BOARD INDEPENDENCE AND THE GENDER PAY GAP
FOR TOP EXECUTIVES [*]

KAREN SELODY [†]

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Abstract

There is a persistent 25%-45% gender pay gap for the top five executives in U.S. publicly traded companies. I present a novel empirical approach to determine the relative importance of two possible explanations that stem from boards' pay setting behavior: taste-based discrimination, and mistake-based discrimination. I exploit the 2003 regulation that required boards to become more independent and disallowed insiders to serve on the compensation committee. Independent board members do not work alongside executives and so might indulge less in taste-based discrimination than insiders. On the other hand, independent board members have less information about executives' performance and might thus rely more on their prior, potentially biased beliefs about women's performance when they set pay. I find that the gender pay gap became 19% larger in firms that were required to convert to more independent boards compared to firms that were not, which is not consistent with taste-based discrimination, but is consistent with mistake-based discrimination. It is also consistent with reverse taste-based discrimination. However, I also find the pay gap reverted over time as independent board members learned about individual performance, and did not widen in occupations where accreditation provided an easy-to-interpret signal of ability, ruling out reverse taste-based discrimination. These results are consistent with independent board members having downward-biased beliefs about women's performance and making systematic mistakes when setting compensation.

I. Introduction

A key issue in the corporate governance literature is the optimal design of corporate boards. One feature often suggested in the literature and in practice is the presence of independent board members. Less emphasis has been placed on the potential drawbacks of independent board members: they lack intimate knowledge of the company and the performance of the executives they monitor. An important application of optimal board design is executive compensation. This paper focuses on the effect of board independence on the top-executive gender gap in compensation. The gender gap has been a persistent feature of executive compensation, ranging between 25% and 45%[1] for the top five executives in U.S. publicly traded companies. The cause of the gap has been difficult to pinpoint. Studies have identified observable differences in the characteristics of executives, such as the rare occurrence of women CEOs, that can proximately explain some of the gender pay gap (Bertrand and Hallock, 2001; Bell, 2005; Yurtoglu and Zulehner, 2007). Still, observable characteristics of executives do not go far to explain the underlying causes of the gap.

I use an original empirical approach to investigate whether characteristics of boards of directors contribute to the gender pay gap. I exploit a change in regulation in 2003 intended to improve corporate governance by making boards more independent and disallowing insiders to serve on the compensation, audit and nominating committees, which was binding for some firms and not for others. The change in the characteristics of board member from insiders to independents allows me to distinguish empirically the channels of boards' possible inefficient pay-setting behavior: (1) gender taste-based discrimination, which is a preference for working with male colleagues (or with female colleagues in the case of reverse taste-based discrimination), and (2) mistake-based discrimination, which is a biased belief about women's performance in the face of incomplete information.

Independent board members are neither employed by nor have business ties with the company, and insiders are typically executives who sit on the board. Independents should be less likely than insiders to allow a preference to work in all-male groups to influence their compensation decisions

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[1]Based on Total Compensation (TDC1 from the Execucomp database) of the top five executives in Standard and Poor's (S&P) LargeCap 500, MidCap 400 and SmallCap 600 companies, or the S&P 1500, 1992-2005. The S&P 1500 cover about 85% of the U.S. equities market.

because they do not work alongside the executives whose pay they set, and so they would be less likely to let their tastes interfere with their obligation to obtain a competitive return for shareholders. Thus increased board independence would reduce a pay gap if it stemmed from taste-based discrimination. However, independent board members do not have as much information available to them as insiders do and so may rely on their potentially biased beliefs about women's performance to set pay. Thus increased board independence would increase a pay gap if it stemmed from downward-biased beliefs about women's performance.

I develop a simple dynamic model with empirical predictions to distinguish between mistake-based discrimination and taste-based discrimination. The model has employer learning that captures the relationship between biased beliefs about women's performance and the gender pay gap (Altonji and Pierret, 2001; Ichino and Moretti, 2006). A Becker-type wedge (1971) between performance and pay captures the effect of taste-based discrimination. The model predicts that if a newly independent board corrects for taste-based or reverse discrimination, the gender pay gap will show a constant decrease or increase over time and a uniform decrease or increase across occupations. In contrast, if newly independent boards have downward-biased beliefs about women's performance, the gender pay gap will initially increase and then revert as newly independent boards learn more about individual performance. Also, when executives possess additional signals of ability, for instance accreditation, newly independent boards will rely less on potentially biased beliefs about women's performance and the initial increase in the pay gap will be less pronounced than for non-accredited executives.

I build a panel of annual data merged from the Execucomp database and the RiskMetrics database over the sample range 1998 to 2005. The Execucomp data consist of the universe of firms in the S&P 1500 and their top five (most highly paid) executives. The RiskMetrics database contains the information about members of the boards of directors that I use to construct a measure of board independence consistent with the policy event.

I test the effect of board independence on the gender gap in executive compensation by using the introduction of the 2003 NYSE/NASD Corporate Governance Listing Standards as the event that changes board independence. This regulation required boards to have a majority of independent

directors, and entirely independent nominating, compensation and audit committees. The control group consists of firms that had already complied with the regulation in 2002, and the treatment group consists of firms that did not comply with the required degree of board independence in 2002 but subsequently complied in 2003 or 2004. The event window spans 2002, before the event, and 2004, after the event, when most firms were required to comply. Using a difference-in-difference-in-differences research design, I compare the pay of men and women executives in the treatment and control firms, before and after the event.

This research methodology has some caveats. The firms in the control and treatment groups are not assigned randomly, which may result in systematic differences between the groups and confound the interpretation of the results. I confirm that the characteristics of the firms, executives and boards in the comparison groups are not significantly different across a wide array of observable characteristics (for instance, market value, number of female top executives in firms, and gender composition of the board). Also, the difference-in-difference-in-differences specification isolates the change in the pay gap between control and treatment firms so any systematic differences between comparison firms is a concern only if it affects men's and women's compensation differently.

I find the gender pay gap became 19% larger in firms that converted to more independent boards compared to firms that did not. This finding is not consistent with independent boards driving out gender taste-based discrimination. I consider two alternative explanations: (1) the widening gap is consistent with downward-biased beliefs about women's performance in the face of incomplete information, and (2) the widening gap is consistent with the new boards correcting for reverse taste-based discrimination. I test these hypotheses by estimating whether the increase in the gender pay gap reverts over time, and whether the increase in the pay gap is less pronounced in occupations that require credentials. I find the increase in the gender pay gap does revert in the years following the event and the pay gap does not widen at the time of the event in the Chief Financial Officer and Legal Counsel occupations, both of which require accreditation. These results comport with a model of employer learning with biased prior beliefs.

These results support corporate governance literature that suggests that board composition matters for corporate decisions, but not necessarily in a way that regulators had intended. For instance, Guner, Malmendier and Tate (2006) find that financial experts sitting on boards significantly influence corporate decisions, but not necessarily in a way that benefits shareholders. Minton, Taillard and Williamson (2010) find that financial expertise was related to more risk taking and better performance prior to the recent financial crisis, but worse performance at the onset of the crisis.

This paper also complements psychological and economic research showing that when assessing the ability of female senior executives, boards are informed by a smaller and shorter sample for women than for men, a pronounced and recent change in skills and labor force attachment for women, more heterogeneous and ambiguous performance measures for women than men. If boards look to gender as a signal of ability, their prior beliefs, which are evolving in the face of changing and uncertain information, might lead them initially to pay women less than their performance would merit.

In another study, (Selody, 2010), I present additional evidence of gender biases in setting executive pay. I find that negative shielding – pay that increases proportionately more in times of increasing market value than it decreases in times of decreasing market value – presents for executives overall, but women's pay is significantly more sensitive than men's to downswings in firms' value. I also find that women's pay is less responsive to "lucky" firm outcomes than men's pay. These results are not consistent with inherent gender differences in risk preferences or men's superior ability. They are consistent with gender biases when boards set executive pay.

The next section lays out a model and empirical predictions. Section III discusses the data and stylized facts and Section IV explains the event. Sections V and VI present and discuss the results. Section VII concludes.

II. MODEL AND EMPIRICAL PREDICTIONS

To distinguish two potential channels for discrimination, mistake-based and taste-based, I present a simple dynamic model where employers can learn about the performance of their employees over

time and thus have a chance to correct their mistakes (Farber and Gibbons, 1996; Altonji and Pierret, 2001; Ichino and Moretti, 2006), and also may have persistent preferences for working in all-male groups.[2]

An employer learning model of the gender pay gap

Boards set compensation for executives to maximize shareholder value by paying executives an estimate of their marginal product. A board, *b*, estimates the individual contribution executive *i* makes to company performance by relying on: (i) g_i, prior beliefs common to all boards about how easily observable characteristics such as gender, education, credentials or race relate to his productivity, and (ii) p_{it}, its beliefs about how the executive's accumulated performance observed by board *b*, is related to his productivity. At each point in time, *t*, the board weighs g_i by α_t and p_{it} by β_t, so the estimated productivity of executive *i* at time *t* is:

$$f_{it|b} = \alpha_t g_i + \beta_t p_{it|b} \tag{1}$$

For simplicity of exposition, I suppress individual variation such that *i = w* for women or *m* for men, so $f_{wt|b}$ and $f_{mt|b}$ denote the estimated productivities of the average female and male executives at time *t*. For example, if female executives perform worse than male executives on average, so $g_w < g_m$, then, all else equal, there will be a gender pay gap $f_{wt|b} - f_{mt|b} < 0$.

