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## Is there a gender gap in CEO compensation?

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## ABSTRACT

The gender pay gap generates significant political and social debate. This study contributes to this discussion by examining if a gender pay gap exists at the highest level of corporate management, the CEOs. While previous studies have documented a gender pay gap for most levels of executives the findings with respect to CEOs are conflicting. In this paper we focus only on CEO's as it is the most homogenous of executive roles and does not require us to assume that executives with similar titles undertake identical roles. Our evidence is based on 291 US firm-years for the period of 1998–2010. We do not find any association between CEO pay and gender using both the total sample and a sample matched using propensity scores to control for firm characteristics. These insignificant results hold for total pay, salary and bonuses, and for different matching procedures and econometric specifications. Our results therefore indicate that women who rise through the “glass ceiling” to the level of CEO are remunerated at similar levels to their male counterparts.

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## 1. Introduction

In 2010 the Joint Economic Committee of the US Congress reported that full-time female employees earned only 77 cents for every dollar earned by their male counterparts.<sup>1</sup> A gender pay gap also exists for managers with the US Government Accounting Office indicating that in 2007 the average female manager's salary was 81% of a male manager's salary.<sup>2</sup> A difference in pay across genders has also been documented in prior academic research (e.g. Bayard et al., 2003).

Recent academic studies also support the proposition that there is a gender bias in executive pay. For example, the studies of Veito and Khan (2012), Munoz-Bullon (2010), Bell (2005) and Bertrand and Hallock (2001) provide evidence that there is a gender difference in executive pay and that male executives are compensated at higher levels than female executives. Bell (2005) also documents that the gender pay gap for female executives reduces when a firm is led by a female CEO. In a recent study, Elkinawy and Stater (2011) find that a gender gap exists in the compensation of lower level executives which has been diminishing for CEOs over time. On the other hand, Jordan et al. (2007) find no evidence of a gender pay gap for CEOs, only for lower level executives. We aim to build on these studies.

The objective of this study is to focus on CEOs alone and to provide evidence on whether there is a gender gap in the total pay, salary and bonuses of male versus female CEOs. We focus only on CEOs because it is the most homogenous of all executive roles.

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<sup>1</sup> Joint Economic Committee Releases Women and the Economy 2010: Top Ten Facts. Available at [http://jec.senate.gov/public/index.cfm?p=PressReleases&ContentRecord\\_id=5bdf6c24-2f48-463b-ae8a-dabab6d25c20&ContentType\\_id=66d767ed-750b-43e8-b8cf-89524ad8a29e](http://jec.senate.gov/public/index.cfm?p=PressReleases&ContentRecord_id=5bdf6c24-2f48-463b-ae8a-dabab6d25c20&ContentType_id=66d767ed-750b-43e8-b8cf-89524ad8a29e), date accessed 2 September, 2011.

<sup>2</sup> Government Accountability Office: Women in Management: Analysis of Female Managers' Representation, Characteristics and Pay. Available at <http://www.gao.gov/new.items/d10892r.pdf>, date accessed 2 September, 2011.

Hence we do not need to define the different executive roles and assume that executives holding the same title across firms have the same responsibilities (Bertrand and Hallock, 2001; Elkinawy and Stater, 2011). An additional advantage of our study is, that in comparison to prior studies examining whether CEO (as opposed to all executives) pay differs with gender, this study uses a larger and more recent sample of CEO firm-years than examined in prior research.<sup>3</sup>

We also aim to take advantage of recent methodological developments within the executive compensation literature that enable us to match firms based on the most relevant characteristics. In doing so we can compare the compensation of CEOs from like firms, but who differ on their gender. To undertake this analysis we use propensity score matching to identify a control firm for each firm employing a female CEO. In previous studies, firms with a female CEO are typically only matched within industry to a similar sized firm employing a male CEO. As discussed by Armstrong et al. (2010), this partial-matching approach may lead to biased parameter estimates. The propensity score matching technique used in this study identifies control firms within year and industry using firm size (sales), board size and percentage of female directors as matching variables. We include the percentage of female directors as a control because previous research reports that firms are more likely to have female executives when the board comprises a greater proportion of female directors (Bell, 2005; Elkinawy and Stater, 2011). Our results indicate that the use of propensity score matching identifies control firms that are statistically similar across multiple dimensions to firms with a female CEO.

Our evidence is based on an initial sample of 291 firm-years and a propensity score matched sample of 210 firm years of US publicly listed companies with female CEOs for the period 1998–2010. Using the propensity score matched sample we find no difference in compensation between genders. This insignificant finding holds for total compensation, salary and bonus. Hence our result is consistent with the findings of Jordan et al. (2007), and also extends prior academic research and informs the political and social debate on the existence of a gender pay gap for corporate executives.

The remainder of this study is structured as follows: Section 2 discusses relevant prior literature; Section 3 describes the research method; Section 4 presents descriptive statistics and a discussion of the sample; Section 5 presents results; and Section 6 concludes the study.

## 2. Prior literature

Most of the literature that addresses issues related to CEO compensation is based on agency theory; however agency theory does not provide any guidance on CEO compensation with respect to gender differences. Bebchuk and Fried (2003) offer an alternative theoretical perspective on CEO compensation in terms of board capture theory (recently referred to as managerial power theory). In this framework CEOs are able to capture the board and extract rents. However, this theoretical approach does not provide any conceptual insights into the association of CEO pay and gender, unless one can argue that female CEOs are better at capturing boards than their male counterparts.

Prior empirical evidence on the association between gender and CEO compensation is also limited and the results from these studies are mixed. Jordan et al. (2007), using univariate analysis, document that the compensation of female CEOs of firms in the Fortune 100 is not significantly different from the compensation of male CEOs. However, this analysis is limited by the small sample size investigated. Mohan and Ruggiero (2003) compare pay for 47 female CEOs in the year 2000 matched to firms employing a male CEO by size and industry, and find that female CEOs receive lower total compensation. However, this result is based on data envelopment analysis (DEA) used to project executives' compensation to the highest attainable level for any level of observed performance. No significant difference is found in any of the compensation measures when using univariate analysis on their matched sample prior to DEA.

Other studies examining the impact of gender on compensation investigate differences at the executive level, rather than focusing exclusively on the CEO. For example, Elkinawy and Stater (2011) identify and codify eleven different senior executive positions including CEO/Chair for the period of 1992–2004. Their cross-sectional experimental design pools observations across these different executive levels and adds to the model certain firm and governance characteristics. Accordingly, their experimental design does not allow one to make inferences specifically about the association of CEO compensation and gender. It only derives some general conclusions about executives' compensation and gender. The key finding is that an approximate 5% pay gap exists between male and female executives' compensation. Vieito and Khan (2012) also report a gender pay gap for US executives using an identical time period to Elkinawy and Stater (2011).

