than men are (Schmitt *et al.*, 2008) and take their responsibilities more seriously (Fondas and Sassalos, 2000). In sum, female directors are tougher monitors than men are (Adams and Ferreira, 2009) and they increase boards' independence (Lucas-Pérez *et al.*, 2015).

On the other hand, the studies that have investigated the causal relationship between women directors on the board and firm performance have reported inconsistent results (for a meta-analysis, see Post and Byron, 2015). Adams and Ferreira (2009) argued that it is not essential that female directors have a positive impact on firm performance, as their presence can improve the internal monitoring mechanism. In addition, Strobl *et al.* (2016) argued that, because firm performance can be influenced by too many variables, it would be more useful to investigate how female directors affect firms' internal governance mechanisms than to investigate the causal relationship between gender diversity in the boardroom and firm performance. Therefore, the number of studies that investigate the influence of female directors on the board and its committees are increasing (e.g. Adams and Ferreira, 2009).

Given the effective role of women directors, we posit that the presence of a woman on a compensation committee adds to the committee's effectiveness and reduces the CEO's influence over the committee. Such committees facilitate the arms-length process of setting the CEO's pay contracts and increase the likelihood that the CEO will be compensated for performance.

3.2 Gender-diverse compensation committees and CEOs' pay
As a solution to agency problems, optimal contracting theory suggests tying top management's compensation to company performance (optimal contract). Therefore, the essence of the agency theory is the relationship between the CEO's pay and firm performance (Baker, 1992; Kaplan, 1994). This relationship is a tool with which to determine the degree to which a firm is successful in dealing with the issue of divorcing interests between managers and owners. Numerous researchers have investigated the relationship between the CEO's compensation and company performance in a variety of countries, but their results have been conflicting: some studies reported a positive relationship (Farmer *et al.*, 2013; Alves *et al.*, 2016), while some reported no relationship or a negative relationship (Jeppson *et al.*, 2009; Gigliotti, 2013; Usman *et al.*, 2015). The reason for these inconsistent results may be differences in data collection methods, the use of different econometrics techniques, different samples, and different study periods, among others (Gomez-Mejia, 1994). In any case, the literature agrees that, if this relationship is insignificant, the efficiency of an incentive pay system is in question (Gomez-Mejia and Wiseman, 1997; Tosi *et al.*, 2000).

Bebchuk *et al.* (2002) provided an alternative argument for this broken relationship, suggesting that the lack of a link between CEO pay and firm performance may be due to managerial power over the board's pay-setting process, as CEOs invariably push to inflate their pay when they have control over their pay-setting arrangements. Managerial power

theory sheds light on the use of top managers' power to extract rents from the company, deepening the assumptions of optimal contracting theory by providing the argument that the use of managerial power is the reason for the failure to devise optimal contacts (Van Essen *et al.*, 2015). Therefore, managers' power over their compensation-setting process is a manifestation of agency issues. Several researchers have found empirical support for the managerial power theory by considering the board's and the compensation committee's structural features that can limit or amplify managerial power over the compensation-setting process (see Core *et al.*, 1999; Brick *et al.*, 2006; Wang *et al.*, 2011; Alves *et al.*, 2016).

The role of the compensation committee has come under the increased scrutiny from both legislators and the public. The main allegations against compensation committees are overpaid top managers and little or no association between such pay and the firm's performance (Morgenson, 2013). Compensation committees usually consist of independent directors whose goal is to pay the top management adequately, not excessively. Moreover, effective compensation committees seek to design contracts that align the top management's interests with those of shareholders, which can be done by tying the top management's pay with firm performance (optimal contract). Therefore, the board's and the compensation committee's structural arrangements are important if there is to be hope that the optimal contract for the CEO can be designed and that the CEO's influence can be reduced.

Several studies have investigated the association between the CEO's compensation and various characteristics of the compensation committee (e.g. committee size, the proportion of non-executive directors, the presence of the CEO on the committee) (see Anderson and Bizjak, 2003; Gregory-Smith, 2012; Conyon, 2014; Kent *et al.*, 2016) Although Bugeja *et al.* (2016) reported a negative association between gender-diverse compensation committees and CEOs' pay, we extend this line of research by also investigating the impact of gender-diverse compensation committees on the link between CEO pay and firm performance.

Given the general traits of women, we expect that the presence of a woman on the compensation committee enhances its independence and effectiveness. We also expect that the presence of a woman on the compensation committee reduces the CEO's power over his or her pay-setting process and that the CEO will be paid more objectively. Therefore, a gender-diverse compensation committee not only restricts the CEO's total pay, but also strengthens the link between CEO pay and firm performance. Therefore, our hypotheses are:

H1. The presence of a woman on a compensation committee is negatively associated with the CEO's total compensation.

H2. The presence of a woman on a compensation committee strengthens the link between CEO pay and firm performance.

4. Data, summary statistics, and statistical methodology
We obtained data from China's stock market and accounting research database. Our initial sample consists of all A-share companies listed on the Shenzhen and Shanghai stock exchanges from 2006 to 2015. We took 2006 as our starting point because it has been mandatory since 2006 to disclose the CEO's total pay separately. In alignment with the literature, we excluded firm years in which a firm had no compensation committee, firm years in which the CEO's compensation was zero or missing, and firm years in which data were missing on the variables. Our final sample was 9,397 firm-year observations.