I decompose the priors g_w into those related to gender, g_w^*, and those related to other characteristics, g_{-w}^*, such that:

$$g_w = \gamma g_w^* + (1 - \gamma)g_{-w}^* \tag{2}$$

When *t* is small and boards are not familiar with an executive's performance, α_t is relatively large because boards estimate performance by relying more heavily on what they believe to be the distribution of *f* given their beliefs of *g*. Priors based on observables allow for statistical

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discrimination. For example, if female executives perform worse than male executives on average, so $g_w < g_m$, then, all else equal, there will be a gender pay gap $f_{wt|b} - f_{mt|b} < 0$.

Allow for the possibility of a bias h in the board's beliefs about women executives' performance. So, boards do not use g_w when they estimate a female executive's productivity, they use:

$$g'_w = \gamma(g^*_w + h) + (1 - \gamma)g^*_{-w} \tag{3}$$

Without loss of generality, consider the case where $\gamma = 1$, and thus $g^*_w = g_w$:

$$f'_{wt|b} = \alpha_t(g_w + h) + \beta_t p_{wt|b} \tag{4}$$

If $h < 0$, then before learning, boards' beliefs mistakenly underestimate women's productivity.

Over time, repeated observations of individuals' performance decrease the weight α_t relative to β_t insofar as p adds new information about productivity that displaces reliance on prior beliefs (Farber and Gibbons, 1996). Thus, as boards learn, the coefficient α_t weakly decreases, $\frac{\delta \alpha_t}{\delta t} \leq 0$, and the coefficient β_t weakly increases, $\frac{\delta \beta_t}{\delta t} \geq 0$.

The experience path depends on the correlation θ between g and p (Altonji and Pierret, 2001).

$$\frac{\delta \alpha_t}{\delta t} = -\theta \times \frac{\delta \beta_t}{\delta t}, \tag{5}$$

where $\theta > 0$ if g is positively correlated with p. Notice that equation (5) holds over time as a board learns, and also over time as an experienced board is replaced by an inexperienced one.

Estimated productivity $f_{wt|b}$, and hence compensation, changes with experience as employers learn that they have erred in their initial judgment. If there is a bias in the beliefs about a group's performance (e.g., *h<0*), then experience will diminish the importance of this bias.

The employer learning model re-expressed in terms of employer characteristics

One difficulty in identifying the source of gender pay gaps is that unobserved (by the economist) differences between men and women employees, such as ability, risk preferences and competitive drive, can be confounded with other sources of the pay gap. Examining pay during a period of discrete change in employer characteristics helps to control for unobserved differences in men and women executives since these differences will be invariant to the change in employer characteristics. The employer learning model is re-expressed in terms of the response of the pay gap to a discrete change in how much the board knows about its executives' performance. The tenure of independent board members characterizes the amount of information that the board has about executives' performance indicators. Assume that when a board becomes independent, either it does not have access to the complete performance history of executives that the insider board members had or, if it does, it does not trust fully the insiders' reporting of the history. In this instance, a newly independent board knows less about the performance of executives than the outgoing insider board. Switching to a newly independent board is equivalent to losing s periods of learning in that α_{t-s} and β_{t-s} are values that were used by the previous board s periods prior, when that board was equally inexperienced.

Assign an insider board a value of one *(b=1)* and independent board a value of zero *(b=0)*. The possibly biased pay equations for the insider and independent boards are:

$$f'_{wt|b=1} = \alpha_t g'_w + \beta_t p_{wt|b=1} \quad . \tag{6a}$$

$$f'_{wt|b=0} = \alpha_{t-s} g'_w + \beta_{t-s} p_{wt|b=0} \quad . \tag{6b}$$

The expressions for men are similar except that $f'_{mt} = f_{mt}$ as $h = 0$ for men. Since, when $\gamma = 1$, $g'_w = g_w + h$, and $\alpha_{t-s} > \alpha_t$, the increased weight on h as a result of the move to a more independent board will widen the gender pay gap.

$$\Delta(f'_{wt} - f_{mt})|_{b=1,0} = (f'_{wt} - f_{mt})|_{b=0} - (f'_{wt} - f_{mt})|_{b=1} < 0 \tag{7}$$

This leads to the following empirical prediction:

Empirical prediction 1: Employer learning with biased beliefs (mistake-based discrimination) predicts the pay gap widens when a newly independent board is put in place.

When employers base their initial estimates of performance on characteristics in addition to gender, a bias related to gender takes on less importance. Other characteristics might include occupations that require specific professional degrees or professional certification and have more objective performance measures, such as a law degree held by the firm's Legal Counsel, or a Chartered Public Accountant certificate held by the firm's Chief Financial Officer, for example. Let g_c be the boards' prior beliefs about the contribution of occupations with credentials to an executives' performance, with γ_c'' the weight given to occupations with credentials. Adding credentials to an executive's easy-to-observe characteristics:

$$g_w'' = \gamma''(g_w^* + h) + \gamma_c'' g_c^* + (1 - \gamma'' - \gamma_c'') g_{-w-c}^*. \tag{8}$$

Consider the case where, $\gamma'' + \gamma_c'' = 1$, and $0 < \gamma_c'' < 1$:

$$f_{wt|b}'' = \alpha_t(\gamma''(g_w^* + h) + \gamma_c'' g_c^*) + \beta_t p_{wt|b} \tag{9}$$

Since $|\gamma'' h| < |h|$, the increase in α_t from a change to a more independent board will have less of a negative impact on the pay gap.

$$\Delta(f_{wt}'' - f_{mt})|_{b=1,0} > \Delta(f_{wt}' - f_{mt})|_{b=1,0} \tag{10}$$

Empirical prediction 2: Employer learning with biased beliefs predicts that when an independent board is put in place, the increase in the gender pay gap will be less pronounced in occupations which require specific credentials and tend to have more objective performance measures.

If newly independent boards use gender and initially underestimate women's productivity ($h < 0$), then as they learn more about a woman's performance and accord relatively more weight to performance, the estimate of productivity will increase and the pay gap between men and women will revert. As *t* increases:

$$\Delta(f''_{wt} - f_{mt})|_{b=1,0} = (f''_{wt} - f_{mt})|_{b=0} - (f''_{wt} - f_{mt})|_{b=1} \rightarrow 0 \qquad (11)$$

Empirical prediction 3: Employer learning with biased beliefs predicts the gap that widened initially with the introduction of a new board will revert over time.

Nesting taste-based discrimination in the employer learning model

Now consider the hypothesis that executives discriminate on the basis of taste. Taste-based discrimination can be rendered in the model as a constant wedge between pay and performance (Becker, 1971) in the form of a perquisite φ. If $\varphi > 0$, insider board members prefer to work with men executives (taste-based discrimination). If $\varphi < 0$, insider board members prefer to work with women executives (reverse taste-based discrimination). The gap in compensation can be re-expressed as:

$$(\hat{f}_{wt} - \hat{f}_{mt})|_b = (f_{wt} - f_{mt} - \varphi)|_b \qquad . \qquad (12)$$

Assume that independent board members do not indulge in taste-based discrimination since they do not work directly with executives. The change in the pay gap after the change from an insider board to an independent board would be:

$$\Delta(\hat{f}_{wt} - \hat{f}_{mt})|_{b=1,0} = (f_{wt} - f_{mt})|_{b=0} - (f_{wt} - f_{mt} - \varphi)|_{b=1} \qquad (13)$$

If there is no mistake-based discrimination $(h = 0)$, then the right hand side of Equation (13) simplifies to φ.

Empirical prediction 1': Taste-based (reverse) discrimination predicts the pay gap narrows (widens) when a newly independent board is put in place.

Empirical prediction 2': Taste-based (reverse) discrimination predicts that when a newly independent board is put in place, the narrowing (widening) will be the same for all occupations, regardless of accreditation.

Empirical prediction 3': Taste-based (reverse) discrimination predicts that the change in the pay gap will be constant (constant) in the years following the event.

III. DATA AND STYLIZED FACTS

Data

I use annual Standard and Poor's Execucomp and RiskMetrics Directors Data merged by CUSIP. The merged panel data set extends from 1998 to 2005. I drop the firms whose CUSIP identifiers differ in Execucomp and RiskMetrics because of inconsistent updating practices (Table A.1 in Appendix A). I limit my sample to firms that are present from 2000 to 2005 inclusively. The degree of board independence in my sample tracks closely the full RiskMetrics sample.

Execucomp data include total compensation (TDC1) and its components, which consist of 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 compensation. Firm size and performance variables consist of market value, assets, and sales in thousands of $2004, and the number of employees.

 The director's data from RiskMetrics covers the S&P 1500 companies and comes primarily from company proxy statements DEF14A. The data provide the names of directors who sit on the board of each firm, whether a director is independent, linked (affiliated), or an employee[3] of the firm, and the committees where he or she presides (i.e. the nominating, compensation, or audit committees).

I drop observations with missing data for total compensation of the executive (9,289 observations), and with zero values for total compensation (26 observations) or salary (45 observations). I drop all executives who were ranked 6 or lower (20,649 observations) in order to have a consistent sample.

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[3] An independent director "has no significant connection with the firm." An affiliated director "provide(s) (or whose employer provides) professional services to the company or is a major customer. [Affiliated directors] also include directors who were former employees; recipients of charitable funds; interlocks; and family members of a director or executive." Directors who are employees of the firm are those who are currently employed (RiskMetrics Director's Data Manual).

My sample has 899 firms and their top five or fewer executives ranked by compensation, which totals an average of 4,405 observations per year, 20,749 observations all told. Women comprise 5.7% of the executives, or 1,172 observations.

