Female CEOs

Atul Gupta*
Bentley University
175 Forest Street
Waltham, MA 02452
agupta@bentley.edu

and

Kartik Raman
Bentley University
175 Forest Street
Waltham, MA 02452
kraman@bentley.edu

Abstract

We examine how the gender distribution of the board and that of the executive suite influences the firm's choice of CEO. We find that the likelihood of a female being appointed CEO increases with the number of (i) female directors and (ii) females among the five highest-paid executives. Consistent with the "critical mass" hypothesis of Moss Kanter (1977), we find a significant jump in this probability at firms with three or more women on the board. We find no gender-specific difference in the stock price reaction to news of the CEO appointment or in the post-appointment operating performance of firms.

JEL Classification: G30; G34; J71;
Keywords: Gender diversity; chief executive officer; women; board composition; critical mass; abnormal return; operating performance;

* Corresponding author. We are grateful for helpful comments from Susan Adams, Sandra Betton, Harjeet Bhabra, Dhaval Dave, Rani Hoitash, Ashwin Malshe, Toni Wolfman, and seminar participants at Bentley University and Concordia University. We are solely responsible for any errors.

Female CEOs

Abstract

We examine how the gender distribution of the board and that of the executive suite influences the firm's choice of CEO. We find that the likelihood of a female being appointed CEO increases with the number of (i) female directors and (ii) females among the five highest-paid executives. Consistent with the "critical mass" hypothesis of Moss Kanter (1977), we find a significant jump in this probability at firms with three or more women on the board. We find no gender-specific difference in the stock price reaction to news of the CEO appointment or in the post-appointment operating performance of firms.

JEL Classification: G30; G34; J71;
Keywords: Gender diversity; chief executive officer; women; board composition; critical mass; abnormal return; operating performance;

Female CEOs

"I think there is a glass ceiling. But it's glass, and glass means you can see through it and you can break through it. But it's not easy. And the reason it's not easy is because the people who are going to help you break through that glass ceiling, at least in my life, have all been men. I think the glass ceiling will go away when women help other women break through that glass ceiling. That's what is really going to make a difference."[1]

Indra K. Nooyi, Chairman and CEO, PepsiCo
The Women's Conference 2008
October 22, 2008
Longbeach, CA

1. Introduction

Less than 2 percent of chief executive officers (CEOs) at the S&P 1500 firms are women.[2] The disproportionate representation of women as CEOs is presumably due to the unavailability of qualified candidates and/or because boards are reluctant to appoint females to this position. Developing an understanding of why female CEO appointments are infrequent is clearly important, given that female directors and executives play a value-relevant role in shaping investment, financing, and governance decisions at corporations (Adams and Ferreira, 2009; Huang and Kisgen, 2012; Levi, Li, and Zhang, 2012; Schwartz-Ziv, 2012). In this study we explore this issue by examining the determinants and consequences of female CEO appointments.

We focus on three primary research questions. First, as appointments of female CEOs tend to be infrequent, do boards have identifiable characteristics that contribute systematically to these relatively unusual appointments? Economic models suggest that if boards of directors have incomplete information about the unobservable attributes of CEO candidates (e.g., core values and risk attitudes), then boards will minimize the measurement error associated with their

[1] http://2001-2009.state.gov/secretary/rm/2008/10/111186.htm
[2] Based on data in the S&P Execucomp database. Bertrand (2009) and Bertrand and Hallock (2001) document that the percentage of women among CEOs was even lower during earlier time periods.

evaluation by appointing a CEO who shares traits (e.g., sex, race, nationality, etc) that are similar to those of the board members (Cornell and Welch, 1996). If, as suggested by Adams and Funk (2012), female executives have valuable intangible traits that differ from those possessed by males, then having a more diverse board would enhance the ability of the board to detect such traits, and thereby enable better informed choices in the selection of a CEO. Thus, we test the hypothesis that female (male) CEOs are more likely to be appointed at firms with greater (smaller) representations of female directors on the board.