Similarly, Bell (2005) uses the Standard and Poor's Execucomp Database to explore gender related pay differences for the top five executives in the US over the period 1992–2003. The results indicate that female executives earn between 8 and 25% less than their male counterparts. The study also reports that firms led by women have significantly greater numbers of female executives and that the disparity in pay between men and women executives decreases when the firm is led by a female.

Since neither agency theory nor current empirical evidence helps us to derive a formal prediction, we treat the association between CEO compensation and gender as an empirical issue and aim to provide the most rigorous evidence to date on this matter.

## 3. Sample and data

Data for US listed firms between 1998 and 2010 are collected from the Investor Responsibility Research Center (IRRC), Compustat Fundamentals Annual and Execucomp databases. Observations with missing CEO compensation data or data required

<sup>3</sup> As a means of comparison the sample in Jordan et al. (2007) comprises three CEOs between 2001 and 2003, while Mohan and Ruggiero (2003) include 47 CEOs in 2000.

**Table 1**

Sample by year and industry.

Panel A: frequency of firms and female CEOs by year				
Year	No. of firms		Female CEOs	Female CEOs%
1998	786		5	0.64
1999	1,042		9	0.86
2000	1,082		13	1.20
2001	1,139		15	1.32
2002	1,161		19	1.64
2003	1,181		19	1.61
2004	1,195		19	1.59
2005	1,207		20	1.66
2006	1,194		26	2.18
2007	1,061		32	3.02
2008	1,142		32	2.80
2009	1,234		38	3.08
2010	1,335		44	3.30
Total	14,759		291	1.97

  

Panel B: frequency of firms and female CEOs by industry				
Industry (2 digit GICS)	No. of firm-years	% of total firm-years	Female CEOs	% of firm-years for industry
Energy	800	5.42	6	0.75
Materials	1,087	7.36	10	0.92
Industrials	2,316	15.69	10	0.43
Consumer discretionary	2,629	17.81	101	3.84
Consumer staples	811	5.49	33	4.07
Health care	1,615	10.94	39	2.41
Financials	1,923	13.03	24	1.25
Information technology	2,587	17.53	54	2.09
Telecommunications	138	0.94	3	2.17
Utilities	853	5.78	11	1.29
Total	14,759	100	291	

to estimate model (1) are excluded from the sample. We also exclude nineteen observations with reported total CEO compensation of \$0. As total compensation includes salary, bonus, stock options granted, restricted stock granted and all other compensation (both cash and non-cash), these observations are either data errors or represent unusual circumstances. The remaining sample comprises 14,759 firm-years. Panel A of Table 1 provides a yearly breakdown of firms and Panel B shows the frequency of firms with a female CEO classified by industry.

Panel A of Table 1 indicates that no single year dominates the sample. Across the sample period, female CEOs represent only 1.97% of firm years. It is notable though that the percentage of firms with a female CEO has increased from 0.64% in 1998 to 3.30% in 2010. Female CEOs are employed most frequently in the consumer discretionary and consumer staples industries (Panel B). The industry with the lowest rate of employment of female CEOs is industrials.

#### 4. Research method

The following model is estimated to examine if CEO gender influences the level of CEO compensation:

$$\begin{aligned}
 \text{Comp}_i = & \beta_0 + \beta_1 \text{Fem\_CEO} + \sum \beta_j \text{Governance characteristics}_i \\
 & + \sum \beta_k \text{CEO characteristics}_i + \sum \beta_l \text{Economic characteristics}_i \\
 & + \sum \beta_m \text{Industry indicators}_i + \sum \beta_n \text{Year indicators}_i + \varepsilon_i
 \end{aligned} \quad (1)$$

The level of annual CEO compensation is used as the dependent variable (*Comp*). CEO compensation is measured using three alternative measures: total annual compensation, annual salary, and annual bonus. The natural logarithm of Execucomp's TDC1 is used to measure total annual compensation. Total compensation (*Total\_comp*) includes the CEO's salary, bonus, other annual compensation, total value of restricted stock granted, total value of stock options granted (valued using Black–Scholes), long-term incentive payouts, and all other compensation (in thousands of dollars). The dollar value of the CEO's base salary (in thousands of dollars) is used as the measure of annual base compensation (*Salary*).<sup>4</sup> The dollar value of the bonus awarded during the fiscal year is specified as the bonus (in thousands of dollars) (*Bonus*). The independent variable of interest is an indicator variable equal to 1 if the CEO is female (*Fem\_CEO*). The remaining independent variables included in model (1) are identified from prior literature and provide controls for governance, CEO, and economic characteristics that are associated with CEO compensation. We also include industry and year indicators in model (1) to control for industry and year effects.

<sup>4</sup> The results are unchanged if the natural logarithm of 1 + salary is used as the dependent variable.

#### 4.1. Corporate governance controls

We incorporate controls in model (1) for board size, the percentage of independent directors, and compensation committee independence. Board size (*Bdsize*) is included as a control as larger boards are expected to be less effective monitors (Jensen, 1993; Yermack, 1996). The second governance control is the percentage of the independent directors on the board (*Inddirs%*). If independent directors are more effective monitors they may act to constrain CEO compensation (Coles et al., 2008; Fama and Jensen, 1983). Alternatively, the board capture theory suggests that independent directors do not always seek to maximize returns for shareholders (e.g. Core et al., 1999) and may result in greater CEO compensation. The final governance control variable is an indicator variable (*Indcompcom*) equal to 1 if the compensation committee is comprised wholly of independent directors.

#### 4.2. CEO characteristics

The CEO characteristics included in model (1) are controls for CEO managerial power and experience. CEO's that have a longer tenure with the firm are expected to exert greater influence over the board. We control for CEO tenure using the natural logarithm of the number of years of service of the current CEO (*Log(CEO\_tenure)*). The next control is an indicator variable equal to 1 which identifies if the CEO is also the board chairperson (*CEO\_chair*). It is expected that CEOs receive higher compensation when they also act as the board chairperson due to their greater influence over the board (Bebchuck and Fried, 2003; Bebchuck et al., 2002; Grinstein and Hribar, 2004). The compensation of CEOs in their first year of appointment at a firm may be atypical due to sign-on bonuses or the use of performance incentives that will not be realized until future years. This effect is controlled for through the use of an indicator variable equal to 1 if it is the CEO's first year of service at a firm (*CEO\_firstyear*). The final control is an indicator variable equal to 1 if the CEO owns 5% or more of the company's stock (*CEO5pct*). CEO's with greater ownership have more personal wealth tied to firm performance and hence are less likely to extract rents through remuneration.