4.1 Variables
4.1.1 CEO compensation. Like Conyon and He (2012), we use the CEO's total cash compensation (which include basic salary, cash bonuses, perks, and so on) because equity compensation (such as stock options) is rare in China. Moreover, to condense the effect of

heteroscedasticity and the magnitude of differences in CEO pay across firms and to increase the results' robustness, we use the log of the CEO's total cash compensation (*Pay*). The average Chinese CEO's total cash compensation increased from RMB266,497 in 2006 to RMB725,914 in 2015, an increase of 272 percent (Table I).

4.1.2 Firm performance. In line with earlier studies on CEO compensation (e.g. Conyon and He, 2011, 2012; Conyon, 2014; Kent *et al.*, 2016), we use return on assets (*ROA*) to measure firm performance. Table II (Panel E) presents an average of *ROA* for each year and for panel data. The average *ROA* for panel data is 3.6 percent.

4.1.3 Compensation committees' gender diversity. Our main variable of interest is compensation committees' gender diversity. Like Bugeja *et al.* (2016), we use two measures, *CFD* and *CFP*, where *CFD* is a dummy variable that equals 1 if there is at least one female director on the compensation committee (and 0 otherwise), and *CFP* is a continuous measure that refers to the proportion of female directors on the compensation committee.

Panels B and C of Table II provide the descriptive statistics about female representation on the board and the compensation committee, respectively. Female representation on boards has increased from 62.02 percent of firms with at least one female director in 2006 to 75.31 percent in 2015. Moreover, the proportion of female directors on boards has also increased, growing from 9.87 percent in 2006 to 14.15 percent in 2015. Similarly, female representation on compensation committees has increased, rising from 31.75 percent of firms with gender-diverse compensation committees in 2006 to 44.82 percent of firms in 2015. The proportion of female directors on compensation committee also shows an increasing trend, with 10.52 percent of directors being female in 2006 and 16.80 percent in 2015.

4.1.4 CEO, board, compensation committee, ownership structure, and firm economic controls. Following the CEO compensation literature (see Core *et al.*, 1999, 2008; Bugeja *et al.*, 2016), we classified our control variables into five categories. A description of each variable is given in Table I. The first category consists of three variables related to the CEO's characteristics: CEO duality (*Dual*), CEO tenure (*CTenure*), and CEO equity-holding (*CEOH*). The second group is the board-structure variables of board size (*BSize*) and board independence (*Bind*). The third group contains variables related to the compensation committee's structure: the compensation committee's size (*CSize*), the compensation committee's independence (*CInd*), and the presence of the CEO on the compensation committee (*CPres*). The fourth group of variables relate to ownership structure: institutional ownership of shares (*InstH*) and state-owned enterprises (*SOE*). The fifth group consists of the economic control variables of firm: firm age (*Age*), financial leverage (*Lev*), firm size (*Fsize*), firm growth (*Fgrow*), and investment opportunity (*GrowOp*).

Panel C of Table II presents the descriptive statistics for the compensation committee's structure. The percentage of firms that have compensation committees increased from 39.88 percent in 2006 to 86.36 percent in 2015. Among these companies, the average committee size was 3.46 members, the proportion of independent directors was 66.13 percent, and 27.22 percent of the committees included the CEO as a member. The number of firms with a woman as a chairperson of the compensation committee is also increasing, rising from 8.56 percent of firms in 2006 to 15.57 percent in 2015.

Panel D of Table II shows the mean of the ownership structure variables. The percentage of state-affiliated firms decreased significantly, falling from 65.50 percent in 2006 to 35.28 percent in 2015. The average percent of shares owned by institutions other than the state in China's firms is 7.29 percent. Table III shows the correlations between the variables. The correlation coefficient between the independent variables remains less than 0.40, which indicates that all of the independent variables reported in the correlation matrix are sufficiently independent and that there is no problem of multicollinearity. However, as we

	1	2	3	4	5	6	7	8	9	10
1. Pay	1									
2. CFD	−0.011	1								
3. CFP	−0.026*	0.891**	1							
4. ROA	0.043**	0.009	0.008	1						
5. CEOH	−0.009	0.009	0.034**	0.014	1					
6. CTenure	0.200**	0.029**	0.036**	0.015	0.172**	1				
7. Dual	0.035**	0.020*	0.040**	−0.020	0.448**	0.140**	1			
8. BSize	0.068**	0.029**	−0.008	−0.010	−0.105**	−0.025*	−0.097**	1		
9. Bind	0.044**	0.001	0.016	0.001	0.107**	0.121**	0.090**	−0.036**	1	
10. CSize	0.042**	0.126**	−0.040**	0.007	−0.118**	−0.034**	−0.114**	0.209**	−0.064**	1
11. CInd	0.065**	−0.022*	0.043**	−0.003	0.011	0.038**	0.010	−0.021*	0.079**	−0.372**
12. CPres	−0.034**	−0.039**	−0.085**	0.007	0.108**	0.046**	0.150**	−0.049**	0.027**	0.195**
13. InstH	0.071**	0.022*	0.009	0.018	−0.052**	−0.066**	−0.024*	0.015	−0.066**	0.029**
14. SOE	−0.020	−0.015	−0.053**	−0.003	−0.325**	−0.163**	−0.282**	0.187**	−0.124**	0.153**
15. Age	0.080**	0.030**	0.007	−0.027**	−0.346**	0.006	−0.181**	0.094**	−0.056**	0.121**
16. Fsize	0.357**	−0.022*	−0.049**	0.044**	−0.151**	0.019	−0.147**	0.209**	0.007	0.101**
17. Lev	−0.028**	−0.012	−0.015	−0.469**	−0.045**	−0.037**	0.010	0.006	0.001	0.006
18. Fgrow	0.041**	−0.007	−0.008	0.099**	0.061**	−0.038**	0.043**	0.050**	0.015	−0.004
19. GrowOp	0.082**	−0.019	−0.035**	−0.014	−0.148**	−0.027**	−0.112**	0.126**	−0.025*	0.061**