The above hypothesis implicitly assumes a monotonic relationship between the number of females on the board and the probability of a female being appointed CEO. This is in contrast to Moss Kanter's (1977) critical mass theory, which suggests that it is only when females represent approximately a third of the board that their influence will begin to matter. We provide evidence on this prediction of critical mass theory by documenting differences in the marginal probability of a female being appointed CEO at firms with at least three women on the board relative to firms with fewer women on the board.

Second, do firms have identifiable characteristics that influence the availability of qualified female candidates for the CEO position? The literature on executive turnover documents that when looking for a new CEO, boards display an overwhelming preference for corporate insiders over outside candidates. This empirical pattern suggests that the road to the corner office tends to run through the executive suite, so that being a member of the top management team is likely to increase the odds of a CEO appointment. Thus, we test the hypothesis that a female (male) is more likely to be appointed CEO at firms with more (fewer) women among the five highest paid executives.

Third, we examine the consequences of a woman being named CEO by focusing on (i) the equity market reaction to announcements of female CEO appointments and (ii) firm performance following such appointments. As described later in the paper, the literature suggests that investors' assessments of the leadership potential of female vis-à-vis male executives and the expected relation between CEO gender and corporate performance are not intuitively self-evident. Adams and Ferreira (2009, p.308) aptly summarize this ambiguity by stating that: "The true relation between gender diversity and firm performance appears to be more complex."

Our empirical analysis is based on a sample of 112 firms in the S&P Indices (identified using the Execucomp database) that appoint female CEOs. For each female CEO identified in Execucomp, we search the LexisNexis Academic database to obtain the date of the earliest public announcement of the appointment and the date on which the executive became CEO. The year in which the executives in our sample began their term as CEO ranges from 1987 to 2010. As we explain in more detail below, for each sample firm we identify an industry and size matched control firm that appoints a male CEO in the same fiscal year (or the closest fiscal year) during which the female CEO is appointed. We use these two samples to examine the role of gender in: CEO selection, investor expectations of CEO performance, and the post-appointment operating performance of firms.

We report several new findings. First, at firms appointing female CEOs, we find that on average, female directors constitute 15.5% of the board; the corresponding number is 9.5% for firms appointing male CEOs. Multivariate analyses indicate a significant positive relation between the likelihood of a female appointed as CEO and the number (and proportion) of female directors on the board in the fiscal year preceding the CEO appointment. This finding supports

the proposition that boards can mitigate the assessment errors arising from incomplete information about unobservable attributes of the candidates, as described in Cornell and Welch (1996), by including directors whose traits are similar to those of the candidate pool.

Second, we find that holding other independent variables at their means, the marginal impact of female directors on the probability of a female CEO appointment is different for firms with different numbers of women on the board. The results indicate that the probability of a female CEO appointment is 1.28 percent at firms with one female director on the board, and is 6.12 percent at firms with two female directors. In contrast, the marginal probability of a female CEO appointment is 24.66 percent at firms with three female directors, suggesting that the likelihood of a female CEO appointment increases dramatically when there are at least three women on the board.

These findings support the critical mass theory advanced by Moss Kanter (1977) and Rosener (1995), among others, and suggest not only that the presence of one or two female directors on the board has a token effect on the board's selection of a female CEO, but also that the presence of three female directors significantly enhances the board's ability and willingness to identify and appoint qualified female executives to the CEO position. The results add to a growing body of evidence on the importance of having gender balance in the boardroom, and on having a critical mass of three women directors in particular (e.g., Schwartz-Ziv, 2012; Konrad, Kramer, and Erkut, 2008). Moreover, the economic significance of the findings in our study lends support to recent calls by prominent CEOs for increasing female representation in boards and senior management positions.[3]

[3] *"Boards without women - blacklist those suckers. It's 2011. They've had the time - it's significant that they don't have women." -- Anne M. Mulcahy, Former CEO, Xerox Corporation, Washington Post, October 6, 2011.*

Third, holding constant the proportion of female directors on the board, we find that female CEOs are more likely to be appointed at firms with a larger number of female executives among the top 5 (based on annual compensation in the year preceding the new CEO appointment). We suggest two avenues through which the number of female executives among the top five may influence the likelihood of a female CEO appointment. First, as the abilities and achievements of these female executives are presumably known by members of the board, these executives may constitute the set of corporate executives who are potential CEO candidates. Second, having more women in the executive suite may serve as a proxy for a culture of diversity, such that the appointment of a female CEO is not a culturally extraordinary event at such firms.