Stylized facts

In 1992, when Execucomp began to report executives by gender, women made up 1.3% of the top five (Bertrand and Hallock, 2001). Their representation increased to 3.4% in 1997 and then to 6.0% by 2005. As more women gradually entered the executive ranks, the gender gap in executive compensation narrowed from 44% between 1992 and 1997 (Bertrand and Hallock, 2001) to 33% between 1998 and 2005 (Table I).

In the first systematic study of the gender pay gap using Execucomp data, Bertrand and Hallock (2001) find that the gender pay gap between 1992 and 1997 can be explained proximately by the lower likelihood of women holding top-paying occupations such as CEO and the lower likelihood of women working in larger firms. Re-estimating the gender gap for top five executives between 1998 and 2005, I find that firm size no longer has an important effect on the pay gap. Occupational segregation continues to account for a large portion of the gender gap. The top ranks, especially rank 1, show by far the widest gap. In other words, the more scarcely women are represented, the larger is the pay gap (Figures A.1 and A.2). In the CFO and Legal Counsel occupations[4], which require specific credentials and tend to have more objective performance measures, the gender pay gap is 9.8%, much smaller than it is for other occupations (31.7%)[5], after accounting for year and firm fixed effects.

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[4] Of women top five executives, 32.1% are CFOs or Legal Counsels. Only 20.7% of men executives hold these positions. Women CFOs outnumber women Legal Counsels by a ratio of 3:2.
[5] Found by regressing the natural log of total compensation in $2004 on gender with time dummies and firm fixed effects.

IV. THE EVENT: THE SEC CORPORATE GOVERNANCE LISTING STANDARDS

In large public companies, Boards of Directors decide the compensation for CEOs and other senior executives.[6] State corporate law allows the boards virtual carte blanche in setting compensation; only rarely will directors' approved compensation packages be overturned (Bebchuk and Hamdani, 2005).[7] Most boards delegate the responsibility for setting compensation to a committee, usually comprising three or four directors. The committee typically adopts a multi-year compensation plan for an executive that lays out the parameters for salary, bonus, and stock grants. Each year the board has the discretion to adjust the pay components within the terms of reference of the multi-year plans. Arguably, independent directors can act as objective monitors of performance and avoid potential conflicts between duty and self-interest that insider board members face (Meckling and Jensen, 1976; Fama, 1980; Fama and Jensen, 1983). But independent board members may not have access to the details of firms' operations and instead may rely on "heuristic forms of thought tied to readily observable data" (*Harvard Law Review*, 2006) when they set pay.

In the spirit of the Sarbanes-Oxley reforms, the SEC chairman announced in February 2002 that he had tasked the New York Stock Exchange (NYSE) and the National Association of Securities Dealers (NASD) to review corporate governance listing standards with the intent to mandate greater board independence and objective monitoring of management's performance (U.S. Securities and Exchange Commission, 2003). The exchanges filed a series of proposals during 2003 with the SEC for public review and the SEC approved the amended proposals for both of the exchanges on November 2003. Listed companies in both exchanges had to comply with the new standards by their first annual meeting by January 15, 2004 or October 31, 2004, whichever was earlier. The rules required that all companies listing common equity shares on their respective exchanges[8] have a

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[6] Bebchuk, Fried and Walker (2002), explain in detail the process of setting executive compensation.

[7] In most jurisdictions in the U.S., the legal duties of directors are expressed only in general terms: the duty of loyalty to the company's shareholders and the duty of care, that is, due diligence in making decisions. If directors can demonstrate that they have acted within these duties, the state courts will not challenge their business judgment regarding compensation.

[8] Classified boards had to comply by December 31, 2005 to comply. Exceptions were made for controlled companies (those who had individuals or entities holding more than 50% voting power), limited partnerships and companies in bankruptcy, management investment companies, trusts and derivatives are exempt from most of the rules except for the auditing provisions.

majority of independent directors, and entirely independent nominating, compensation, and audit committees. Those who failed to comply faced suspension or delisting. (Appendix B)

For the most part, boards did not undergo a wholesale change in members. Even so, the increase in board independence was widely characterized as a "regime change," giving newly independent boards the mandate to correct incidences of excessive pay. Even though the broad parameters of executive pay are laid out in compensation plans, boards have discretion to trim or increase pay from year to year. Discretion can be wide: the average absolute variation in top executive pay from one year to the next is over 40%.

Empirical analysis of the event

For the empirical analysis, I form control and treatment groups based on pre- and post-regulation compliance. Compliance is defined as having: a majority of independent directors, an entirely independent nominating committee and an entirely independent compensation committee. Noncompliance is defined as not satisfying these conditions of compliance. I omit the independent audit committee condition from the definition of compliance because the mandated changes to the auditing procedures of firms were set in motion earlier than the other requirements through Sarbanes-Oxley. To ensure the results are robust, I vary the compliance condition when estimating the impact of the event.

The control group consists of the firms that had complied pre-regulation by 2002. The treatment group consists of the firms that had not complied in 2002 but subsequently complied in 2003 or 2004. A structural break in compliance occurs between 2002 and 2003 when the percent of compliers jumped from 45% to 57%, making 2002 a reasonable "before" date (Figure I). Although the formal date for compliance was not until 2004, the SEC widely circulated drafts of the new rules in 2003, which explains the significant increase in compliance. Given that the window for compliance is large, I test the robustness of the results by staggering the compliance dates.

In 2002 control firms had an average of two insiders and treatment firms an average of four insiders. Between 2002 and 2004, the number of insiders in the treatment firms fell to an average of between two and three, while the average number of insiders in control firms remained the same. The

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average number of board members in control firms is 9.6 and in treatment firms is 9.7, statistically indistinguishable.

The main concern with this methodology is non-random assignment to the treatment group. Hence, systematic differences between the comparison groups might confound the interpretation of the results. In order to mitigate this concern I employ a difference-in-difference-in-differences design. My results are based on the change in the difference between men's and women's compensation as well as between control and treatment firms pre- and post-regulation. Thus, only those systematic differences between control and treatment firms that affect men's and women's compensation differently are a concern. To examine this possibility I compare the observable characteristics of the control and treatment firms (Table A.2). There are no significant differences in market value, sales, employees, assets or return on assets. I cannot reject the null hypothesis of equality of means (F=1.08). The distribution of industries in the control and treatment firms is also similar. I correct for time-unvarying unobserved differences in control and treatment firms by introducing firm fixed effects in the estimation.

The executives in the control and treatment firms are also comparable (Table A.2, bottom panel). The percentage of women in the control firms is 5.5% and in treatment firms is 5.2%, statistically indistinguishable. The percentage of women CEOs in control firms is 1.3%, a statistically insignificant difference from 1.9% in treatment firms. The mean total compensation and total compensation for men and women each are also statistically indistinguishable. The gender pay gaps in the control and treatment groups track within two percent of each other in the two years before the event (Figure II).

During the time that the SEC regulations for board independence took effect, other regulatory reforms were taking place that might also have had an effect on executive compensation, most notably, Sarbanes-Oxley (SOX). SOX required that CEOs and CFOs attest to the company's financial reports and that Legal Counsels report violations in securities regulations. This increased emphasis on proper accounting and legal practices might have increased the demand for qualified CFOs and Legal Counsels, and thus their compensation. However, there is no evidence of a shift in the total number or proportion of CFOs and Legal Counsels in the control or treatment groups

before or after the event. As Table A.2 shows, the percentage of women CFOs and Legal Counsels in control firms (8.9%) is insignificantly different from the percentage (7.2%) in treatment firms.

Boards with a strong representation of women tend to pay women executives more than boards with a weak representation (Bell, 2005). I confirm that the change between treatment and control of the number of women directors per firm and the number of women directors on the compensation committee is not statistically or economically significant (Table A.3).

V. RESULTS

Empirical specification

Recall that equation 7 from the model expresses the change in the gender pay gap as the difference in the gap before and after a board becomes more independent. This relationship can be estimated as the cross-term in a difference-in-difference-in-differences equation specification that compares compensation for executives in treatment and control firms, before and after the regulation event:

$$\ln(\text{total pay}) = \alpha + \beta_1 (\text{Post-reg}_t * \text{Treatment}_i) + \beta_2 (\text{Female}_i * \text{Treatment}_i) +$$
$$\beta_3 (\text{Female}_i * \text{Post-reg}_t * \text{Treatment}_i) + (\text{year dummies})\, \Gamma_Y + (\text{Female}_i * \text{year dummies})\, \Gamma_{FY} +$$
$$(\text{Female}_i * X_{it})\, \Gamma_{FX} + (X_{it})\, \Gamma_X + \text{firm fixed effects}$$

where ln(total pay) is the natural log of total compensation (TDC1) in $2004 for each executive.

The expression Post-reg * Treatment equals 1 after 2003 for firms that did not comply in 2002, but complied after the announcement of the change in regulation in 2003 or 2004. X is a vector of lagged control variables that account for firm performance, such as the natural log of: market value, assets, sales (all in 2004$) and the number of employees. Female * Treatment equals 1 for women in firms in the treatment group. Men's and women's compensation might not be equally sensitive to the market value, assets, sales, or number of employees of the firm, so for that reason, I interact gender with these firm performance variables. The regression includes year dummies and firm fixed effects, and the standard errors are clustered by firm. The year dummies control for trends in compensation over time. Men's and women's compensation may be following a different time

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trend, so for that reason, I include the interaction between gender and year dummies. Firm fixed effects account for whether firms are complying or not complying in 2002, so Treatment does not need to be included in the regression separately. Similarly, since there are year fixed effects the Post-reg term need not be included separately. The coefficients of interest are β_1 the effect on pay for all executives of complying with board independence regulations, and β_3, the effect on the gender gap in pay of complying with board independence regulations.