	11	12	13	14	15	16	17	18	19
1. Pay									
2. CFD									
3. CFP									
4. ROA									
5. CEOH									
6. CTenure									
7. Dual									
8. BSize									
9. Bind									
10. CSize									
11. CInd	1								
12. CPres	−0.218**	1							
13. InstH	−0.006	−0.023*	1						
14. SOE	0.058**	−0.118**	0.104**	1					
15. Age	−0.001	−0.072**	0.051**	0.364**	1				
16. Fsize	0.083**	−0.071**	0.089**	0.280**	0.161**	1			
17. Lev	−0.001	0.009	−0.010	0.026*	0.073**	−0.018	1		
18. Fgrow	−0.010	0.032**	0.054**	−0.067**	−0.062**	0.079**	−0.045**	1	
19. GrowOp	0.063**	−0.062**	−0.036**	0.255**	0.189**	0.466**	0.065**	−0.019	1

Notes: For a detailed description of variables see Table I. *,**Significant at 5 and 1 percent levels, respectively

Table III.
Correlation matrix

expected, the correlation between *CFD* and *CFP* is higher than the accepted limit, which shows a problem of multicollinearity. To mitigate the issue, we estimate separate regression for each gender-diversity measures.

4.2 Statistical methodology

We estimate Equation (1) to test the direct impact of a gender-diverse compensation committee on the CEO's total compensation, and we estimate Equation (2) to test its impact on the link between CEO pay and firm performance. Following Bugeja *et al.* (2016), we use pooled ordinary least square (OLS) regression as our baseline methodology to estimate the following equations:

$$Pay_{it} = \beta_0 + \beta_1 ROA_{it} + \beta_2 CWomen_{it} + \sum_{i=1}^{n} \beta_n\, Controls_{it} + \varepsilon_{it} \tag{1}$$

$$Pay_{it} = \beta_0 + \beta_1 ROA_{it} + \beta_2 CWomen_{it} + \beta_3 ROA \times CWomen_{it} + \sum_{i=1}^{n} \beta_n\, Controls_{it} + \varepsilon_{it} \tag{2}$$

where *Pay* is the log of the CEO's total cash compensation; *ROA* is return on assets; *CWomen* refers to the gender-diversity measures of *CFD* and *CFP*; *ROA* × *CWomen* refers to the interaction variables between firm performance measures and proxies for gender diversity on the compensation committee; *Controls* refers to the CEO's characteristics, board structure, compensation committee structure, ownership structure, and the firm economic, year, and industry dummies controls of *Dual*, *CTenure*, *CEOH*, *BSize*, *Bind*, *CSize*, *CInd*, *CPres*, *InstH*, *SOE*, *Age*, *Lev*, *Fsize*, *Fgrow*, and *GrowOp*; and *it* refers to firm *i* and year *t*. For additional descriptions of variables, see Table I.

5. Regression results

Table IV shows the results of tests of *H1* and *H2*. Models 1 and 2 show the direct impact of a gender-diverse compensation committee on the CEO's total compensation. The coefficients of *CFD* and *CFP* in both models are negative and significant at $p < 0.01$. These results support *H1* and are consistent with Bugeja *et al.* (2016), who also reported a negative relationship between a gender-diverse compensation committee and the CEO total's compensation. We extend our analysis a step farther to investigate whether a gender-diverse compensation committee strengthens the link between CEO pay and firm performance. The results are reported in Models 3 and 4 (Table IV). The coefficients of the interaction variables *ROA* × *CFD* and *ROA* × *CFP* remain positive and highly significant at $p < 0.01$, indicating that a gender-diverse compensation committee strengthens the link between CEO pay and firm performance. These results support *H2*. In general, our results validate the findings of prior studies that have reported that female directors can improve firms' internal governance by monitoring top management's actions (Adams and Ferreira, 2009; Gul *et al.*, 2011). In particular, the presence of female directors on compensation committees can increase the