#### 4.3. Economic controls

Consistent with previous studies, controls are included for economic characteristics of the firm that will influence compensation. Because compensation is used as an incentive to improve performance, controls are measured 1 year prior to the year compensation is awarded (year *t-1*). Due to greater complexity and responsibility, larger firms pay their executives more than smaller firms (Smith and Watts, 1992) hence the natural logarithm of sales revenue is used as a control for size (*Log(Sale)*). Murphy (1985) finds that CEO compensation is higher for companies with greater investment opportunities. We use a firm's book-to-market ratio (*BMV*) as a measure of their investment opportunities. Core et al. (1999) show that executive pay is a function of firm performance. We control for firm performance using both an accounting and market performance measure. The market measure is a company's annual common stock return (*RET*) and the accounting measure is return on assets (*ROA*). Similar to previous studies we control for firm risk using the standard deviation of common stock returns (*Log(Std3RET)*) and the standard deviation of return on assets measured over the previous three years (*Log(Std3ROA)*).<sup>5</sup> Core et al. (1999) find a negative association between risk and CEO compensation. Firm leverage is controlled for using average total liabilities divided by average total equity (*DE*).

### 5. Results

Table 2 provides descriptive statistics on the total pooled sample partitioned by gender.

A Wilcoxon–Mann–Whitney test on the medians of the variables of both groups reports that, on average, male CEOs receive a higher bonus but there is no difference in total compensation. The mean and median salary for female CEOs is higher than that for male CEOs but the difference is insignificant. These findings are similar to those documented for executives by Munoz-Bullon (2010) and Elkinawy and Stater (2011). Consistent with Bell (2005) and Elkinawy and Stater (2011), a female CEO is more likely to be employed when the board comprises more female directors. Firms with female CEOs are significantly smaller in size and have fewer directors on the board. Male CEOs have a significantly longer tenure than female CEOs and are significantly more likely to be board chairperson. Firms headed by a female CEO have significantly lower leverage. The standard deviation of ROA and annual stock returns does not statistically differ between male and female CEOs. There is also no difference across the gender of CEOs in either the accounting or stock market measures of performance.

As there is a large disparity in numbers of male and female CEO firm years, we conduct our main analysis of a difference in CEO pay between the genders using a matched sample. Prior literature examining gender pay differences for executives and CEOs has typically selected matched firms of similar size within the same industry. As discussed by Armstrong et al. (2010), this partial-matching approach will potentially produce biased parameter estimates. We therefore follow the approach suggested by Armstrong et al. (2010) and identify matched firms using a propensity score procedure.<sup>6</sup> The probability of a firm having a female CEO is modeled within a year using a logit regression with firm size (*Sale*), board size (*Bdsize*) and percentage of female directors (*Fem-dirs%*) as the independent variables. We include the percentage of female directors as a control because previous research

<sup>5</sup> The natural logarithm of these measures is used due to the positively skewed distribution. Our results are unchanged if we use the standard deviation of returns over the previous five years as a control for risk. Using this longer time period however results in a reduction in the sample size.

<sup>6</sup> See Rosenbaum (2001) for an overview of the process of propensity score matching and Rosenbaum and Rubin (1983) for a theoretical discussion.

**Table 2**

Wilcoxon–Mann–Whitney test of difference between male and female CEO firms using the total sample.

Variable	Male CEO firms (N = 14,468)		Female CEO firms (N = 291)		Wilcoxon–Mann–Whitney test	
	Mean	Median	Mean	Median	Z	P >  Z
<i>Total comp</i>	5503.50	3,124.54	5,447.38	3,066.74	−0.29	0.77
<i>Salary</i>	736.58	691.30	780.41	700.00	0.53	0.59
<i>Bonus</i>	650.63	167.40	345.98	0.00	−4.79***	0.00
<i>Femdirs%</i>	0.10	0.10	0.25	0.25	16.64***	0.00
<i>Bdsize</i>	9.54	9.00	8.80	8.00	−4.10***	0.00
<i>Inddirs%</i>	0.71	0.73	0.74	0.75	3.46***	0.00
<i>Indcompcom</i>	0.82	1.00	0.88	1.00	2.78***	0.01
<i>CEO_tenure</i>	7.18	5.00	5.32	3.00	−5.31***	0.00
<i>CEO_chair</i>	0.61	1.00	0.55	1.00	−2.30**	0.02
<i>CEO_firstyear</i>	0.07	0.00	0.11	0.00	2.79***	0.01
<i>CEO5pct</i>	0.09	0.00	0.07	0.00	−1.14	0.25
<i>Sale</i>	5,926.40	1,478.38	6,263.54	947.49	−2.90***	0.00
<i>BMV</i>	0.52	0.43	0.53	0.44	0.89	0.37
<i>DE</i>	2.40	1.27	2.46	0.96	−3.85***	0.00
<i>RET</i>	0.07	0.01	0.05	0.01	−0.18	0.86
<i>ROA</i>	0.10	0.09	0.10	0.09	0.89	0.37
<i>Std3RET</i>	0.71	0.31	0.39	0.32	0.30	0.77
<i>Std3ROA</i>	0.03	0.02	0.03	0.02	1.60	0.11

Total comp equals Execucomp's TDC1, which comprises the CEO's salary, bonus, other annual compensation, total value of restricted stock granted, total value of stock options granted (using Black–Scholes), long-term incentive payouts, and all other total (in thousands of dollars). *Salary* is the dollar value of the CEO's base salary (in thousands of dollars). *Bonus* is the dollar value of bonus earned during the fiscal year (in thousands of dollars). *Femdirs%* is the fraction of directors that are female. *Bdsize* represents the number of directors on the board. *Inddirs%* is the fraction of directors that are independent. *Indcompcom* is an indicator variable equal to 1 if the compensation committee is composed wholly of independent members, 0 otherwise. *CEO\_tenure* is the number of years of service of the current CEO. *CEO\_chair* is an indicator variable equal to 1 if the CEO is also the chair of the board, 0 otherwise. *CEO\_firstyear* is an indicator variable equal to 1 if it is the CEO's first year at that firm, 0 otherwise. *CEO5pct* is an indicator variable equal to 1 if the CEO owns 5% or more of the company's shares. *Sale* represents gross sales reduced by cash discounts, trade discounts, returned sales and allowances for which credit is given to customers (measured in millions of dollars). *BMV* (book to market value) is measured as total common equity divided by market value (measured in millions of dollars). *DE* equals average total liabilities divided by average total equity (in millions of dollars). *RET* is the annual stock return. *ROA* is the annual return on assets (EBIT/avgAT). *Std3RET* and *Std3ROA* represent the three year standard deviation of *RET* and *ROA* respectively.

\*\*\* Significant at 1%.

\*\* Significant at 5%.

\* Significant at 10%.

shows that the number of males on the board is negatively related to the employment of female executives. Using the results from this logit model we match within industry each firm led by a female CEO to a firm headed by a male CEO with the lowest difference in propensity scores.<sup>7</sup> For 81 CEO firm years it was not possible to identify a reasonable propensity score match resulting in the sample being reduced to 210 CEO firm years. The use of propensity score matching controls for self-selection bias arising from the observable characteristics included in the first stage logit model.<sup>8</sup>

The results of estimating the logit regressions which are used to match firms with male and female CEOs are provided in Table 3.