Regarding the consequences of female CEO appointments, we find that the average three-day announcement period (-1 to +1) cumulative abnormal stock return (CAR) for female CEO appointments is -0.09%. This average CAR is not significantly different from the average CAR of 0.13% for firms appointing male CEOs. Moreover, these averages are not statistically significant in and of themselves. Thus, the results suggest that on average, investors do not expect the gender of the newly appointed CEO to be value-relevant. The multivariate analyses confirm that investors do not perceive female CEO appointments differently from those of male CEO appointments. The conclusions are robust with respect to concerns regarding the possibility of correlated omitted variables driving the results. Specifically, we include the Inverse Mills ratio from the CEO choice regression as an additional control variable in regressions explaining the announcement period CAR, and also estimate the announcement abnormal returns using alternate methods, and find that the conclusions are unchanged.

Our findings, based on a relatively large sample of female CEOs, are in contrast to Lee and James (2007) who report a significant negative stock price reaction of around -2.5 percent to announcements of female CEO appointments. The findings of Lee and James (2007) are consistent with prior studies which find that women leaders are more averse to competition and less effective than their male counterparts, especially in competitive environments.[4] However, our findings are generally supportive of Huang and Kisgen (2012), who find that investors respond more favorably to investment and financing decisions by firms with female top executives (CFOs and CEOs) compared to decisions at firms headed by men. Similarly, Levi, Li, and Zhang (2012) present evidence that firms with more women on the board are less acquisitive and pay smaller premiums in completed acquisitions compared to firms with more men on their boards. Wolfers (2006) reports a statistically insignificant difference between the stock returns of firms headed by female CEOs versus the returns on firms headed by male CEOs.

Finally, we compare the operating performance of firms appointing female CEOs with that of similar sized firms from the same industry that appoint male CEOs. The results, based on different measures including ROA, profit margin, ROE, and Tobin's Q, indicate no systematic differences between the operating performance of the two sets of firms following the fiscal year in which the newly appointed CEO took office. Additionally, we find that for the most part, the performance of firms during the three years prior to appointing female CEOs is not significantly different from the performance subsequent to the appointment. These results, indicating the actual performance outcomes following CEO appointments, are consistent with results on investor expectations, and suggest that firms appointing women as CEOs do not perform differently from those appointing male CEOs.

[4] Gneezy, Niederle and Rustichini, 2003; Niederle and Vesterlund, 2007; Agars, 2004; Bowen, Swim and Jacobs, 2000; Eagly and Karau, 2002; Eagly, Makhijani and Klonsky, 1992; Heilman, 2001; Schein, 2001; Eagly, Karau and Makhijani, 1995.

In sum, the analyses suggest that the degree of gender diversity in the boardroom and in the executive suite are significant determinants of the likelihood of a female CEO appointment, that female CEO appointments are not perceived by investors as actions that are likely to destroy firm value, and that there is no systematic difference in the post-appointment operating performance of firms with male versus female CEOs. Our study contributes to a growing body of research on the role of gender in corporate decisions (e.g., Bilimoria, 2006; Huang and Kisgen, 2009; Adams and Ferreira, 2009; Matsa and Miller, 2011a, 2011b; Adams and Funk, 2012; Ahern and Dittmar, 2012; Levi, Li, and Zhang, 2012, Schwartz-Ziv, 2012).

The rest of the paper proceeds as follows. In Section 2, we describe the arguments and literature driving our hypotheses. Section 3 presents a description of the procedures used to form the sample along with a description of the salient features of the sample of female CEOs. In Section 4, we discuss the results of multivariate analyses explaining the likelihood of female CEO appointments, followed in Section 5 with evidence on the consequences of female CEO appointments. We conclude the paper in Section 6.