	Model 1	Model 2	Model 3	Model 4
ROA	0.040** (2.48)	0.040** (2.49)	0.034** (2.10)	0.035** (2.14)
CFD	−0.041*** (−2.65)	–	−0.065*** (−3.98)	–
CFP	–	−0.137*** (−3.44)	–	−0.204*** (−4.79)
ROA × *CFD*	–	–	0.619***(4.46)	–
ROA × *CFP*	–	–	–	1.721***(4.42)
CEOH	−0.350*** (−3.48)	−0.349*** (−3.46)	−0.354*** (−3.51)	−0.354*** (−3.52)
CTenure	0.036*** (12.03)	0.036*** (12.00)	0.035*** (11.94)	0.035*** (11.92)
Dual	0.121*** (5.85)	0.121*** (5.87)	0.122*** (5.91)	0.122*** (5.93)
BSize	−0.003 (−0.83)	−0.003 (−0.84)	−0.002 (−0.76)	−0.002 (−0.76)
Bind	−0.099 (−0.90)	−0.097 (−0.88)	−0.096 (−0.87)	−0.094 (−0.86)
CSize	0.050*** (5.90)	0.047*** (5.62)	0.050*** (5.85)	0.047*** (5.56)
CInd	0.333*** (4.87)	0.336*** (4.90)	0.332*** (4.86)	0.335*** (4.91)
CPres	−0.053*** (−2.99)	−0.055*** (−3.10)	−0.053*** (−2.98)	−0.055*** (−3.09)
InstH	0.004*** (5.22)	0.004*** (5.23)	0.004*** (5.21)	0.004*** (5.20)
SOE	−0.133*** (−7.22)	−0.134*** (−7.27)	−0.130*** (−7.05)	−0.132*** (−7.14)
Age	0.001 (0.55)	0.001 (0.56)	0.001 (0.71)	0.001 (0.72)
Lev	0.008 (1.20)	0.008 (1.20)	0.007 (1.10)	0.008 (1.12)
Fsize	0.251*** (39.79)	0.251*** (39.75)	0.248*** (38.99)	0.247*** (38.99)
Fgrow	−0.008* (−1.61)	−0.008* (−1.62)	−0.010** (−2.00)	−0.010** (−2.03)
GrowOp	−0.079*** (−8.80)	−0.079*** (−8.80)	−0.075*** (−8.30)	−0.076*** (−8.34)
Year and industry	Yes	Yes	Yes	Yes
Constant	7.557*** (51.70)	7.576*** (51.77)	7.627*** (51.93)	7.642*** (52.00)
F-value	48.961	49.058	48.649	48.736
Adj. R^2 (%)	26.30	26.40	26.50	26.50

Table IV.
Influence of gender-diverse compensation committee on CEO pay and CEO pay-performance link

Notes: $n = 9,390$. This table demonstrates the results of *H1* and *H2*. For a detailed description of variables, see Table I. *T*-statistics are reported in parentheses. *,**,***Significant at 10, 5 and 1 percent levels, respectively

committees' effectiveness and facilitate the arms-length bargaining procedure when the committees set CEOs' compensation. Our results extend the findings of earlier studies on the compensation committee and CEO pay (see Anderson and Bizjak, 2003; Gregory-Smith, 2012; Conyon, 2014; Kent *et al.*, 2016) by suggesting that female directors on compensation committees improve the committees' objectivity is setting the executive compensation.

In Models 1 and 2, *ROA* is positive and highly significant at $p < 0.01$, supporting our expectation that the average Chinese CEO is paid for firm performance. Moreover, the control variables reported in Table IV, which are significant, are in line with the findings of the previous literature (see Anderson and Bizjak, 2003; Gregory-Smith, 2012; Conyon, 2014; Bugeja *et al.*, 2016). The control variables also exhibit the same relationship with dependent variables as in the proceeding models.

5.1 Additional test

Previous study on the association between gender-diverse compensation committees and CEOs' compensation has used data from public listed companies in the USA (Bugeja *et al.*, 2016). The governance and ownership structure of China's firms differs significantly from those of developed countries (e.g. Australia, the UK, and the USA) firms. For example, the rules and guidance introduced by the regulatory bodies and the major stock exchanges in the developed countries stipulate that all members of compensation, audit, and nominating committees should be independent. For example, Bugeja *et al.* (2016) highlighted that, in their sample of US listed companies, the majority of the female directors on compensation committees were independent, but such is not the case in China, where there is a blend of executive and independent female directors on compensation committees (for details see Panel 2 of Table II). Therefore, we have a unique opportunity to investigate whether the independent and executive female directors in China have the same monitoring role in setting CEOs' compensation. In addition, our sample contains a reasonable proportion of female directors on compensation committees, which allows us to investigate whether more female directors on compensation committees further improves the committees' effectiveness. Furthermore, unlike in the developed countries the majority of our sample of China's listed companies are owned and controlled by the state or the government, so we can investigate whether the effect of female directors on CEO compensation varies by type of ownership.

5.1.1 Independent vs executive female directors. Generally, the role of independent directors is to improve the firm's performance through monitoring, while the executive directors influence the firm's performance through their skills and knowledge about the company's operations. Proponents of managerial power theory argue that executive directors are ineffective in setting CEOs' pay because the CEO has power over them and over their own pay and career advancement (Beatty and Zajac, 1994; Bebchuk *et al.*, 2002). Executive female directors have usually worked hard to get into the boardroom (Eagly and Carli, 2003) and are pressured to "get along." As a vice chairwoman at Value Edge Advisors, a consulting firm that works with shareholder groups on compensation and other issues, observed, "It's very difficult for women to get on boards, and I think they are under even more pressure to go along and get along [because] the culture of the boardroom is to vote yes. You want to stay on the board, don't you?" Thus, in alignment with managerial power theory, we expect that independent female directors on compensation committees are more effective in setting CEOs' pay than are executive female directors.

To investigate the impact of independent (executive) female directors, we use *CFID* (*CFED*), a dummy variable that equals 1 if there is at least one independent (executive) female director on the compensation committee and 0 otherwise. We also use the proportion of independent (executive) female directors on the compensation committee *CFIP* (*CFEP*). For additional descriptions of variables, see Table I.