Similar to the results in Bell (2005) and Elkinawy and Stater (2011) firms are significantly more likely to have a female CEO when there is a higher percentage of female directors on the board. Board size is significantly negatively associated with the probability of having a female CEO in seven of the 13 years. In all years firm size is unrelated to the likelihood of hiring a female CEO.

Table 4 displays descriptive statistics for the paired subsample and univariate tests of differences between male and female CEO firms.

By construction no difference (in level or magnitude) is evident in *Sale*, *Bdsize* or *Fem\_dirs%* between male and female CEO firms. The Wilcoxon–Mann–Whitney test reports no difference in any of the compensation measures between male and female CEOs. The average and median total compensation are lower for female CEOs but the differences are not significantly different. Note the median bonus for both male and female CEOs is zero. A comparison of the other governance, CEO and economic controls across gender indicates there are no significant differences other than for *CEO\_tenure*, *CEO\_chair* and *CEO\_firstyear*. The similarity of control variables across gender indicates that the propensity score matching procedure has been successful in matching firms with male and female CEOs across multiple dimensions.

<sup>7</sup> The match used is a caliber match where the control and treatment firm's propensity score are allowed to differ by up to 0.10.

<sup>8</sup> As propensity score matching assumes self-selection only arises from the observable characteristics included in the first-stage model it does not control for unobservable characteristics (Lennox et al., 2012; Li and Prabhala, 2007). The alternative Heckman (1979) method requires the use of theory to identify instrumental variables for the first-stage model that can be validly excluded in the second stage (Lennox et al., 2012; Li and Prabhala, 2007). As theory does not guide us in the choice of instrumental variables, we have chosen the propensity score matching approach.



**Table 3**Logit regressions (*Fem\_CEO* = 1) for propensity-score matching each year.

Year	Intercept	<i>Fem_dirs%</i>	<i>Bdsize</i>	<i>Sales</i>
1998	−4.61 (5.41)**	10.11 (9.12)***	−0.13 (0.39)	−0.00 (0.43)
1999	−2.85 (2.98)*	15.08 (24.81)***	−0.35 (2.63)	−0.00 (2.52)
2000	−3.51 (7.34)***	13.02 (30.94)***	−0.32 (4.85)**	0.00 (0.18)
2001	−2.19 (3.17)*	13.70 (36.95)***	−0.49 (9.58)***	0.00 (0.02)
2002	−3.36 (9.66)***	12.70 (38.69)***	−0.29 (5.62)**	0.00 (0.05)
2003	−2.52 (4.62)**	13.74 (39.92)***	−0.44 (9.45)***	0.00 (0.53)
2004	−3.53 (9.07)***	13.07 (38.41)***	−0.31 (5.97)**	0.00 (0.04)
2005	−4.58 (13.55)***	14.40 (42.37)***	−0.18 (1.72)	−0.00 (2.27)
2006	−3.96 (13.30)***	12.60 (42.83)***	−0.19 (2.61)	−0.00 (1.19)
2007	−3.36 (14.26)***	9.83 (38.34)***	−0.18 (3.54)*	−0.00 (0.00)
2008	−4.89 (27.07)***	12.49 (48.40)***	−0.09 (0.86)	−0.00 (0.06)
2009	−5.06 (31.80)***	14.32 (65.37)***	−0.11 (1.56)	−0.00 (0.05)
2010	−4.37 (26.26)***	13.45 (75.37)***	−0.16 (3.65)*	0.00 (0.02)

*Fem\_dirs%* is the fraction of directors that are female. *Bdsize* represents the number of directors on the board. *Sale* is gross sales (in \$mil) reduced by cash discounts, trade discounts, returned sales and allowances for which credit is given to customers. Chi-square statistics are given in parentheses.

\*\*\* Significant at 1%.

\*\* Significant at 5%.

\* Significant at 10%.

Table 5 reports the results for estimating the regression model for the full sample. We cluster standard errors by firm to control for firm fixed effects (because it is possible for the same firm to enter the pooled sample a number of times).

As the adjusted R-squared for the total compensation and salary models are above 41%, the model has reasonable explanatory power. The coefficient on the experimental variable *Fem\_CEO* is insignificant for total compensation and bonus but positive and significant for salary. The significant positive coefficient on salary for female CEOs is consistent with the higher mean and median salary reported in Table 2. The results based on the total sample are inconclusive, not unlike previous studies and highlights the need for careful matching.

The results for the control variables are generally consistent with previous studies (see for example Chalmers et al., 2006; Core et al., 1999). CEOs with a longer tenure receive significantly higher salary and bonus, but there is no difference for total compensation. For all three compensation measures CEOs who are also chairpersons receive significantly more pay. This may be interpreted as CEOs using their power to extract greater pay, or it may reflect additional talent or effort. In the first year of employment CEOs receive significantly lower salary and significantly higher total compensation and bonus pay. CEOs who own more than 5% of stock are paid significantly less. This finding can be explained by agency costs: CEOs with lower ownership are more likely to extract higher pay inconsistent with maximizing shareholder wealth. As expected, smaller firms and those with less growth options (as measured by the book-to-market ratio) remunerate their CEOs less. The relationship between firm stock performance and remuneration is positive for CEO bonus and total pay. A higher ROA increases bonus but surprisingly is negatively related to salary. The impact of firm risk on total compensation and salary is generally positive, although a significant negative relationship is shown between salary and the standard deviation of returns. The significant results on the corporate governance measures are generally positive and indicate that salary and total compensation increases with board size and total compensation increases with the percentage of independent directors. An independent compensation committee is unrelated to CEO remuneration. Overall, the results for the corporate governance measures are similar to those in prior literature (e.g. Core et al., 1999; Wade et al., 1990) and are consistent with board capture theory suggesting that independent directors do not necessarily seek to maximize shareholder wealth (Bebchuck and Weisbach, 2009).

Table 6 presents the results of estimating model (1) using the propensity score matched subsample.<sup>9</sup>

<sup>9</sup> The reported results do not include controls for firm fixed effects because the majority of the matched sample comprises unique firms. As a check we re-estimate model (1) on the matched sample including firm fixed effects and results are unchanged.

**Table 4**

Wilcoxon–Mann–Whitney test of difference between male and female CEO firms using matched subsample.