2. Hypotheses and related literature

One of the most important tasks for corporate boards is to select a CEO. In this section, we develop a framework to examine the role of gender in CEO appointments. Specifically, we present testable hypotheses about why some firms are more likely to appoint a female CEO while others are more likely to appoint a male CEO. Given that female CEO appointments are few and far between, we also discuss the potential consequences of firms appointing female CEOs and present a hypothesis relating the gender of the newly appointed CEO to investor expectations of firm performance.

2.1. The role of gender in CEO appointments

In a labor market where employers are fully informed about the abilities and qualities of the candidates, a gender bias could only arise if employers have a pre-determined preference for one group of candidates over the other (Becker, 1957). However, if employers have incomplete information about the unobservable attributes of candidates, Cornell and Welch (1996) predict that it is rational for employers to discriminate by selecting candidates with backgrounds that are similar to those of their own, even if there is no strict preference for discrimination. A key assumption in Cornell and Welch (1996) is that job candidates have attributes that are critical for the job but are not easily observable by the potential employer. This assumption is well suited to a study of the role of gender in CEO appointments because extant research points to significant gender differences among corporate executives with respect to unobservable characteristics such as attitude toward values, risk, and overconfidence (Adams and Funk, 2012; Huang and Kisgen, 2012).[5]

In the framework of Cornell and Welch (1996), employers hire a single employee by screening from a pool of applicants. While the screening process provides signals about each candidate, employers observe an additional signal for candidates belonging to the same-group as that of the employer (based on attributes such as race, gender, etc), over and above what they observe for other-group candidates. This result implies that for instance, a board comprising of only male directors would observe additional signals about the competence of male CEO candidates, over and above what they would observe for female candidates. Thus, when choosing between male and female candidates of similar quality, boards dominated by male

[5] In particular, Adams and Funk (2012) examine the characteristics of corporate leaders using a large survey of 628 individuals (including directors and CEOs), and find that female directors emphasize self-transcendence values (universalism and benevolence) whereas male directors care more about self-achievement and power. They also find that women directors care less about security and tradition, and are slightly more risk-loving compared to male directors.

directors are likely to be less informed about the unobservable but potentially valuable traits of female candidates (as compared to those of the male candidates) and hence, are unlikely to relate certain job-specific attributes of female candidates with those of their own. Given the potentially high ex-post costs of choosing a low quality CEO, including potential losses from bad decisions by the CEO, excess perquisite consumption, and high severance costs associated with termination of poor performing CEOs (e.g., Yermack, 2006a; 2006b), the optimal choice for an all-male board would be to minimize measurement error by not appointing a female CEO.

While the informational opacity based argument in Cornell and Welch (1996) helps explain why so few women are appointed as CEOs, it also has implications for why some firms may be more likely to appoint women as CEOs. One approach that would reduce measurement error associated with the appointment of a female CEO is to have female board members. Based on their own past experiences, female directors are likely to perceive the professional experiences of female candidates quite differently from those of the male directors. Accordingly, greater representation of women on the board would increase the number of signals (and hence the accuracy of information) received by the board about a female candidate's job-specific intangible qualities, and thereby reduce the measurement error associated with the assessment of female candidates.

Gender diversity on the board may not only enhance the likelihood that potentially unobservable attributes of female candidates are considered in CEO selection but could also signal that the firm is "committed to the advancement of women at all levels" (Daily and Dalton, 2003). Consistent with this proposition, Matsa and Miller (2011a) find a strong positive relation between the number of women among the five highest-paid executives and lagged values of the proportion of female directors. The presence of females on the board may thus signal a 'female

friendly' culture, which could be an important contributor to the success of a female CEO. Creating such a culture is important, given the evidence that workers tend to prefer male supervision (Simon and Landis, 1989), and that female leaders are perceived as being less effective (Agars, 2004; Bowen, Swim and Jacobs, 2000; Eagly and Karau, 2002; Eagly, Makhijani and Klonsky, 1992; Heilman, 2001; Schein, 2001) and receive a lot more scrutiny than males (Eagly, Karau and Makhijani, 1995). The presence of a gender diverse board may make corporate employees at all levels more receptive to the idea of female leadership, increasing the likelihood that a qualified female candidate is promoted to the corner office.