Models 1-4 in Panel A of Table V address the question concerning whether independent and executive female directors are equally effective in limiting CEOs' pay and in strengthening the link between CEOs' pay and firm performance. The coefficients of CFID and CFIP (CFED and CFEP) in models 1 and 2, respectively, are negative (negative) and significant (insignificant) at $p < 0.01$ ($p > 0.10$). The interaction variables $ROA \times CFID$ and $ROA \times CFIP$ ($ROA \times CFED$ and $ROA \times CFEP$) in models 3 and 4, respectively, are positive (positive) and significant (insignificant) at $p < 0.01$ ($p > 0.10$). These results indicate that independent female directors are tougher monitors than executive female directors are and that, unlike executive female directors, they facilitate the objective determination of CEO compensation, resulting in lower CEO compensation and a high level of sensitivity of CEO compensation to firm performance. These results support managerial power theory and the intuition that independent directors improve the firm's performance through monitoring channels.

5.1.2 Female representation beyond token (token vs critical mass). A group of women may provide a better set of solutions to a problem than a group of men would (Wood *et al.*, 1985). The results of a psychological experiment conducted by Wood *et al.* (1985) indicated that all-female groups provided better-quality solutions to a problem, while all-male groups generated a higher number of solutions. Campbell and Minguez-Vera (2008) reported that the positive impact of gender diversity in the boardroom on firm performance is more evident when the board has a high proportion of women, rather than a single woman. Konrad *et al.* (2008) reported that two women on the board have more impact than a single woman does and that three women ("critical mass/magic number") are better than two. Similarly, Kramer *et al.* (2007) pointed out that "magic seems to occur when three or more women serve on a board together" because the women create critical mass and are no longer considered outsiders. The impact of a higher percentage of women on a compensation committee is more pronounced than that of a single woman who is likely to be treated as a "token" by the committee members, limiting her impact on pay-setting decisions. Therefore, we expect that a compensation committee with a critical mass of female directors is more effective in setting the CEO's pay than is a committee with a single female director.

We use *CFT* as a measure for the token appointment of one woman on the compensation committee. *CFT* is a dummy variable that equals 1 if there is only one woman on the compensation committee and 0 otherwise. We use *CFCM* as a proxy for a critical mass of female directors on the compensation committee. *CFCM* is also a dummy variable that equals 1 if the compensation committee is at least 50 percent female directors and 0 otherwise. We cannot use the measure of three directors as a proxy for critical mass (see Kramer *et al.*, 2007; Konrad *et al.*, 2008) because the average size of the compensation committees in our sample is 3.46. (see Panel C of Table II). It is reasonable to expect that critical mass at the committee level can be achieved when at least half of the directors on the compensation committee are women.

Models 5 and 6 in Panel A of Table V show that the coefficients of *CFT* and *CDCM* remain negative and significant. However, the coefficient of *CDCM* is greater than that of *CFT*, and the *F*-test reveals that the difference between the coefficients is significant. These results suggest that a compensation committee with a critical mass of female directors is more effective in limiting the CEO's pay than is a committee with a single woman. The coefficient of interaction variables *ROA_CFT* and *ROA_CFCM* remains positive and significant. Similarly, the coefficient of *ROA_CFCM* is greater than the coefficient of *ROA_CFT*. Further, the *F*-test indicates that the coefficients are significantly different. Taken together, these results suggest that a compensation committee with a critical mass of female directors is more effective in limiting the CEO's total pay and strengthening the link between CEO pay and firm performance than is a committee with only one woman.

Panel A: impact of independent vs executive and token vs critical mass of female directors on CEO pay and the link between CEO pay and firm performance (n = 9,393)

	Independent vs executive women directors				Token vs critical mass	
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
ROA	0.040** (2.48)	0.035** (2.14)	0.040** (2.49)	0.035** (2.14)	0.040** (2.48)	0.033** (2.07)
CFID	−0.043*** (−2.67)	−0.064*** (−3.69)	–	–	–	–
CFED	−0.020 (−0.85)	−0.035 (−1.33)	–	–	–	–
ROA × CFID	–	0.535*** (3.53)	–	–	–	–
ROA × CFED	–	0.410 (1.41)	–	–	–	–
CFIP	–	–	−0.152*** (−3.30)	−0.217*** (−4.41)	–	–
CFEP	–	–	−0.093 (−1.16)	−0.167 (−1.60)	–	–
ROA × CFIP	–	–	–	1.690*** (3.81)	–	–
ROA × CFEP	–	–	–	1.870 (1.55)	–	–
CFT	–	–	–	–	−0.025* (−1.68)	−0.050*** (−2.92)
CFCM	–	–	–	–	−0.101*** (−3.03)	−0.197*** (−5.02)
ROA × CFT	–	–	–	–	–	0.676*** (4.35)
ROA × CFCM	–	–	–	–	–	2.519*** (4.65)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
F-value	48.282	47.289	48.368	47.399	48.347	47.811
Adj. R^2 (%)	0.263	0.265	0.264	0.265	0.264	0.267

Panel B: impact of compensation committees' gender diversity on CEO pay and the link between CEO pay and firm performance in state-controlled and non-state-controlled firms