Equations are estimated for the years 2000-2005. I end the sample in 2005 because in 2006 the Financial Accounting Standards Board introduced FAS 123r "Share-Based Payments," a major change to accounting rules to make compensation disclosures more transparent. Companies were required for the first time to report in their income statements the expenses incurred from employee stock options, when they were granted, and their fair market value. The accounting change could increase the disclosure of stock options but might also cut back on their use as they came under greater scrutiny, creating a change in the composition of pay. Since this change could affect firms, and male and female executives differently, results in 2006 onward would be difficult to interpret.

The effect of greater board independence on the gender pay gap

The results are presented in Table II. Column (1) shows the effect of firm size and performance variables as well as gender on compensation without taking the event into account. The average gender gap in executive compensation is 30.4%. Predictably, the market value of the firm significantly influences the compensation of the firm's executives.

In columns (2) – (5) Female is interacted with year dummies to allow for different trends in compensation for men and women, so gender is not included in the regression separately. Column (2) estimates the effect of adopting a more independent board in compliance with the NYSE/NASD regulations on all executives' compensation. The effect is essentially zero, which is consistent with newly independent boards not correcting for "skimming."[9] The lack of evidence of a correction for skimming does not support the hypothesis that managers are using their power to

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[9] Estimates on the impact of director independence on executive compensation vary, from negative (Chhaochharia and Grinstein, 2006), to conditional on other board features (Bertrand and Mullainathan, 2001; Bebchuk and Grinstein, 2005) to positive (Hall and Murphy, 2003; Hermalin, 2005).

indulge in taste-based or reverse discrimination. If insiders had the managerial power to skim firm value to create discriminatory pay gaps, it would be surprising if they abstained from skimming for their own benefit too.

Column (3) estimates the effect of compliance on all executives, as well as on women executives in relation to all executives. The coefficient Female*Treatment is not economically or statistically significant, confirming that women's pay in the treatment and control groups are insignificantly different before the event. The coefficient on Female*Post-reg*Treatment is significant at the 95% level and negative, indicating that women executives in firms that comply have lower pay after compliance than those in the control group. The effect is also economically significant – women in the treatment group do worse than women in the control group and so the pay gap widens by 19.2%. This result contradicts the hypothesis of taste-based discrimination by male executives who were entrenched on the board before the regulation. It is consistent with either reverse taste-based discrimination or employer learning with mistake-based discrimination.

There is a more negative and more significant coefficient on Female*Post-reg*Treatment for salary plus bonus than for total compensation (-21.0%, significant at the 99% level), indicating women in treatment firms experience a hit to their cash component of pay (Table II; column (4)). This is also the component where boards have considerable discretion over changing in the short term.

To determine how much of the decline in compensation came from women leaving and entering, I restrict the sample to include only executives who were present from 2002 to 2005 (Table II; column (5)). The sample size drops from 20,749 to 12,297. The gender pay gap for salary plus bonus widens, but by slightly less than in the entire sample (-18.3%), and is statistically significant at the 90% level. Thus the widening gap does not appear to be the result of turnover.

One alternative interpretation is that male executives practice taste-based discrimination by not hiring women in the first place. If taste-based discrimination manifested before compliance as a constraint on hiring or promoting women to senior executive positions, then after compliance the number of women would likely increase. Regression estimates show that the number of women executives increases overall with time but there is no significant post-regulation increase (or

decrease) in the Treatment group (Table III; column (3)). Thus the evidence does not suggest that insider boards were engaging in taste-based discrimination through restrictive hiring practices or reverse discrimination through over-hiring.

The effect of compliance on the gender gap differs among executives depending on their occupation (Table IV). Notably, the response of the pay gap for executives who are not CFOs or Legal Counsels is significantly negative for all firms (column (2)) as well as for firms with executives present from 2002 to 2005 (column (3)), while the response of the pay gap for the executives who are CFOs and Legal Counsels is not significant (columns (5) and (6)). CFOs and Legal Counsels have jobs that have specific credentials and more easily observable measures of performance. This result is consistent with employer learning with downward-biased beliefs (Empirical prediction 2) but is not consistent with reverse-discrimination (Empirical prediction 2'). If reverse discrimination were occurring, there is no reason to expect the response in pay after the event would differ by occupation.

Mistake-based discrimination also predicts that the gap will widen after the event and subsequently narrow as independent directors gain more experience with executives' performance (Empirical prediction 3), whereas the reverse discrimination model predicts no moderation (Empirical prediction 3'). In Table V, I alter the specification to estimate the effect of Female* Post-reg*Treatment in 2004 and in 2005 separately. The gap increases in 2004 in firms that previously did not comply, but by 2005 the gap has reverted towards the control (column (1)). This pattern is the same for executives who are not CFOs and Legal Counsels (column (2)) and for the salary and bonus component of pay for all executives (column (3)).

Robustness tests

To ensure the results are invariant to the sample selection, I limit the sample to firms that had at least one woman in the top five positions – about 20% of all firms. Consistent with the results in the full sample, the impact on total compensation for all executives in these firms is not significantly different than zero, and the impact on the pay gap is negative (-15.0%) and significant. The results are also invariant to extending the sample back to 1998 (Table A.4).

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The results continue to hold when the samples are stratified by industry. In five separate samples containing the two, five and six industries with the lowest proportion of women and the five and six industries with the highest proportion of women, the increase in the pay gap stays in the 18% to 25% range (Table A.5).

I test the robustness of the timing of the event by staggering the event into those who complied in 2003, and those who complied in 2004. I find that in the group of firms that complied in 2003, the decline in pay occurred in 2003, reached its trough in 2004, and moderated the next year. In the group of companies that complied in 2004, the decline in pay reached its trough in 2004 and moderated in 2005. Thus in each instance the gap reverted after the newly independent board members gained experience (Table A.6).

Since women are under-represented in the top ranks and over-represented in the bottom ranks, I break the sample into pay ranks to make sure that the decline in pay is not skewed towards the lower ranks and thus the result of a compositional effect. I find the gender gap increases for both high ranks where women are under-represented and in low ranks where women are over-represented. The gap increases by less in middle ranks, due in large part to the presence of CFOs and Legal Counsels in these ranks. Thus, the concentration of women in the lower ranks does not appear to explain the fall in women's compensation after compliance (Table A.7).

In response to greater board independence, the gender pay gap increases in both smaller and larger firms, but by more in smaller firms. This may be because smaller firms have less formalized pay oversight than large firms. If this were the case, then the new independent board members would have more leeway in smaller firms than in larger firm to introduce their biases into the pay setting process (Table A.8).

The findings are robust to a definition of compliance that includes independent audit committees as well as the other three requirements. Adding the independent audit committee requirement had very little effect on the number of non-complying firms in 2002, probably because most firms had already complied by 2002 with the introduction of SOX. No single criterion – majority of directors,

independent compensation committee or independent nominating committee – is sufficient to significantly widen the pay gap after the SEC event.

Additional evidence

If boards have downward biased prior beliefs about women's performance, then in other situations where boards have less information about executives, the gender pay gap should be wider. To test this prediction, I track the gender pay gap for new executives as their tenure increases. Between 1999 and 2002, 2,969 men and 346 women executives were new either to the company or to the top five ranks. I calculate the mean total compensation for the executives' first, second and third years of tenure. As executives' tenure in the top jobs increases, the gender pay gap narrows (Figure III). The gender pay gap for new executives exceeded 30% in the first year of tenure. The pay gap for those same executives narrowed considerably in the second year of tenure, and continued to narrow in the third year.[10] This is consistent with boards having an initial bias that compelled them to pay unknown women less than unknown men.[11]

An additional piece of evidence reported in a related study, I determine whether boards of directors assign credit and blame differently to men and women executives for their firm's performance (Selody, 2010). I find that negative shielding – pay that increases proportionately more in times of increasing market value that it decreases in times of decreasing market value – presents for executives overall, but women's pay is significantly more sensitive than men's to downswings in firms' value. Women's pay is also less responsive to observable exogenous factors that influence firm performance, or "luck." This pattern does not appear to stem from inherent gender differences in risk preferences or ability of top executives. It is suggestive of mistake-based discrimination on the part of boards when they compare the performance of women relative to men.

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[10] A narrowing pay gap for top executives is not inconsistent with evidence of a widening pay gap for young workers in the corporate and financial sectors as their tenure increases found by Bertrand, Goldin and Katz (2009). In this instance, the widening pay gap can be traced mainly to the financial penalty that women face when they interrupt work or reduce their hours when they have children. Women who have reached the top five executive spots would, for the most part, have their childbearing years behind them.

[11] The narrowing of the gap with increased tenure might stem in part from the slightly higher leaving rates of women than men. If the lowest performing women are more likely to leave the firm, then the pay of new men and women would tend to converge. This effect does not occur in the board independence test because leaving rates are stable over the event window.

VI. DISCUSSION

The results of this study are consistent with the view that boards have biased beliefs about women's performance and make systematic mistakes when they set executive compensation. Boards' reliance on pre-existing norms can lead to the prolonged underestimation of women's performance and a persistent pay gap (Goldin, 2002). Historical studies show that the information that boards use to ascertain the abilities of women executives as a group rests on a very small sample and a very brief history. Three decades ago, information about top women executives was hard to come by because there were almost no top women executives (Bertrand and Hallock, 2001; Cappelli and Hamori, 2004). Then, in the span of thirty years, women's skills and labor force attachment changed utterly (Blau and Kahn, 2003). The ratio of women-to-men college graduates and post-graduates climbed rapidly in the 1970s and now exceeds unity. The most prestigious private universities lifted the longstanding quotas and prohibitions on women applicants[12] and women made an about turn from "female intensive" concentrations such as Education to male intensive concentrations such as Business and Management and Law (Goldin, 2004). Currently, the top women executives in the S&P 1500 are slightly more likely than men to have graduated from a private college or a top university and slightly less likely to have earned only a terminal undergraduate degree (Bell, 2005). And, having made the long climb to the top, these women of high ability tend not to self-select into less challenging jobs (Bertrand and Hallock, 2001). Even so, this recent history appends to a long and stable history of weaker skills and labor force attachment for women.