Based on the above lines of reasoning, we propose that a female (male) CEO is more likely to be appointed at firms with higher (lower) proportions of female directors. The hypothesis is formally stated as:

H1: The likelihood that a female is appointed as CEO is positively related to the proportion of female directors on the board.

The arguments above suggest that the addition of a female member will change the dynamics of an all-male board and influence policy choices made by the board. In contrast, Moss Kanter (1977) argues that in "skewed" groups where one type of person is numerically dominant, members of a different type become "tokens", because "they are treated as representatives of their category, as symbols rather than individuals." Moss Kanter argues that a ratio of perhaps 65:35 represents a critical mass whereby minority members become potential allies and can "affect the culture of the group." Rosener (1995) and Shrader et al. (1997) use these ideas from Moss Kanter's critical mass theory to argue that adding one or two female

directors to a nine member board may have no impact on the group, but that having three women on such a board is likely to have a discernible impact on decision outcomes.

Two recent studies find empirical support for these arguments. In interviews with both male and female directors, Konrad, Kramer, and Erkut (2008) find that three is considered the magic number after which the views of female directors begin to have an impact. Schwartz-Ziv (2012) analyzes detailed minutes from board meetings at eleven Israeli companies. She finds that boards where at least three members of each gender were in attendance were twice as likely to request information and to take an initiative. In addition, firms with at least three female directors were more profitable.

We use the insights of critical mass theory to propose that the marginal impact of having one additional female director on the probability of a female being appointed CEO is not constant. Instead, it depends upon the number of females that are already on the board. In particular, critical mass theory suggests that (i) moving from zero to one, and one to two females on the board is not likely to have a significant impact on the probability of a female being appointed CEO, and (iii) the addition of a third female to the board is expected to yield a significant increase in this probability. The hypothesis is formally stated as:

H2: The probability that a female is appointed CEO is significantly larger at firms with three females on the board, relative to firms with two or fewer female board members.

The literature on CEO turnover documents that boards tend to look inside the firm for new leadership. Parrino (1997) for example, reports that 85% of the new CEOs in his sample are insiders; the corresponding number is 81% in Borokhovich, Parrino and Trapani (1996) and in

Huson, Malatesta and Parrino (2004). The propensity to appoint insiders as CEOs suggests that the probability of a female being appointed CEO is likely to be influenced by the availability of qualified female candidates inside the firm. Assuming that CEO candidates are likely to be members of the top management team, we propose that a female (male) CEO is more likely to be appointed at firms with a larger (smaller) number of females among the five highest paid executives. The hypothesis is formally stated as follows:

H3: The likelihood that a female is appointed as CEO is positively related to the number of females among the five highest-paid executives at the firm.

2.2. CEO gender, investor expectations, and firm performance

The role of gender in influencing performance expectations for firms appointing CEOs depends upon investor beliefs about the leadership abilities of female versus male CEOs. While there is a vast amount of research relating gender, leadership, and firm performance, collectively the literature is ambiguous about the relative efficacy of one gender versus the other in affecting corporate performance. Some studies suggest that the expectations of corporate performance at firms appointing female CEOs are likely to be downward biased, because women shy away from competition and are expected to perform worse than their male counterparts in competitive environments.[6] In addition, women appear to be less willing than men to make risky decisions on behalf of a group, suggesting an element of reluctance by women to emerge as decision-

[6] Niederle and Vesterlund, 2007; Gneezy, Niederle, and Rustichini, 2003; Gneezy and Rustichini, 2004.

makers within a group setting (Ertac and Gurdal, 2012). Further, men are also perceived as being less risk averse and appearing more overconfident than women.[7]