	State controlled		Non-state controlled	
	Model 1	Model 2	Model 3	Model 4
ROA	0.136* (1.81)	0.044 (0.57)	0.036** (2.14)	0.036** (2.11)
CFP	−0.163*** (−2.93)	−0.241*** (−4.10)	−0.119*** (−2.08)	−0.135** (−2.17)
ROA × CFP	–	2.335*** (4.16)	–	0.377 (0.66)
Controls	Yes	Yes	Yes	Yes
F-value	34.906***	34.754***	23.505***	23.163***
Adj. R^2 (%)	30.70	30.90	25.50	25.50
n	4,974	4,974	4,413	4,413

Notes: This table demonstrates the results of *H1* and *H2* using alternative statistical methodologies. All of the models reported in this table include all control variables. For a detailed description of variables, see Table I. *T*-statistics are reported in parentheses. *,**,***Significant at 10, 5, and 1 percent levels, respectively

Table V.
Additional test

Overall, our findings indicate that a critical mass of female directors on a compensation committee increases the committee's effectiveness.

5.1.3 Whether the effect of female directors varies with firm ownership. Since 46.6 percent of the firms in our sample are owned and controlled by the state or the government, we test the effect of state or government ownership on the relationship between gender diversity on the compensation committee and CEO pay and the link between CEO pay and firm performance. To do so, we split the sample into state-controlled and non-state-controlled firms. Models 1-4 in Panel B of Table V show that the coefficient of *CFP* is negative and highly significant in both subsamples, while the interaction variable *ROA_CFP* is positive and highly significant only in the state-controlled subsample. Taken together, these results suggest that gender-diverse compensation committees are more effective in designing the CEO's compensation contract in state-controlled firms. Previous research has argued that firms that have a government as majority owner have the ultimate separation between owners (citizens) and control (management/bureaucrats) and are subject to severe agency issues (see Megginson and Netter, 2001). Our results provide further support for the female directors' monitoring role being stronger in firms that have severe agency issues. The coefficient *ROA* in state-controlled firms is positive and marginally significant ($p < 0.10$), while in other firms it is positive and highly significant ($p < 0.05$), adding to the argument that state-controlled firms have more agency issues than other firms do, as the link between CEO pay and firm performance is weaker in state-controlled firms. In this context, our finding that gender diversity on compensation committees is more effective in setting CEOs' compensation in state-controlled firms suggests that female directors' monitoring is more consequential in firms that face severe agency issues.

Overall, the results reported in Tables IV and V indicate that a gender-diverse compensation committee limits the CEO's total compensation and strengthens the link between CEO pay and firm performance. Our results also show that firms that have a compensation committee with a critical mass of female directors or independent female directors are more effective in objectively setting the CEO's compensation. Moreover, a gender-diverse compensation committee is more effective in designing an optimal contract for its CEO in state-controlled firms than it is in other firms.

5.2 Endogeneity
In corporate governance research – especially research on boards' and their committees' structure – the major concern is endogeneity. Some may argue that the boards that women join are not random but tend to fall into discrete groups, suggesting the potential for bias in the coefficient estimator. This notion is consistent with the perception that woman may select which firms they join as directors (Bilimoria and Piderit, 1994) and that there may be such an issue with respect to compensation committees. Therefore, we use three model specifications to deal with the possible problem of endogeneity.

5.2.1 The lagged gender-diversity measures method. We use one-year lagged compensation committee gender-diversity measures and other compensation committee diversity characteristics in our main regression because women directors and other compensation committee characteristics need time before they can influence pay-setting decisions. In Models-4 in Panel A of Table VI, the coefficients of *CFD* and *CFP* remain negative and significant, and the coefficients of *ROA_CFD* and *ROA_CFP* remain positive and significant. These findings are similar to our previous findings that gender-diverse compensation committees not only restrict their CEOs' total compensation but also strengthen the link between CEO pay and firm performance.

5.2.2 Two-stage least square (2-SLS) regression method. We use instrument variables and estimate our main regression via the 2-SLS method, so we need to identify the

	Model 1	Model 2	Model 3	Model 4
Panel A: influence of a gender-diverse compensation committee on CEO pay and the link between CEO pay and firm performance using one-year lagged compensation committee gender diversity measures (n = 6,339)				
ROA	0.571*** (5.90)	0.021 (1.01)	0.571*** (5.90)	0.021 (1.02)
CFD	−0.019* (−1.82)	−0.060*** (−2.97)	–	–
CFP	–	–	−0.086* (−1.73)	−0.180*** (−3.30)
ROA × CFD	–	0.677*** (3.95)	–	–
ROA × CFP	–	–	–	2.089*** (4.16)
Adj. R^2 (%)	25.15	25.71	25.16	25.72
Panel B: influence of a gender-diverse compensation committee on CEO pay and the link between CEO pay and firm performance using 2-SLS regression (n = 6,339)				
ROA	0.561*** (5.82)	0.019 (0.94)	0.561*** (5.83)	0.019 (0.94)
CFD	−0.034* (−1.89)	−0.059** (−2.38)	–	–
CFP	–	–	−0.094* (−1.87)	−0.156*** (−2.56)
ROA × CFD	–	0.562*** (3.52)	–	–
ROA × CFP	–	–	–	1.631*** (3.60)
Adj. R^2 (%)	25.97	25.73	26.00	26.13
Panel C: influence of a gender-diverse compensation committee on CEO pay and the link between CEO pay and firm performance using the PSM method (n = 7,158)				
ROA	−0.038 (−1.30)	−0.046 (−1.60)	−0.038 (−1.30)	−0.044 (1.53)
CFD	−0.048*** (−2.72)	−0.070*** (−3.83)	–	–
CFP	–	–	−0.168*** (−3.87)	−0.231*** (−5.00)
ROA × CFD	–	0.580*** (4.12)	–	–
ROA × CFP	–	–	–	1.601*** (4.06)
Adj. R^2 (%)	28.74	28.90	28.81	28.97