Boards might also underestimate women executives' performance because they have a harder time interpreting ability from the resumés of women than from those of men. Family responsibilities have induced women executives to seek more flexibility in the way they organize when and where they work and what path they take to the top (Hewlett and Luce, 2005), which makes their performance history unlike the traditional history of male executives. Bertrand, Goldin, and Katz (2009) find that the penalties from modest career interruptions for women who chose to have children were enormous, particularly for MBAs (Goldin and Katz, 2008). Boards often measure "leadership" ability, a requirement for senior executives, by ambiguous qualities such as "charisma,"

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[12] Yale adopted an equal access policy in 1972; Harvard in 1975. Princeton did not admit any women until 1972.

"stature," "confidence," and "vision," (Khurana, 2002) which can invite subjective comparisons that boards might not even be aware they are making (Bertrand, Chugh, and Mullainathan, 2005). Both the heterogeneity and the ambiguity of the performance measures can introduce an unintended bias in beliefs about women's abilities.

Even when men and women present the same performance indicators, boards might attribute lower competence and lower pay to a woman than a man, but that the biases are mitigated as more information on individual performance becomes available. For example, business finance students presented with identical prospectuses and CEO biographies for an imaginary initial public offering – identical except in one case the CEO was named Robert and in the other case Roberta – were willing to invest three times more in the "male" companies and rank the "women" CEOs as having less leadership experience, less ability to deal with a crisis and more likelihood to engender conflict in the management team than "men" CEOs (Bigelow and Parks, 2005). However, if boards have access to information on individual performance, gender becomes less salient and the effect of gender stereotypes on performance evaluations is mitigated (Nieva and Gutek, 1980).

Market participants tend to perceive the ability of women CEOs as lower than men. Stock markets react more negatively to the announcement of women CEOs than men, especially if the women are appointed from outside the firm (Lee and Hayes, 2007). Moreover, analysts', particularly male analysts', earnings forecast errors are systematically larger for firms led by women (Wolfers, 2007). If beliefs about women's ability were downward biased, this would suggest excess stock market returns in firms led by women. Systematically excess returns have not been found for women-led firms, however, which may simply reflect the weakness of statistical tests given the small sample of women CEOs rather than an inference about the presence or lack of biased beliefs (Wolfers, 2007).

VII. CONCLUSION

The gender gap has been a persistent feature of executive compensation, and its cause has been difficult to pinpoint. An executive's marginal product is usually unobserved and the observable characteristics of executives do not represent the underlying cause of the discrepancy in pay. In this paper I exploit an exogenous shock to the characteristics of the compensation setters, a regulation

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requiring a more independent board of directors. I investigate the causes of the gender gap in executive compensation. Because the event involves a change in employer characteristics, differences in productivity between men and women do not confound the results. Nor do differences in self-selection into the top paying jobs. I find that the gap widens after the event, consistent with mistake-based discrimination. In addition, a subsequent moderation of the effect and a smaller effect for jobs with higher information content rule out alternative explanations such as reverse taste-based discrimination.

These findings inform the choice among policies aimed at mitigating the gender gap in executive pay. Policies that encourage more distance between the boards and the executives whose pay they set, such as requiring more independent boards, do not seem to help narrow the gap, and in fact might exacerbate it. Although independent board members may be less affected by personal preferences for one gender over another, they share the same potential biases about women's ability as society as a whole. Biases coupled with less information about individual executives' performance would make independent boards initially more likely than insider boards to pay women executives less than men. More effective policies, then, might be to encourage boards to attach less importance to the pre-existing norms that could lead them to underestimate women's ability (Goldin, 2002). Boards might be encouraged to require more information from CEOs about the executives whose pay they set, to mandate more time spent reviewing executives' history and appraisals, and to monitor executives more closely. By uncovering a more complete history of performance of executives, boards could attend to the individual characteristics of the executive rather than potentially biased group characteristics.

Another way to potentially diminish the gender pay gap might be to increase the rigor and transparency of the performance measures. Implicit discrimination is more likely to occur when performance measures are ambiguous (Bertrand, Chugh, and Mullainathan, 2005). If boards were required to set out clear and quantifiable performance measures on which executives could be judged before evaluating individual executives, unconscious biases of the boards would have less opportunity to assert themselves.

Finally, any discussion about the gender pay gap for top executives cannot ignore the sheer scarcity of women executives. The same policies that improve the parity of women to men in top corporate jobs could also help diminish the pay gap. Increasing the number of women top executives would increase the exposure of boards to women's performance and thus diminish biases that boards may hold about women's ability as a group.

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TABLES

TABLE I
Executive Compensation for Men and Women
Summary Statistics, 1998-2005

Variable ($ Thousands)	Male executives				Female executives				Gender difference
	Obs.	Mean	Median	SD	Obs.	Mean	Median	SD	p-value
Total pay	38,433	3,142	1,439	7,659	2,112	2,111	1,142	4,074	0.000
Salary	38,433	463	384	288	2,112	380	324	203	0.000
Bonus	38,433	547	240	1,507	2,112	343	187	642	0.000
Options granted	38,433	346	0	1,609	2,112	270	0	1,785	0.028
Restricted stocks granted	38,433	1,481	387	6,416	2,112	923	304	2,572	0.000
Long-term incentive plan	38,433	142	0	842	2,112	75	0	346	0.000
Other annual	38,433	36	0	193	2,112	21	0	104	0.000
All other	38,433	127	17	888	2,122	99	12	1128	0.000
CEO total pay	7,967	6,135	3,195	13,234	108	4,883	2,809	6,453	0.026
CFO and Legal Counsel total pay	7,954	1,828	1,104	3,453	678	1,560	963	2,009	0.000
Total pay by industry									
Energy	1,868	3,340	1,522	6,542	53	1,413	1,094	936	0.000
Materials	2,988	1,854	1,130	2,668	92	943	763	638	0.000
Industrials	5,952	2,573	1,189	7,154	228	1,184	856	998	0.000
Consumer staples	6,955	3,078	1,492	6,653	583	1,967	1,266	2,651	0.000
Health care	2,168	3,385	1,827	4,982	144	3,127	2,306	3,040	0.175
Financials	3,892	3,328	1,766	5,724	252	2,020	1,359	2,075	0.000
Information Technology	4,975	4,159	1,810	8,000	236	2,466	1,018	3,517	0.000
Telecom	6,554	3,655	1,484	12,108	337	3,196	1,103	8,387	0.170
Services	343	7,458	4,369	10,218	32	2,858	2,424	2,806	0.000
Utilities	2,738	1,738	956	2,652	155	1,109	673	1,508	0.000

Notes: Compensation variables are in $2004 thousands. Total compensation includes salary, bonus, other annual, total value of restricted stock granted, total value of stock options granted (using Black-Scholes), long-term incentive payouts, and all other total (TDC1 in Execucomp). Other annual consists of perquisites, other personal benefits, above market earnings on restricted stock, tax reimbursements. All other annual includes severance payments, debt forgiveness, imputed interest, payments for unused vacation, signing bonuses, 401K contributions and life insurance premiums. Gender differences p-value from Welch t-test, testing difference in mean pay, by gender.

TABLE II
The Effect of Board Independence on the Gender Pay Gap

	(1)	(2)	(3)	(4)	(5) Executives in the sample 2002-2005
Dependent variable:	ln(total compensation)	ln(total compensation)	ln(total compensation)	ln(salary + bonus)	ln(salary + bonus)
Female	-0.304				
	(0.036)***				
Post-reg*Treatment		-0.003	0.008	-0.018	-0.035
		(0.028)	(0.028)	(0.021)	(0.024)
Female*Treatment			-0.037	-0.023	0.066
			(0.072)	(0.054)	(0.106)
Female*Post-reg*Treatment			-0.192	-0.210	-0.183
			(0.080)**	(0.068)***	(0.111)*
Market Value	0.350	0.349	0.348	0.068	0.060
	(0.028)***	(0.028)***	(0.028)***	(0.017)***	(0.019)***
Firm fixed effects	yes	yes	yes	yes	yes
Year dummies	yes	yes	yes	yes	yes
Female*Year dummies	no	yes	yes	yes	yes
Female*(Firm variables)	no	yes	yes	yes	yes
Observations	20,749	20,749	20,749	20,749	12,297
Adj. R-squared	0.596	0.597	0.597	0.530	0.571

Notes: Dependent variable in natural logs $2004 thousands, 2000-2005. Total compensation includes salary, bonus, other annual, total value of restricted stock granted, total value of stock options granted (using Black-Scholes), long-term incentive payouts, and all other total (TDC1 in Execucomp). All regressions include firm market value, assets, number of employees and sale, lagged and in natural logs. Robust standard errors are clustered at the firm level in parentheses.
*significant at 10%; **significant at 5%; ***significant at 1%

TABLE III
The Effect of More Independent Boards
on the Number of Female Executives, 2000-2005

Dependent variable: Number of female executives per firm

	(1)	(2)	(3)
Post-reg*Treatment			0.017
			(0.029)
Market Value	0.028	0.013	0.013
	(0.016)**	(0.019)	(0.019)
Assets	-0.043	0.003	-0.000
	(0.016)***	(0.044)	(0.041)
Number of Employees	0.019	-0.059	-0.061
	(0.013)	(0.050)	(0.047)
Time trend	0.022	0.016	0.015
	(0.004)***	(0.006)***	(0.006)**
Year dummies	yes	yes	yes
Firm Fixed Effects	no	yes	yes
Observations	4,830	4,830	4,830
R-squared	0.012	0.652	0.652