While differences in attributes such as risk-aversion and overconfidence may not necessarily translate into differences in corporate performance, they are likely to influence the perception of investors about the leadership abilities of the candidates. Reuben, Rey-Biel, Sapienza, and Zingales (2012) find that in competitive environments, women are selected less often (than what would be implied by their abilities) as leaders of their groups, mainly because men appear more overconfident vis-à-vis women when describing their own past performance, and hence, the group perceives women as having weaker performance records compared to men. Such gender differences in describing one's own performance are perhaps best captured by a comment from the recently appointed CEO of IBM, Virginia Rometty, as reported by Hymowitz and Frier (2011):

> *This month at Fortune magazine's Power Women Summit, Rometty said she learned shortly after beginning to work that she needed to take risks to advance.*
>
> *"Really early, early in my career, I can remember being offered a big job," she said. "Right away I said, 'You know what? I'm not ready for this job.'" That night "as I'm telling my husband about this, he just looked at me and he said,'Do you think a man would have ever answered that question that way?'" she said. "What that taught me was you have to be very confident even though you're so self-critical inside. Growth and comfort do not coexist."*

Evidence on the relation between gender diversity and corporate performance is mixed. Adams and Ferreira (2009) find that although gender-diverse boards are associated with more monitoring at firms, the effect of boardroom gender diversity on firm performance is negative on average. Lee and James (2007) report a negative average stock price reaction to public

[7] Charness and Gneezy, 2012; Sapienza, Zingales, and Maestripieri, 2009; Croson and Gneezy, 2009; Agnew, Balduzzi and Sunden, 2003; Byrnes, Miller and Schafer, 1999; Eckel and Grossman, 2002; Huang and Kisgen, 2012.

announcements of female CEO appointments, and suggest that the negative change in firm performance expected under female leadership is attributable to negative stereotyping of women and to the accordance of a 'token status' to women executives. These studies suggest that investors would expect firm performance to be worse following the appointment of a female CEO relative to that for male CEOs.

However, there is also a large stream of research pointing to the benefits of gender diversity. Extant studies suggest that women may have better overall leadership abilities than men (Eagly et al., 2003), and that diversity and differences in leadership styles can enhance the types of information available, improve information processing and overall decision making. Caliper (2005) for example, reports from personality assessments and in-depth interviews with 59 women leaders at major U.S. and British firms that women leaders are more assertive and persuasive, and are more willing to take risks than men. Adams and Funk (2012) examine 628 responses from a large survey of directors in Sweden and find that female directors are slightly more risk-loving than male directors, suggesting that women in leadership positions may have attributes that differ from the population average. Wiersema and Bantel (1992) find that diversity is associated with higher levels of creativity and innovation, and Phillips, Liljenquist and Neale (2009) show that discomfort associated with diversity can actually lead to superior decision making. Similarly, Hillman et al. (2007) argue that given the multifaceted nature of tasks faced by entities such as the board, the benefits of gender diversity outweigh the costs.

Differences in the way women lead can also have a positive impact on an organization that has traditionally followed a male-oriented culture. Female executives are more likely to display an interactive leadership style that emphasizes inclusiveness, soliciting input from others, sharing power and information, and keeping open lines of communication. This type of corporate

culture is less hierarchical, more cooperative and collaborative, and can bolster employee self-worth and performance (Rosener, 1995; Book, 2000; Eagly and Johnson, 1990; van Knippenburg et al., 2004). Female leaders focus more on mentoring and development (Eagly, Johannesen-Schmidt, and van Eagan, 2003), and their empowering and participatory leadership styles have been linked to improving intrinsic motivation and creativity (Zhang and Bartol, 2010).

While the above studies provide insights into the positive aspects of the leadership styles of female executives, a number of studies present evidence suggesting that the performance of firms with female executives is at least as good as that of firms with male executives. Dezso and Ross (2012) argue that having females in top management adds informational and social diversity, and motivates female employees in middle management; they find a significant positive relation between gender diversity in executive ranks and corporate performance at firms that are focused on innovation. Huang and Kisgen (2012) find that firms with women executives appear to make better (i.e., more value enhancing) investment and financial decisions as compared to firms with male executives. Atkinson, Baird and Frye (2003) find that the performance, risk, and other fund characteristics of fixed income funds managed by male managers do not differ significantly from those managed by female managers. Mohan and Chen (2004) find that the initial pricing and the post-issue performance of IPO firms headed by female CEOs does not significantly differ from those of IPO firms with male CEOs. Furthermore, Wolfers (2006) examines a sample of 64 female CEOs during the period from 1992 to 2004 and finds no significant difference between the returns on stocks of firms with female CEOs and those of firms with male CEOs.