Variable	Male CEO firms (N = 210)		Female CEO firms (N = 210)		Wilcoxon–Mann–Whitney test	
	Mean	Median	Mean	Median	Z	P >  Z
<i>Total comp</i>	4,811.62	3,147.60	4,586.74	2,761.51	1.17	0.24
<i>Salary</i>	725.25	675.01	733.98	647.50	0.97	0.33
<i>Bonus</i>	276.63	0.00	288.29	0.00	−0.49	0.62
<i>Fem_dirs%</i>	0.21	0.20	0.21	0.20	−0.16	0.88
<i>Bdsize</i>	8.57	8.00	8.75	8.00	−0.09	0.93
<i>Inddirs%</i>	0.73	0.75	0.73	0.75	0.29	0.77
<i>Indcompcom</i>	0.85	1.00	0.88	1.00	−0.85	0.40
<i>CEO_tenure</i>	6.41	5.00	5.89	3.50	3.13***	0.00
<i>CEO_chair</i>	0.59	1.00	0.50	0.50	1.76*	0.08
<i>CEO_firstyear</i>	0.07	0.00	0.11	0.00	1.70*	0.09
<i>CEO5pct</i>	0.07	0.00	0.09	0.00	−0.73	0.46
<i>Sale</i>	3,805.84	863.98	4,050.15	730.65	0.58	0.56
<i>BMV</i>	0.53	0.40	0.53	0.45	−1.36	0.17
<i>DE</i>	1.98	1.01	2.93	0.94	1.17	0.24
<i>RET</i>	0.15	0.01	0.09	0.03	−0.58	0.56
<i>ROA</i>	0.10	0.09	0.09	0.09	1.17	0.24
<i>Std3RET</i>	0.43	0.32	0.41	0.33	−0.19	0.85
<i>Std3ROA</i>	0.03	0.02	0.03	0.02	0.19	0.85

*Total comp* equals Execucomp's TDC1, which comprises the CEO's salary, bonus, other annual compensation, total value of restricted stock granted, total value of stock options granted (using Black–Scholes), long-term incentive payouts, and all other total (in thousands of dollars). *Salary* is the dollar value of the CEO's base salary (in thousands of dollars). *Bonus* is the dollar value of bonus earned during the fiscal year (in thousands of dollars). *Fem\_dirs%* is the fraction of directors that are female. *Bdsize* represents the number of directors on the board. *Inddirs%* is the fraction of directors that are independent. *Indcompcom* is an indicator variable equal to 1 if the compensation committee is composed wholly of independent members, 0 otherwise. *CEO\_tenure* is the number of years of service of the current CEO. *CEO\_chair* is an indicator variable equal to 1 if the CEO is also the chair of the board, 0 otherwise. *CEO\_firstyear* is an indicator variable equal to 1 if it is the CEO's first year at that firm, 0 otherwise. *CEO5pct* is an indicator variable equal to 1 if the CEO owns 5% or more of the company's shares. *Sale* represents gross sales reduced by cash discounts, trade discounts, returned sales and allowances for which credit is given to customers (measured in millions of dollars). *BMV* (book to market value) is measured as total common equity divided by market value (measured in millions of dollars). *DE* equals average total liabilities divided by average total equity (in millions of dollars). *RET* is the annual stock return. *ROA* is the annual return on assets (EBIT/avgAT). *Std3RET* and *Std3ROA* represent the three year standard deviation of *RET* and *ROA* respectively.

\*\*\* Significant at 1%.

\*\* Significant at 5%.

\* Significant at 10%.

The adjusted R-squared for total compensation is 45% but increases to 50% for salary. The coefficient on *Fem\_CEO* is insignificant for all measures of compensation. This finding indicates that if firms with a male and female CEO are appropriately matched, the gender pay gap does not exist. A comparison with Table 5 indicates that fewer of the control variables attain significance. However, those controls that are significant provide results that are generally consistent with those reported in Table 5. It is notable though that board size is insignificant. This is potentially explained by this variable being used to match female and male CEO firms reducing the dispersion of the data for this variable entering the regression. Also, using the matched sample the independent compensation committee dummy variable is positive and significant for total compensation.

As an additional analysis we analyze if our results are robust to including as additional variables in regression model (1) the percentage of female directors on the board (*Femdirs%*) or an indicator variable indicating the presence of a female on the compensation committee (*Femcompcom*).<sup>10</sup> The findings from estimating this extended version of the regression model are presented in Table 7 using the propensity score matched sample.

Consistent with the findings disclosed in Table 6 we find no pay disparity between male and female CEOs. The results indicate that CEO salary is negatively associated with both the percentage of females on the board and having a compensation committee comprising one or more female directors. The indicator variable highlighting female representation on the compensation committee is also inversely related to total CEO compensation. Our results stand in contrast to those of Adams and Ferreira (2009) who report no relationship between the percentage of board members that are female and total or incentive-based CEO pay.<sup>11</sup>

<sup>10</sup> These variables are included alternatively in estimating the model due to the high degree of multicollinearity between the variables.

<sup>11</sup> Our findings are not directly comparable to the results in Adams and Ferreira (2009) as that study does not control for CEO gender in their regression models. Furthermore, their regression results are estimated on a broad sample of CEO firm years, while our results are based on a narrow sample of propensity score matched female and male CEO firm years.

**Table 5**

Pooled cross-sectional regression on total CEO sample (N = 14,759).

$$\text{Comp} = \text{Fem\_CEO} + \text{Bdsize} + \text{Inddirs\%} + \text{Indcompcom} + \text{Log(CEO\_tenure)} + \text{CEO\_chair} + \text{CEO\_firstyear} \\ + \text{CEO5pct} + \text{Log(Sale)} + \text{BMV} + \text{DE} + \text{RET} + \text{ROA} + \text{Log(Std3RET)} + \text{Log(Std3ROA)} + \text{Industry indicators} + \text{Year indicators}$$

Parameter	Total comp	Salary	Bonus (Tobit)
Intercept	4.46*** (33.11)	−545.97*** (−10.04)	−5255.49*** (−22.78)
Fem_CEO	0.09 (1.75)	64.16** (2.34)	−74.69 (−0.48)
Bdsize	1.40 (1.75)	18.61*** (5.46)	−2.91 (−0.30)
Inddirs%	0.01* (2.84)	−1.30 (−0.03)	−971.41*** (−6.10)
Indcompcom	0.28*** (0.68)	11.78 (1.02)	84.93 (1.47)
Log(CEO_tenure)	0.02 (1.55)	31.13*** (3.80)	195.62*** (6.38)
CEO_chair	0.03*** (6.30)	71.01*** (7.46)	166.92*** (3.61)
CEO_firstyear	0.11*** (2.81)	−79.44*** (−6.28)	247.91*** (2.65)
CEO5pct	−0.43*** (−7.51)	−52.64*** (−2.64)	−425.35*** (−5.41)
Log(Sale)	0.40*** (26.13)	138.31*** (22.33)	390.51*** (22.84)
BMV	−0.40*** (−12.27)	−34.05*** (−2.81)	−120.63* (−1.86)
DE	−0.00 (−0.23)	−2.71* (−1.67)	25.26*** (4.24)
RET	0.14*** (8.01)	2.89 (0.54)	310.96*** (6.56)
ROA	−0.10 (−0.62)	−185.75*** (−3.34)	625.02** (2.38)
Log(Std3RET)	0.20*** (3.91)	−5.58** (−0.34)	−77.06 (−0.78)
Log(Std3ROA)	0.80** (2.07)	191.99* (1.77)	−462.60 (−0.70)
Industry indicators	Yes	Yes	Yes
Year indicators	Yes	Yes	Yes
Adj. R-squared	.4168	.4527	
F value	293.10***	340.12***	
Sigma			2160.28***
Censored values			6,231