Notes: 2000-2005. Market value, assets and number of employees are lagged and in natural logs. Robust standard errors in parentheses. *significant at 10%; **significant at 5%; ***significant at 1%

TABLE IV

The Effect of Board Independence on the Gender Pay Gap, by Occupation

Dependent variable: ln(total compensation)

	Top five executives except CFOs and Legal Counsels			Top five executives who are CFOs or Legal Counsels		
	(1)	(2)	(3) Executives in the sample 2002-2005	(4)	(5)	(6) Executives in the sample 2002-2005
Female	-0.315			-0.086		
	(0.052)***			(0.048)*		
Post-reg*Treatment		0.027	0.039		-0.012	0.025
		(0.030)	(0.033)		(0.040)	(0.042)
Female*Treatment		-0.091	-0.074		-0.239	-0.135
		(0.100)	(0.209)		(0.101)**	(0.136)
Female*Post-reg*Treatment		-0.370	-0.312		0.143	0.136
		(0.099)***	(0.144)**		(0.105)	(0.140)
Market Value	0.355	0.354	0.376	0.356	0.351	0.349
	(0.052)***	(0.028)***	(0.033)***	(0.045)***	(0.045)***	(0.056)***
Firm fixed effects	yes	yes	yes	yes	yes	yes
Year dummies	yes	yes	yes	yes	yes	yes
Female*(Year dummies)	no	yes	yes	no	yes	yes
Female*(Firm variables)	no	yes	yes	no	yes	yes
Observations	16,231	16,231	9,620	4,522	4,522	2,677
Adj. R-squared	0.596	0.596	0.654	0.738	0.738	0.772

Notes: Dependent variable in natural logs, $2004 thousands, 2000-2005. Total compensation includes salary, bonus, other annual, total value of restricted stock granted, total value of stock options granted (using Black-Scholes), long-term incentive payouts, and all other total. All regressions include firm market value, assets, number of employees and sales are lagged and in natural logs. Robust standard errors are clustered at the firm level in parentheses. *significant at 10%; **significant at 5%; ***significant at 1%

TABLE V
The Effect of Boards Independence on the Gender Pay Gap
in the First and Second Years After Compliance

Dependent variable:	(1) All executives ln(total compensation)	(2) Executives who are not CFO or Legal Counsel ln(total compensation)	(3) All executives ln(salary + bonus)
Post-reg*Treatment	0.009	0.027	-0.018
	(0.028)	(0.030)	(0.021)
Female*Treatment	-0.039	-0.093	-0.022
	(0.072)	(0.100)	(0.054)
Female*Treatment*2004	-0.268	-0.477	-0.241
	(0.095)***	(0.122)***	(0.073)***
Female*Treatment*2005	-0.114	-0.260	-0.178
	(0.098)	(0.117)**	(0.090)**
Market Value	0.348	0.354	0.068
	(0.028)***	(0.028)***	(0.017)***
Firm fixed effects	yes	yes	yes
Year dummies	yes	yes	yes
Female*(Year dummies)	yes	yes	yes
Female*(Firm variables)	yes	yes	yes
Observations	20,753	16,231	20,753
Adj. R-squared	0.597	0.596	0.530

Notes: The dependent variables are in natural logs in $2004 thousands, 1999-2005. Total compensation includes salary, bonus, other annual, total value of restricted stock granted, total value of stock options granted (using Black-Scholes), long-term incentive payouts, and all other total. All regressions include market value, assets, number of employees and sales, lagged and in natural logs. Robust standard errors are clustered at the firm level in parentheses.
*significant at 10%; **significant at 5%; ***significant at 1%

FIGURE I

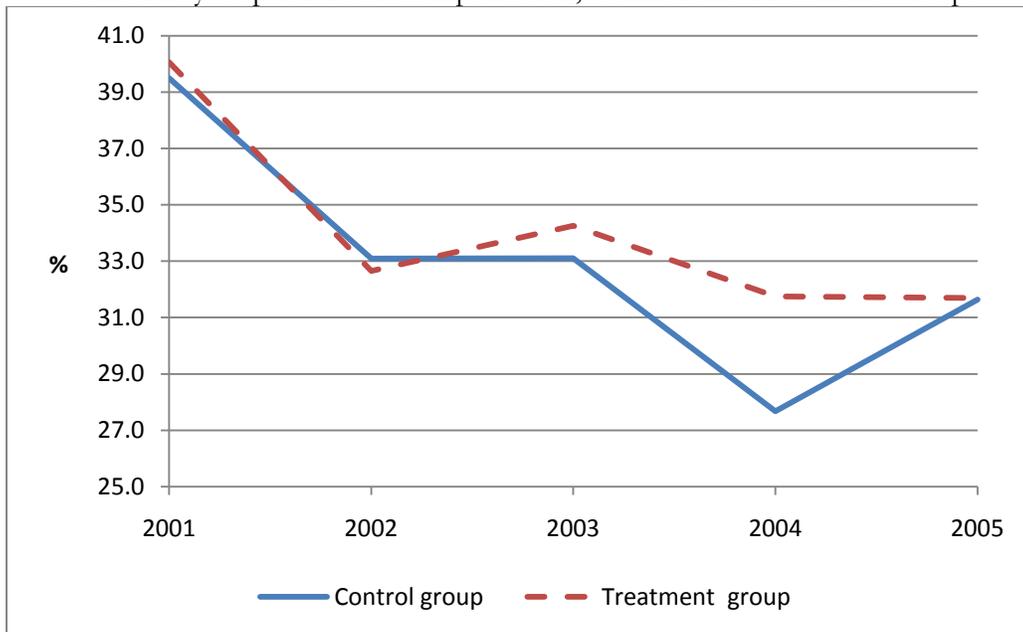The Proportion of Firms in the Merged Sample that Complied with SEC Requirements
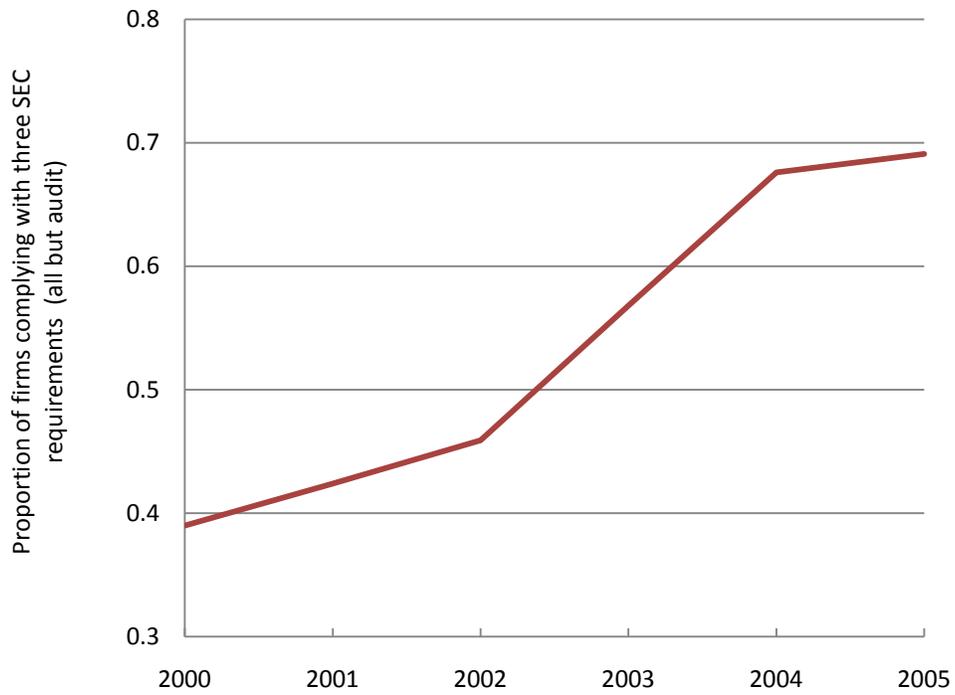
Source: Merged Execucomp and RiskMetrics databases

FIGURE II
Gender Pay Gap for Total Compensation, Control and Treatment Groups

Note: Total compensation scaled by market value. Source: Merged Execucomp and RiskMetrics databases

FIGURE III
Mean Total Compensation of New Executives by Year of Tenure
1999-2004
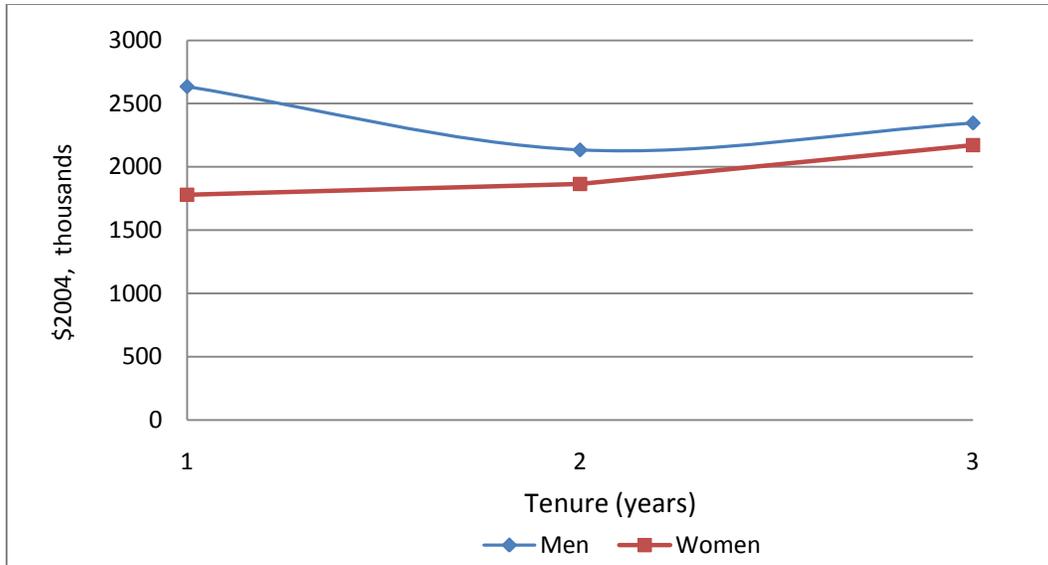
Source: Execucomp