Notes: This table demonstrates the results of *H1* and *H2* using alternative statistical methodologies. All of the models reported in this table include all control variables. For a detailed description of variables, see Table I. *T*-statistics are reported in parentheses. *,**,***Significant at 10, 5, and 1 percent levels, respectively

Table VI.
Endeogeneity test

instrument variable(s) that can satisfy the exclusion restriction (i.e. correlated with the decision to have women on the compensation committee but not correlated with CEO pay). In line with Bruynseels and Cardinaels (2014), we use as instrument variables the lag, then the industry average, and finally both lagged values and the industry average of compensation committees' gender-diversity measures. Models-4 in Panel B of Table VI show that the coefficients of *CFD* and *CFP* remain negative and significant and the coefficients of the interaction variables *ROA_CFD* and *ROA_CFP* remain positive and significant. These results validate our previous findings.

5.2.3 Propensity score matching (PSM) method. It is possible that our OLS results are misleading because of self-selection bias if other characteristics of firms that have and do not have gender-diverse compensation committees differ and are associated with lower CEO compensation and a strong link between CEO pay and firm performance. To investigate whether such is the case, we test both hypotheses on subsamples of firms matched by industry and year using the PSM method. In alignment with Bugeja *et al.* (2016), PSM is based on the probability that a firm has at least one female director on its compensation committee (*CFD*) based on the firm size (*Fsize*), board size (*BSize*), and proportion of female directors on the board. Firm size and board size are considered because larger firms face pressure to include women, and larger boards are associated with gender diversity. The proportion of female directors must be controlled for because the chances of having gender-diverse compensation committee increase as the proportion of female directors on the board increases. In addition to these three determinants, we also include the proportion of independent directors on the board (*Bind*) and institutional ownership (*InstH*).

Bind is included because the chances of having female and minority directors increase with the proportion of independent directors (Carter *et al.*, 2003). *InstH* is included because the institutional investor may exert pressure to have diversity on the board (Coffey and Freyxell, 1991). Models 1-4 in Panel C of Table VI show that the results of our gender diversity measures are the same as those reported in Table IV. Overall, our entire endogeneity control test indicates that our OLS results are consistent. For the sake of parsimony, we reported only the results on our hypotheses. The results reported in additional tests are also verified using the three model specifications.

5.3 Further robustness tests

To ensure the further robustness of our study, we use three alternative measures of gender diversity on the compensation committee: *CFN*, *CFBI*, and *CFSI*. *CFN* is the number of female directors on the compensation committee, while *CFBI* and *CFSI* are two comprehensive measures of gender diversity on the compensation committee measured using formulas from the Blau index (Blau, 1977) and the Shannon index (Shannon, 1948), respectively (for a detailed description of variables, see Table I). Moreover, as a cleaner test, we exclude firms that offer stock options to their CEOs (this exclusion reduces our sample from 9,390 firm-year observations to 8,985 firm-year observations). Table VII shows that the gender-diversity measures (*CFN*, *CFBI*, and *CFSI*) remain significant and negative and that the interaction variables (*ROA_CFN*, *ROA_CFBI*, and *ROA_CFSI*) remain significant and positive. These results further validate our previous findings.

6. Summary and conclusions

The findings of this study make six important contributions. First, similar to Bugeja *et al.* (2016), we find significant and reliable evidence that a woman on a compensation committee limits the CEO's total compensation. Extending Bugeja *et al.* (2016), we find that a gender-diverse compensation committee strengthens the link between CEO pay and firm performance. In the spirit of boardroom gender-diversity studies (Kramer *et al.*, 2007; Konrad *et al.*, 2008), we also investigate whether having a single woman or a critical mass of women on a compensation committee is sufficient to ensure the objective determination of the CEO's compensation. Our results indicate that a compensation committee is more effective in setting the CEO's pay when it has a critical mass of female directors than it is when it has a single woman. We also find that only independent female directors are effective in limiting the CEO's total pay and strengthening the link between CEO pay and firm performance. This result is consistent with the intuition that independent directors improve firm performance through monitoring channels, while executive directors do so through executive channels (Liu *et al.*, 2014).