This table presents results of pooled cross-sectional regressions for the natural logarithm of CEO total compensation, dollar value of salary, and Tobit regression for the log of 1 + bonus. We control for firm fixed effects by clustering standard errors by firm. *Total comp* equals Execucomp's TDC1, which comprises the CEO's salary, bonus, other annual compensation, total value of restricted stock granted, total value of stock options granted (using Black–Scholes), long-term incentive payouts, and all other total (in thousands of dollars). *Salary* is the dollar value of the CEO's base salary (in thousands of dollars). *Bonus* is the dollar value of bonus earned during the fiscal year (in thousands of dollars). *Bdsize* represents the number of directors on the board. *Inddirs%* is the fraction of directors that are independent. *Indcompcom* is an indicator variable equal to 1 if the compensation committee is composed wholly of independent members, 0 otherwise. *CEO\_tenure* is the number of years of service of the current CEO. *CEO\_chair* is an indicator variable equal to 1 if the CEO is also the chair of the board, 0 otherwise. *CEO\_firstyear* is an indicator variable equal to 1 if it is the CEO's first year at that firm, 0 otherwise. *CEO5pct* is an indicator variable equal to 1 if the CEO owns 5% or more of the company's shares. *Sale* represents gross sales reduced by cash discounts, trade discounts, returned sales and allowances for which credit is given to customers (measured in millions of dollars). *BMV* (book to market value) is measured as total common equity divided by market value (measured in millions of dollars). *DE* equals average total liabilities divided by average total equity (in millions of dollars). *RET* is the annual stock return. *ROA* is the annual return on assets (EBIT/avgAT). *Std3RET* and *Std3ROA* represent the three year standard deviation of *RET* and *ROA* respectively.

\*\*\* Significant at 1%.

\*\* Significant at 5%.

\* Significant at 10%.

## 5.1. Sensitivity testing and additional analysis

### 5.1.1. Alternative matching methods

There may be doubts that the percentage of female directors on the board influences the hiring of a female CEO, hence we repeat the propensity score matching procedure using only firm size and board size to match female CEO firms to male CEO firms. Regression model (1) was then estimated using this alternate matched sample. The conclusions from the results were consistent with those shown in Table 6. We also use an alternative and less rigorous matching procedure by ranking firms based on size (*Sale*) within industry and year. We match firms with a female CEO to firms with a male CEO of the next highest rank (i.e. male



**Table 6**

Pooled cross-sectional regression on matched CEO subsample (N = 420).

$$\text{Comp} = \text{Fem\_CEO} + \text{Bdsize} + \text{Inddirs\%} + \text{Indcompcom} + \text{Log(CEO\_tenure)} + \text{CEO\_chair} + \text{CEO\_firstyear} + \text{CEO5pct} + \text{Log(Sale)} \\ + \text{BMV} + \text{DE} + \text{RET} + \text{ROA} + \text{Log(Std3RET)} + \text{Log(Std3ROA)} + \text{Industry indicators} + \text{Year indicators}$$

Parameter	Total comp	Salary	Bonus (Tobit)
Intercept	5.31*** (12.74)	−340.94*** (2.68)	−0.15 (−0.05)
Fem_CEO	0.04 (0.54)	27.75 (1.15)	0.69 (1.31)
Bdsize	0.03 (1.17)	14.50 (1.64)	−0.27 (−1.37)
Inddirs%	−0.24 (−0.65)	−50.81 (−0.45)	−3.81 (−1.58)
Indcompcom	0.25* (1.76)	−13.35 (−0.31)	−0.14 (−0.16)
Log(CEO_tenure)	0.10 (1.38)	31.05 (1.46)	−0.21 (−0.46)
CEO_chair	0.03 (0.34)	58.47** (2.01)	0.70 (1.10)
CEO_firstyear	0.01 (0.06)	−88.02 (−1.61)	0.06 (0.06)
CEO5pct	−0.46** (−2.58)	15.17 (0.28)	−3.55*** (−2.83)
Log(Sale)	0.38*** (9.38)	140.94*** (11.30)	0.01 (0.03)
BMV	−0.32*** (−3.10)	−33.26 (−1.07)	0.96 (1.39)
DE	−0.00 (−1.06)	−0.35 (−0.26)	−0.09 (−1.29)
RET	0.12* (1.69)	5.90 (0.27)	0.98** (2.11)
ROA	0.07 (0.17)	−28.25 (−0.23)	3.60 (1.65)
Log(Std3RET)	−0.03 (−0.57)	−6.82 (−0.47)	0.18 (0.56)
Log(Std3ROA)	0.06 (1.43)	4.18 (0.31)	0.02 (0.08)
Industry indicators	Yes	Yes	Yes
Year indicators	Yes	Yes	Yes
Adj R-squared	.4454	.4993	
F value	10.61***	13.40***	
Sigma			4.43***
Censored values			241

This table presents results of pooled cross-sectional regressions for the natural logarithm of CEO total compensation, dollar value of salary, and Tobit regression for the log of 1 + bonus. 210 male CEO firms are matched to 210 female CEO firms (within year and industry) using a propensity score procedure. *Total comp* equals Execucomp's TDC1, which comprises the CEO's salary, bonus, other annual compensation, total value of restricted stock granted, total value of stock options granted (using Black–Scholes), long-term incentive payouts, and all other total (in thousands of dollars). *Salary* is the dollar value of the CEO's base salary (in thousands of dollars). *Bonus* is the dollar value of bonus earned during the fiscal year (in thousands of dollars). *Bdsize* represents the number of directors on the board. *Inddirs%* is the fraction of directors that are independent. *Indcompcom* is an indicator variable equal to 1 if the compensation committee is comprised wholly of independent members, 0 otherwise. *CEO\_tenure* is the number of years of service of the current CEO. *CEO\_chair* is an indicator variable equal to 1 if the CEO is also the chair of the board, 0 otherwise. *CEO\_firstyear* is an indicator variable equal to 1 if it is the CEO's first year at that firm, 0 otherwise. *CEO5pct* is an indicator variable equal to 1 if the CEO owns 5% or more of the company's shares. *Sale* represents gross sales reduced by cash discounts, trade discounts, returned sales and allowances for which credit is given to customers (measured in millions of dollars). *BMV* (book to market value) is measured as total common equity divided by market value (measured in millions of dollars). *DE* equals average total liabilities divided by average total equity (in millions of dollars). *RET* is the annual stock return. *ROA* is the annual return on assets (EBIT/avgAT). *Std3RET* and *Std3ROA* represent the three year standard deviation of *RET* and *ROA* respectively.

\*\*\* Significant at 1%.

\*\* Significant at 5%.

\* Significant at 10%.