APPENDIX A: DATA AND ADDITIONAL ROBUSTNESS CHECKS

TABLE A.1
The Number of Firms in Execucomp, RiskMetrics and the Merged Sample

Year	Number of firms in Execucomp	Number of firms in RiskMetrics	Number of firms in merged sample
1998	1,265	1,756	839
1999	1,270	1,789	894
2000	1,268	1,736	942
2001	1,272	1,769	989
2002	1,400	1,426	1,073
2003	1,409	1,455	1,143
2004	1,412	1,461	1,168
2005	1,414	1,439	1,212

Source: Execucomp and Riskmetrics merged annual data

TABLE A.2
Comparison of the Complying and Non-complying Firms in the Merged Sample

	Mean for complying firms, 2002	Mean for non-complying firms, 2002	
			P-value
Market Value (millions)	8,170.11	7,321.89	0.56
	(1,150.37)	(918.99)	
Assets (millions)	15,346.59	17,977.78	0.54
	(2,678.60)	(3,414.41)	
Sales (millions)	6213.16	5670.21	0.60
	(862.38)	(552.76)	
Employees (thousands)	25.34	21.78	0.42
	(4.03)	(1.76)	
Return on Assets	1.02	1.03	0.24
	(0.01)	(0.01)	
Mean total pay of top 5 executives (thousands)	2,946.29	2,800.19	
	(104.85)	(95.61)	0.30
Number of directors on the board	9.57	9.68	0.53
	(0.12)	(0.13)	
Proportion female executives	0.055	0.052	0.69
	(0.004)	(0.005)	
Proportion of female CEOs	0.013	0.019	0.37
	(0.004)	(0.007)	
Proportion of female CFOs and Legal Counsels	0.080	0.096	0.31
	(0.012)	(0.012)	
Mean total pay for female top 5 executives (thousands)	1,687.02	1,963.43	0.33
	(195.19)	(188.23)	
Mean total pay for male top 5 executives (thousands)	2,938.71	2,863.77	0.62
	(106.79)	(102.78)	
Number of firms	434	634	

Notes: Total pay in $2004. Standard errors in parentheses. P-test assesses equality of pair-wise means of firm variables for complying and non-complying firms.

TABLE A.3
The Effect of Board Independence
on the Number of Female Directors

Dependent variable:	(1) Number of female directors per firm	(2) Number of female directors on the compensation committee per firm
Post-reg*Treatment	-0.019	-0.011
	(0.046)	(0.039)
Time trend	0.041	0.025
	(0.007)***	(0.006)***
Year dummies	yes	yes
Firm Fixed Effects	yes	yes
Observations	4,861	4,861
Adj. R-squared	0.788	0.628

Notes: 1998-2005. Market value, assets and number of employees are lagged and in natural logs. Robust standard errors in parentheses. *significant at 10%; **significant at 5%; ***significant at 1%

The Effect of Boards Independence on the Gender Pay Gap, 1998-2005

	(1) All executives	(2) Executives who are not CFO or Legal Counsel	(3) All executives
Dependent variable:	ln(total compensation)	ln(total compensation)	ln(salary + bonus)
Post-reg*Treatment	0.022	0.043	-0.011
	(0.028)	(0.030)	(0.022)
Female*Treatment	-0.022	-0.077	-0.025
	(0.041)	(0.102)	(0.055)
Female*Post-reg*Treatment	-0.193	-0.356	-0.210
	(0.080)**	(0.098)***	(0.068)***
Market Value	0.301	0.304	0.056
	(0.025)***	(0.026)***	(0.017)***
Firm fixed effects	yes	yes	yes
Year dummies	yes	yes	yes
Female*(Year dummies)	yes	yes	yes
Female*(Firm variables)	yes	yes	yes
Observations	23,763	18,681	23,763
Adj. R-squared	0.590	0.588	0.526

Notes: The dependent variables are in natural logs in $2004 thousands, 1998-2005. Total compensation includes salary, bonus, other annual, total value of restricted stock granted, total value of stock options granted (using Black-Scholes), long-term incentive payouts, and all other total. All regressions include market value, assets, number of employees and sales, lagged and in natural logs. Robust standard errors are clustered at the firm level in parentheses.
*significant at 10%; **significant at 5%; ***significant at 1%

TABLE A.5

The Effect of Boards Independence on the Gender Pay Gap, by Industry

Dependent variable: ln(total compensation)

	With the fewest women			With the most women		
	(1)	(2)	(3)	(4)	(5)	(6)
	Bottom 2 industries	Bottom 5 industries	Bottom 6 industries	Top 2 industries	Top 5 industries	Top 6 industries
Post-reg*Treatment	0.104	0.021	0.020	-0.020	0.019	0.021
	(0.070)	(0.039)	(0.037)	(0.054)	(0.040)	(0.041)
Female*Treatment	-0.093	0.115	0.119	-0.362	-0.158	-0.208
	(0.112)	(0.109)	(0.101)	(0.132)***	(0.097)	(0.108)*
Female*Post-reg*Treatment	-0.259	-0.220	-0.190	-0.020	-0.181	-0.195
	(0.180)	(0.135)	(0.120)	(0.054)	(0.106)*	(0.115)*
Market Value	0.299	0.297	0.290	0.392	0.296	0.313
	(0.064)***	(0.033)***	(0.032)***	(0.049)***	(0.035)***	(0.038)***
Firm fixed effects	yes	yes	yes	yes	yes	yes
Year dummies	yes	yes	yes	yes	yes	yes
Female*(Year dummies)	no	yes	yes	no	yes	yes
Female*(Firm variables)	no	yes	yes	no	yes	yes
Observations	2,997	13,224	15,182	4,776	10,540	8,636
Percent women	0.029	0.041	0.042	0.078	0.068	0.070
Adj. R-squared	0.536	0.582	0.583	0.597	0.603	0.599

Notes: Dependent variable in natural logs, $2004 thousands, 1998-2005. Total compensation includes salary, bonus, other annual, total value of restricted stock granted, total value of stock options granted (using Black-Scholes), long-term incentive payouts, and all other total. All regressions include firm market value, assets, number of employees and sales are lagged and in natural logs. Firms categorized in 10 industry groups. Industries with the most women: Top 2: Consumer staples, Services; Top 4 industries: Consumer Staples, Health care, Financials, Services; Top 5 industries: Consumer Staples, Health care, Financials, Services, Utilities. Industries with the fewest women: Bottom 2: Energy, Materials; Bottom 5: Energy, Materials, Industrials, Information Technology, Telecom. Bottom 6: Energy, Materials, Industrials, Information Technology, Telecom, Utilities. Robust standard errors are clustered at the firm level in parentheses. *significant at 10%; **significant at 5%; ***significant at 1%

TABLE A.6
The Effect of Boards Independence on the Gender Pay Gap
in the First and Second Years After Compliance

Dependent variable:	(1) All executives ln(total compensation)	(2) Executives who are not CFO or Legal Counsel ln(total compensation)
Post-reg*Treatment	0.009	0.026
	(0.026)	(0.027)
Female*Treatment	-0.018	-0.046
	(0.072)	(0.098)
Y2003*(Female*Treatment, comply in 2003)	-0.182	-0.337
	(0.098)*	(0.120)***
Y2004*(Female*Treatment, comply in 2003)	-0.230	-0.385
	(0.110)**	(0.157)**
Y2005*(Female*Treatment, comply in 2003)	-0.005	-0.220
	(0.135)	(0.156)
Y2004*(Female*Treatment, comply in 2004)	-0.280	-0.507
	(0.122)**	(0.153)***
Y2005*(Female*Treatment, comply in 2004)	-0.262	-0.347
	(0.106)**	(0.138)**
Market Value	0.309	0.315
	(0.024)***	(0.025)***
Firm fixed effects	yes	yes
Year dummies	yes	yes
Female*(Year dummies)	yes	yes
Female*(Firm variables)	yes	yes
Observations	23,765	18,683
R-squared	0.590	0.588

Notes: The dependent variables are in natural logs in $2004 thousands, 1999-2005. Total compensation includes salary, bonus, other annual, total value of restricted stock granted, total value of stock options granted (using Black-Scholes), long-term incentive payouts, and all other total. All regressions include market value, assets, number of employees and sales, lagged and in natural logs. Robust standard errors are clustered at the firm level in parentheses.
*significant at 10%; **significant at 5%; ***significant at 1%

TABLE A.7

The Effect of Board Independence on the Gender Pay Gap by Rank

Dependent variable: ln(total compensation)