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
ROA	0.038** (−2.36)	0.033** (−2.07)	0.038** (−2.36)	0.033** (−2.02)	0.038** (−2.35)	0.032** (−1.97)
CFN	−0.035*** (−2.85)	−0.051*** (−3.92)	–	–	–	–
CFBI	–	–	−0.092** (−2.47)	−0.140*** (−3.59)	–	–
CFSI	–	–	–	–	−0.013*** (−2.74)	−0.025*** (−3.09)
ROA × CFN	–	0.40*** (−3.74)	–	–	–	–
ROA × CFBI	–	–	–	1.273*** (4.00)	–	–
ROA × CFSI	–	–	–	–	–	0.301*** (−4.41)
Adj. R^2 (%)	25.18	25.29	25.17	25.29	25.14	25.3

Table VII.
Further
robustness test

Notes: Influence of a gender-diverse compensation committee on CEO pay and the link between CEO pay and firm performance using alternative measures for a sample of firms that offer no equity compensation ($N = 8,985$). This table demonstrates the results of *H1* and *H2* using alternative statistical methodologies. All of the models reported in this table include all control variables. For a detailed description of variables, see Table I. *T*-statistics are reported in parentheses. *,**,***Significant at 10, 5, and 1 percent levels, respectively

Second, we extend the findings of earlier studies on the compensation committee and CEO pay (see Anderson and Bizjak, 2003; Gregory-Smith, 2012; Conyon, 2014; Kent *et al.*, 2016) by suggesting that female directors on compensation committees improve the committees' effectiveness. Third, in line with Bugeja *et al.* (2016), we suggest that policymakers recommend, instead of Say on Pay legislation, that female directors serve on compensation committees as an economical way to ensure the objective determination of CEOs' compensation. Fourth, our findings contribute to the recent global debate about recommending boardroom gender diversity based on its economic effect. Fifth, in line with studies on female directors and firm governance (Gul *et al.*, 2008; Adams and Ferreira, 2009; Gul *et al.*, 2011) our results support the notion that female directors can improve firm-level governance by monitoring management's actions and decisions, such as decisions related to setting the CEO's compensation. Sixth, we provide the first empirical evidence that the influence of a gender-diverse compensation committee varies by firm ownership, as we find that a gender-diverse compensation committee is more effective in setting the CEO's compensation in state-controlled firms, where agency issues are severe, than it is in other firms. Therefore, our findings suggest that gender diversity can strengthen the weak governance structure in China. Moreover, we shed light on China's diversity practices at the boardroom level and provide useful empirical guidance to the China's regulatory bodies on this subject.

Our results raise issues for policy, practice, and theory. Although some countries have given the attention to the presence of female directors on the board, much more research attention has been paid to independent directors. For example, Terjesen *et al.* (2016) noted that virtually all of the best corporate governance codes around the globe require listed companies to have a certain proportion of outside directors, whereas only a few codes consider gender diversity. Given our study's finding that the presence of female directors on the compensation committee improves the committee objectivity and effectiveness in designing the executives' compensation contracts, codes of corporate governance should give the same importance to the presence of female directors that they give to independent directors. In addition, the best corporate governance codes recommend an independent compensation committee (i.e. a committee composed of a majority of or all independent directors). However, according to Capezio *et al.* (2011), this prescription is just a belief of regulatory bodies, rather than empirically validated fact, because the majority of studies have reported that independent compensation committees do not compensate the firms' executives objectively. Given this study's findings, we suggest that corporate governance codes at least consider recommending gender diversity on compensation committees.

The study's practical implications include its support for the notion that gender diversity at the top management level is an important corporate governance issue. Given the findings of our study that gender-diverse compensation committees are more effective when the principal-agent issues are severe, we suggest that the presence of female directors can improve firm-level governance in developing countries, where governance and investor protection tend to be weak. In particular, we shed light on China's diversity practices at the boardroom level and provide useful empirical guidance to China's regulatory bodies on this subject.

As for the theoretical perspective, we extend the managerial power theory's and the agency theory's assumption about an independent compensation committee (a committee composed of all or a majority of independent directors) to the compensation committee's gender diversity by suggesting that the presence of female directors on the committee enhances its effectiveness and objectivity in designing optimal contracts for CEOs that tie their pay to company performance. We also extend the gender-diversity literature and provide the novel insight that independent female directors play a greater role in effective governance than executive female directors do. We also contribute to critical mass theory in finding that the governance role of female directors is stronger when they reach a critical mass on the board. Unlike the critical mass theory's assumptions, we find that a single

woman on the compensation committee can also improve the committee's objectivity, but a critical mass of female directors further improves the committee's objectivity and effectiveness. In addition, our findings provide a new insight into how within-country institutional factors affect the governance role of female directors. The literature has largely overlooked within-country institutional factors in investigating the effect of female directors on firm governance or firm performance.

Like every study, this study is subject to limitations that provide promising directions for future research. First, we used data from an emerging market (China), so our results may not be generalizable outside of China, where the hypotheses should be tested further. Second, we consider only a few institutional factors in investigating the governance effect of female directors on CEOs' pay. Future studies should consider the role of other within-country institutional factors (e.g. family-owned firms, firms with concentrated ownership, and group-affiliated firms). Third, this study considers only the CEO's total cash compensation, so there is a unique opportunity to investigate the effect of a gender-diverse compensation committee on the CEO's pay structure. Fourth, similar to Bugeja *et al.* (2016), we use data from a country in which having women on boards is not mandatory, so there is an opportunity to compare the economic effect of female directors in countries that make gender-diverse boards mandatory with those that do not. Such research will contribute to the global debate on whether forced representation of women on corporate boards and voluntary representation have the same outcomes. Fourth, several kinds of diversity on compensation committees other than gender diversity (e.g. national and ethnic diversity) can affect CEOs' pay, so there are research opportunities in investigating whether the various kinds of diversity have the same or different effects as those found in this study. Finally, the literature on the governance role of female directors on firms' internal governance has overlooked questions concerning whether female directors affect the CEO's pay disparity. In our future work, we will work on these research directions.

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