CEO firms will be the same or slightly larger in size). This matching procedure allows certain firm and CEO characteristics to vary between the matched firms; such as CEO tenure, stockholdings and the percentage of female directors on the board. Using this less rigorous approach results in the *Fem\_CEO* variable being positive and significant at the 5% level for total compensation and salary, but not bonus. However, no difference is reported in univariate tests of the three compensation measures. These results indicate that the matching procedures of prior research may be responsible for the erroneous conclusion that a gender gap exists in CEO pay.

**Table 7**

Pooled cross-sectional regression on matched CEO subsample (N = 420).

$$\text{Comp} = \text{Fem\_CEO} + \text{Fem\_dirs\%}(\text{or Femcompcom}) + \text{Bdsize} + \text{Inddirs\%} + \text{Indcompcom} + \text{Log}(\text{CEO\_tenure}) + \text{CEO\_chair} + \text{CEO\_firstyear} + \text{CEO5pct} \\ + \text{Log}(\text{Sale}) + \text{BMV} + \text{DE} + \text{RET} + \text{ROA} + \text{Log}(\text{Std3RET}) + \text{Log}(\text{Std3ROA}) + \text{Industry indicators} + \text{Year indicators}$$

Parameter	Total comp	Salary	Bonus (Tobit)	Total comp	Salary	Bonus (Tobit)
<i>Intercept</i>	5.32*** (12.54)	−295.63** (2.29)	−0.17 (−0.06)	5.37*** (12.90)	−310.76** (−2.45)	0.02 (0.01)
<i>Fem_CEO</i>	0.04 (0.55)	28.81 (1.20)	0.69 (1.31)	−0.01 (−0.20)	0.56 (0.02)	0.51 (0.89)
<i>Fem_dirs%</i>	−0.08 (−0.15)	−314.71** (−1.94)	0.15 (0.04)			
<i>Femcompcom</i>				−0.17* (−1.90)	−78.91*** (−2.83)	−0.52 (−0.85)
<i>Bdsize</i>	0.03 (1.17)	14.50 (1.64)	−0.27 (−1.37)	0.04 (1.43)	18.03** (2.03)	−0.25 (−1.26)
<i>Inddirs%</i>	−0.23 (−0.63)	−37.59 (−0.33)	−3.82 (−1.57)	−0.19 (−0.51)	−28.28 (−0.25)	−3.60 (−1.48)
<i>Indcompcom</i>	0.25* (1.76)	−14.48 (−0.33)	−0.14 (−0.16)	0.25* (1.78)	−12.50 (−0.29)	−0.15 (−0.17)
<i>Log(CEO_tenure)</i>	0.10 (1.38)	30.58 (1.45)	−0.21 (−0.46)	0.08 (1.18)	24.90 (1.18)	−0.26 (−0.55)
<i>CEO_chair</i>	0.03 (0.34)	57.51** (1.99)	0.70 (1.10)	0.03 (0.35)	58.84** (2.05)	0.71 (1.13)
<i>CEO_firstyear</i>	0.01 (0.06)	−88.44 (−1.62)	0.06 (0.05)	0.02 (0.10)	−84.53 (−1.56)	0.09 (0.08)
<i>CEO5pct</i>	−0.46** (−2.57)	17.87 (0.33)	−3.55*** (−2.83)	−0.45*** (−2.60)	14.69 (0.27)	−3.58*** (−2.85)
<i>Log(Sale)</i>	0.38*** (9.27)	144.94*** (11.51)	0.01 (0.02)	0.38*** (9.43)	141.27*** (11.43)	0.01 (0.05)
<i>BMV</i>	−0.31*** (−3.08)	−30.20 (−0.97)	0.95 (1.39)	−0.31*** (−3.07)	−31.68 (−1.03)	0.97 (1.42)
<i>DE</i>	−0.00 (−1.07)	−0.51 (−0.38)	−0.09 (−1.28)	−0.00 (−0.97)	−0.16 (−0.12)	−0.09 (−1.29)
<i>RET</i>	0.12* (1.68)	4.34 (0.20)	0.98** (2.11)	0.12* (1.74)	7.29 (0.34)	0.99** (2.13)
<i>ROA</i>	0.07 (0.17)	−17.53 (−0.14)	3.60 (1.34)	0.05 (0.12)	−36.29 (−0.30)	3.51 (1.31)
<i>Log(Std3RET)</i>	−0.03 (−0.58)	−7.95 (−0.55)	0.18 (0.56)	−0.02 (−0.40)	−2.98 (−0.21)	0.19 (0.62)
<i>Log(Std3ROA)</i>	0.06 (1.43)	5.01 (0.38)	0.02 (0.08)	0.06 (1.44)	4.23 (0.32)	0.03 (0.11)
<i>Industry indicators</i>	Yes	Yes	Yes	Yes	Yes	Yes
<i>Year indicators</i>	Yes	Yes	Yes	Yes	Yes	Yes
<i>Adj R-squared</i>	.4440	.5029		.4491	.5083	
<i>F value</i>	10.29***	12.77***		10.49***	13.03***	
<i>Sigma</i>			4.43***			4.43***
<i>Censored values</i>			241			241

This table presents results of pooled cross-sectional regressions for the natural logarithm of CEO total compensation, dollar value of salary, and Tobit regression for the log of 1 + bonus. 120 male CEO firms are matched to 120 female CEO firms (within year and industry) using a propensity score procedure. *Total comp* equals Execucomp's TDC1, which comprises the CEO's salary, bonus, other annual compensation, total value of restricted stock granted, total value of stock options granted (using Black–Scholes), long-term incentive payouts, and all other total (in thousands of dollars). *Salary* is the dollar value of the CEO's base salary (in thousands of dollars). *Bonus* is the dollar value of bonus earned during the fiscal year (in thousands of dollars). *Fem\_dirs%* is the fraction of directors that are female. *Femcompcom* is an indicator variable equal to 1 if a female is represented on the compensation committee. *Bdsize* represents the number of directors on the board. *Inddirs%* is the fraction of directors that are independent. *Indcompcom* is an indicator variable equal to 1 if the compensation committee is comprised wholly of independent members, 0 otherwise. *CEO\_tenure* is the number of years of service of the current CEO. *CEO\_chair* is an indicator variable equal to 1 if the CEO is also the chair of the board, 0 otherwise. *CEO\_firstyear* is an indicator variable equal to 1 if it is the CEO's first year at that firm, 0 otherwise. *CEO5pct* is an indicator variable equal to 1 if the CEO owns 5% or more of the company's shares. *Sale* represents gross sales reduced by cash discounts, trade discounts, returned sales and allowances for which credit is given to customers (measured in millions of dollars). *BMV* (book to market value) is measured as total common equity divided by market value (measured in millions of dollars). *DE* equals average total liabilities divided by average total equity (in millions of dollars). *RET* is the annual stock return. *ROA* is the annual return on assets (EBIT/avgAT). *Std3RET* and *Std3ROA* represent the three year standard deviation of RET and ROA respectively.

\*\*\* Significant at 1%.

\*\* Significant at 5%.

\* Significant at 10%.