	Rank 1	Ranks 2 and 3	Ranks 4 and 5
Female*Treatment	-.315	.062	.029
	(.375)	(.061)	(.067)
After*Treatment	.039	.006	.047
	(.040)	(.030)	(.031)
Female*Post-reg*Treatment	-0.271	-.038	-.092
	(.226)	(.029)	(.067)
Market Value	0.357	.294	.258
	(.030)***	(.056)***	(.026)***
Firm Fixed Effects	yes	yes	yes
Year Dummies	yes	yes	yes
Female*Year Dummies	yes	yes	yes
Firm variables	yes	yes	yes
Female*Firm variables	yes	yes	yes
Observations	6294	11656	8999
R-squared	0.76	0.76	0.77

Notes: Dependent variable in natural logs $2004 thousands, 1998-2005. Total compensation includes salary, bonus, other annual, total value of restricted stock granted, total value of stock options granted (using Black-Scholes), long-term incentive payouts, and all other total (TDC1 in Execucomp). All regressions include firm market value, assets, number of employees and sale, lagged and in natural logs. Robust standard errors are clustered at the firm level in parentheses.
*significant at 10%; **significant at 5%; ***significant at 1%

TABLE A.8

The Effect of Board Independence on the Gender Pay Gap, by Firm Size

Dependent variable: ln(total compensation)

|	Standard and Poor's Large Cap			Standard and Poor's Medium Cap and Small Cap		
	(1)	(2)	(3) Executives who are not CFOs or Legal Counsels	(4)	(5)	(6) Executives who are not CFOs or Legal Counsels
Female	-0.302			-0.304		
	(0.055)***			(0.045)***		
Post-reg*Treatment		0.077	0.043		0.035	0.040
		(0.121)	(0.046)		(0.036)	(0.040)
Female*Treatment		0.001	0.072		-0.123	-0.208
		(0.044)	(0.166)		(0.088)	(0.124)*
Female*Post-reg*Treatment		-0.123	-0.238		-0.256	-0.465
		(0.120)	(0.142)*		(0.107)**	(0.142)***
Market Value	0.375	0.373	0.388	0.233	0.235	0.227
	(0.039)***	(0.039)***	(0.041)***	(0.031)***	(0.031)***	(0.031)***
Firm fixed effects	yes	yes	yes	yes	yes	yes
Year dummies	yes	yes	yes	yes	yes	yes
Female*(Year dummies)	no	yes	yes	no	yes	yes
Female*(Firm variables)	no	yes	yes	no	yes	yes
Observations	10,491	10,491	8,408	13,272	13,272	10,273
Adj. R-squared	0.429	0.429	0.425	0.429	0.431	0.438

Notes: Dependent variable in natural logs, $2004 thousands, 1998-2005. Total compensation includes salary, bonus, other annual, total value of restricted stock granted, total value of stock options granted (using Black-Scholes), long-term incentive payouts, and all other total. All regressions include firm market value, assets, number of employees and sales are lagged and in natural logs. Robust standard errors are clustered at the firm level in parentheses. *significant at 10%; **significant at 5%; ***significant at 1%

Figure A.1
The Number of Female Executives by Rank
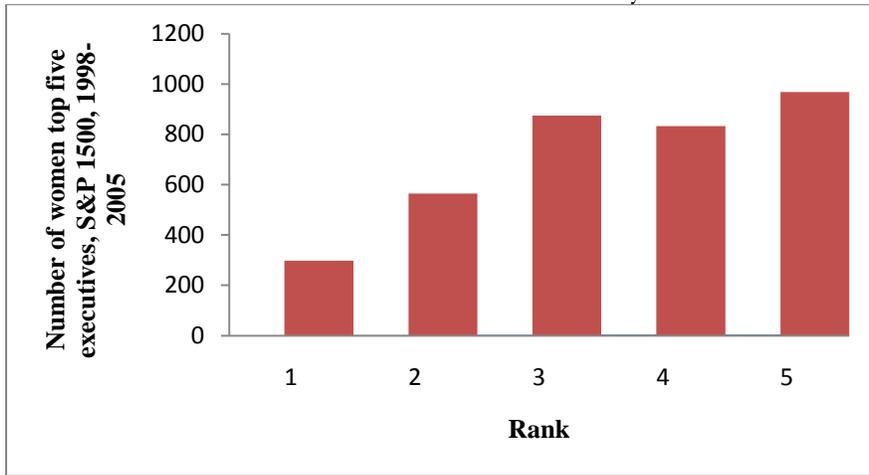
Note: Data from Execucomp database

FIGURE A.2
The Gender Gap in Executive Compensation by Rank
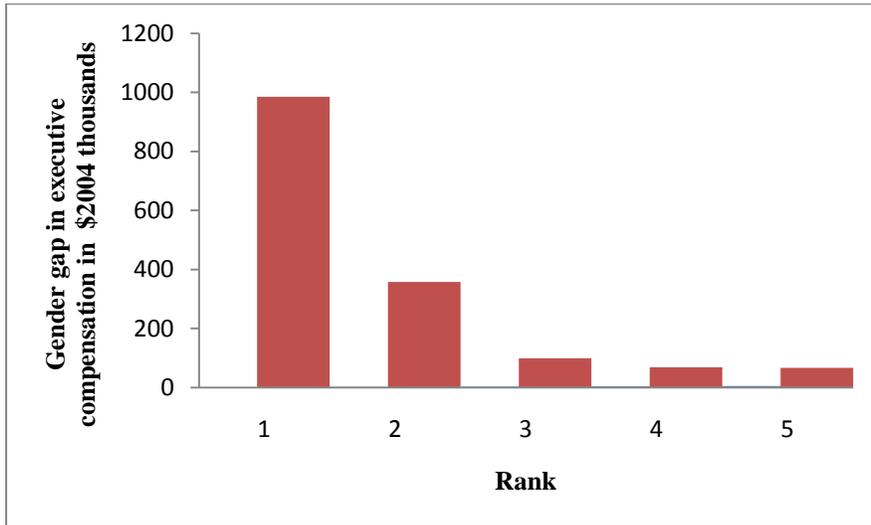
Note: Data from Execucomp database. Gender gap in total compensation (TDC1r)
2004$ thousands.

APPENDIX B: THE 2003 CHANGES TO THE NYSE/NASD LISTING STANDARDS[13]

1   Majority independent directors
- The boards of directors for each listed company must have a majority of independent directors[14] and the definition of director has been made more stringent.
- Directors must meet regularly without management. The NYSE also requires that the name of the presiding director be disclosed in annual proxy statements so that interested parties know to whom they can address their concerns.

2   Independent nominating committees
- The nominating committee must comprise wholly of independent directors.
- The committee must adopt and publish a formal charter laying out the process for identifying and nominating qualified candidates. The NYSE also requires a formal performance evaluation of the nominating committee members.
- The committee has the authority and budget to retain an independent search firm to identify potential nominees.
- Nasdaq does not stipulate that companies must have nominating committees, but does require that a majority of independent directors recommend nominees. Nasdaq also allows one non-independent director to sit on a nominating committee of three or more for a maximum of two years, if this is disclosed in the annual proxy statement.

3   Compensation Committee
- The compensation committee must comprise wholly of independent directors.
- The committee itself or with other independent directors determines CEO compensation, based on the CEO performance evaluation, and recommends senior executive compensation to the board.
- The committee must publish a charter in the annual proxy that explains
    - its purpose and responsibility as well as the evaluation process for determining CEO compensation;
    - an annual performance evaluation of the compensation committee members.
- Nasdaq rules do not require companies to have compensation committees. However, compensation decisions for the CEO and other executives must be made either by an independent compensation committee or a majority of independent directors. The CEO may be present for voting on compensation for executive officers but not for the vote of his own compensation. Nasdaq also allows one non-independent director to sit on a compensation committee of three or more for a maximum of two years, if this is disclosed in the annual proxy statement.

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13 US Securities and Exchange Commission, 2003
14 To be independent, a director must not be an employee of the firm, be related to an executive of the firm, must not have, or have a family member who has received more than $100,000 in direct compensation from the firm in the past three years, must not be affiliated with or have a family member who is affiliated with the firm in the past three years

4   Audit Committee
-   The audit committee must have at least three members and all must be independent.
-   All members must be financially literate and one member must be a financial expert.
-   A member sitting on the audit committee who sits on the committees of more than three boards must disclose the fact and explain why this does not diminish his capacity to serve.
-   Audit committees must publish a charter in annual proxies and their websites that lays out the purpose and duties of the members. An audit committee report must be published and the financial matters discussed regularly in separate meetings with independent auditors and management.
-   NYSE companies must have an internal audit function.
-   Under exceptional circumstances Nasdaq allows one non-independent member to serve on the audit committee for no more than two years.

5   Other NYSE/NASD standards
-   Shareholders must have the chance to vote on all equity compensation plans and any material revisions made to them, except when they are used as employment inducements.
-   NYSE requires that companies publish on their website and their annual proxies the corporate governance guidelines and the charters of the committees.
-   Companies must adopt a code of ethics.
-   NYSE requires that the CEO certifies each year in the annual report that he is not aware of any violation of NYSE corporate governance listing standards. The CEO must notify the NYSE in writing when he becomes aware of any violation.
-   The NYSE will issue a public reprimand letter to the company that violates the listing standards. Suspension and delisting continue to be the ultimate penalties.

6   Lead or presiding directors
-   In September 2002 the Conference Board Blue-Ribbon Commission on Public Trust and Private Enterprise made several recommendations regarding executive compensation and corporate governance. Many of these were adopted in the NYSE/NASD listing standards. The Commission also recommended that the role of management and ownership be separated either by having a Chairman who is not a CEO or by having a separate "lead director" in addition to the Chairman.
-   The NYSE standards also require a presiding director for executive non-management sessions.
-   Many companies have taken this cue and appointed a lead or presiding director. This could substantially reduce the influence of the CEO/Chairman on setting the agenda and controlling information presented to the board.