5.1.1.1. *Alternative specifications of model (1).* Kulich et al. (2011) find that in the UK there is a higher pay for performance sensitivity for male executives than female executives. To examine if a similar relationship exists for female CEOs in the US, we introduce into regression model (1) an interaction variable between *Fem\_CEO* and both the stock return (*RET*) and accounting measure (*ROA*) of performance. These interaction variables are insignificant and the remaining results are unchanged from those

reported in Table 6. Prior studies on the relation between gender and compensation have included CEO age as a proxy for experience (Mohan and Ruggiero, 2003). CEO age is a noisy proxy for experience and should not be related to the level of CEO compensation. While it may influence the hiring of a particular CEO, the compensation thereafter should be a function of firm performance and other economic characteristics. Nevertheless, we include CEO age in our regressions as a sensitivity test. The descriptive statistics on the total sample show that on average male CEOs are significantly older than female CEOs (by 3 years); however, there is no significant difference in mean age for the propensity score matched sample. These results indicate that female CEOs are not taking longer to climb the corporate ladder as suggested in the press and in prior gender-pay literature. The results of estimating model (1) including the CEO age variable do not change for both the total sample and matched sample.<sup>12</sup>

## 6. Conclusion

A gender pay gap for executives, CEOs and other employees is a subject that attracts the attention of media, government, advocate groups and academics. This study examines whether a gender pay gap exists for US CEOs using a much larger sample than studied in prior research. Furthermore, we use propensity score matching to provide a better matched control firm for those firms employing a female CEO. Our results indicate that there is no difference in total pay, salary or bonus for female CEOs. These findings show that if women are able to climb the corporate ladder to the very top, they face no gender bias in pay. The insignificant difference in bonuses paid to CEOs across the genders is inconsistent with the suggestion, at least for CEOs, that women are risk-averse and will be reluctant to accept performance-based compensation. Our results will be of interest to regulators, academics and the wider professional community. As an extension of our study, future research may consider examining whether a gender-pay gap exists at specific executive levels below the CEO (e.g. CFO's). Furthermore, as our study is limited by the small sample of female CEO firm years, with the passage of time subsequent research can examine whether a gender pay gap exists using a longer time series of data.

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## References

- Adams, R., Ferreira, D., 2009. Women in the boardroom and their impact on governance and performance. *J. Financ. Econ.* 94, 291–309.
- Armstrong, C., Ittner, C., Larcker, D., 2010. Chief executive officer equity incentives and accounting irregularities. *J. Account. Res.* 48, 225–271.
- Bayard, K., Hellerstein, J., Neumark, D., Troske, K., 2003. New evidence on sex segregation and sex differences in wage from matched employee–employer data. *J. Labor Econ.* 21, 887–922.
- Bebchuck, L., Fried, J., Walker, D., 2002. Managerial power and rent extraction in the design of executive compensation. *Univ. Chic. Law Rev.* 69, 751–846.
- Bebchuck, L., Fried, J., 2003. Executive compensation as an agency problem. *J. Econ. Perspect.* 17, 71–92.
- Bebchuck, L., Weisbach, M., 2009. The state of corporate governance research. *Rev. Financ. Stud.* 23, 939–961.
- Bell, L., 2005. Women-led firms and the gender gap in top executive jobs. Institute for the Study of Labor Working Paper No. 1689 (Germany).
- Bertrand, M., Hallock, K., 2001. The gender gap in top corporate jobs. *Ind. Labor Relat. Rev.* 55, 3–21.
- Chalmers, K., Koh, P., Stapledon, G., 2006. The determinants of CEO compensation: rent extraction or labour demand? *Br. Account. Rev.* 38, 259–275.
- Coles, J., Daniel, N., Naveen, L., 2008. Boards: does one size fit all? *J. Financ. Econ.* 87, 329–356.
- Core, J., Holthausen, R., Larcker, D., 1999. Corporate governance, chief executive officer compensation, and firm performance. *J. Financ. Econ.* 51, 371–406.
- Elkinawy, S., Stater, M., 2011. Gender differences in executive compensation: variation with board gender compensation and time. *J. Econ. Bus.* 63, 23–45.
- Fama, E., Jensen, M., 1983. Separation of ownership and control. *J. Law Econ.* 26, 301–326.
- Grinstein, Y., Hribar, P., 2004. CEO compensation and incentives: evidence from M and A bonuses. *J. Financ. Econ.* 73, 119–143.
- Heckman, J., 1979. The sample selection bias as a specification error. *Econometrica* 47, 153–162.
- Jensen, M., 1993. The modern industrial revolution, exit, and the failure of internal control systems. *J. Finance* 48, 831–880.
- Jordan, C., Clark, S., Waldron, M., 2007. Gender bias and compensation in the executive suite of the Fortune 100. *J. Organ. Cult. Commun. Conflict* 11, 19–29.
- Kulich, C., Trojanowski, G., Ryan, M., Haslam, S., Renneboog, L., 2011. Who gets the carrot and who gets the stick? Evidence of gender disparities in executive remuneration. *Strateg. Manag. J.* 32, 301–321.
- Lennox, C., Francis, J., Wang, Z., 2012. Selection models in accounting research. *Account. Rev.* 87, 589–616.
- Li, K., Prabhala, N., 2007. Self-selection models in corporate finance (Chapter 2) In: Eckbo, B. (Ed.), *Handbook of Corporate Finance: Empirical Corporate Finance*, Volume 2. North-Holland, Oxford, pp. 37–86.
- Mohan, N., Ruggiero, J., 2003. Compensation differences between male and female CEOs for publicly traded firms: a nonparametric analysis. *J. Oper. Res. Soc.* 54, 1242–1248.
- Munoz-Bullon, F., 2010. Gender-compensation differences among high-level executives in the United States. *Ind. Relat.* 49, 346–370.
- Murphy, K., 1985. Corporate performance and managerial remuneration: an empirical analysis. *J. Account. Econ.* 7, 11–42.
- Rosenbaum, P., 2001. Observational studies: overview. In: Neil, J.S., Paul, B.B. (Eds.), *International Encyclopedia of the Social and Behavioral Sciences*. Pergamon, Oxford, pp. 10808–10815.
- Rosenbaum, P., Rubin, D., 1983. The central role of the propensity score in observational studies for causal effects. *Biometrika* 70, 41–55.
- Smith Jr., C., Watts, R., 1992. The investment opportunity set and corporate financing, dividend, and compensation policies. *J. Financ. Econ.* 32, 263–292.
- Vieito, J., Khan, W., 2012. Executive compensation and gender: S and P 1500 listed firms. *J. Econ. Finance* 36, 371–399.
- Wade, J., O'Reilly, I., Chandratat, I., 1990. Golden parachutes: CEOs and the exercise of social influence. *Adm. Sci. Q.* 35, 587–603.
- Yermack, D., 1996. Higher market valuation of companies with a small board of directors. *J. Financ. Econ.* 40, 185–211.

<sup>12</sup> For brevity sensitivity results are not reported but are available from the authors.