In short, based on the collective set of arguments and evidence presented in the literature, it is not evident that investors would expect a difference between the performance of firms

appointing a female CEO and that of firms appointing a male CEO. Our hypothesis can be formally stated as follows:

H4: Investors do not expect firms appointing female CEOs to perform differently from firms appointing male CEOs.

3. Sample and descriptive statistics

In this section, we describe the procedure used to form the sample of firms appointing female CEOs and the sample of matched firms that appoint male CEOs. We also present a discussion of the salient features of the sample firms and their newly appointed CEOs. Variable definitions and data sources used are detailed in Appendix 2.

3.1. Sample formation

We construct the sample of female CEOs by starting with an initial sample of 125 firms identified in the Execucomp database as having female CEOs during the period from 1992 to 2010. Based on the criteria used by Execucomp, the firms in our sample were part of the S&P 1500 Index during the sample period (active, inactive, current, and previous members of the index). For each of the female CEOs, we search news articles on the Lexis Nexis Academic database to determine the date of the earliest public announcement regarding the new CEO appointment and the date on which the new CEO took office. From the news articles, we also obtain information regarding the circumstances surrounding the new CEO appointment, such as whether or not the new CEO is an insider, whether the previous CEO resigned or retired, and the age of the new CEO.

From the initial sample of 125 firms we exclude 10 firms that did not have publicly available financial statement information at the time of the CEO appointment, 1 firm that was an internal subsidiary of a parent company at the time of the appointment (and hence did not have publicly available information), and 2 firms that appointed interim CEOs (as opposed to permanent CEOs).[8] Thus, the final sample comprises of 112 public companies that appointed women as CEOs. The earliest year in our sample is 1987 when Linda Wachner became CEO of Warnaco Group Inc, whereas the last year in our sample is 2010 when women at 5 different companies began their terms as CEOs. The 112 observations in our sample are represented by 107 unique firms, with four firms appointing multiple female CEOs during the sample period.[9] While previous studies examine the financial implications of firms appointing female executives, the number of female CEOs included in the sample varies from 17 CEOs in Lee and James (2007) to 64 CEOs in Wolfers (2006). In comparison, the sample of 112 women CEOs in this study is relatively large.

In order to examine the determinants of female CEO appointments, for each sample firm we identify a matched firm that appoints a male CEO. While the details of the procedure followed to identify the matched firms are provided in Appendix 1, we note that the matched firms belong to the same industry (based on the 2-digit SIC code), are of similar size (based on total assets), and appoint a male CEO either in or around the same year in which the sample firm appoints a female CEO. The absolute value of the difference between the year of appointment of female CEOs and that of male CEOs is distributed with a mean of 3.38 years and a median of 2

[8] Advo Inc. and New England Electric System appointed interim CEOs. We include two firms (Advent Software Inc. and Zale Corp) that announced the appointment of permanent CEOs, who were previously the interim CEOs at these firms. For these firms, we use the announcement date and the effective date pertaining to the permanent CEO appointment, not the initial announcement pertaining to the interim CEO appointment.

[9] Zale Corp appointed three CEOs in different years during the sample period. The other three firms (Ann Inc, Gymboree Corp, and Xerox Corp) appointed two different CEOs during the sample period.

years (not tabulated), indicating that at least half of our sample firms are matched with control firms that appointed male CEOs within two years of the appointment of a female CEO. Moreover, as we examine the stock price reaction to news of CEO appointments, we ensure that the matched firm is not associated with a contaminating public announcement that coincides with the announcement of the new CEO appointment. If a matched firm identified in the first round of search is associated with a contaminating announcement, we identify an alternate matched firm in the next round of search.

The matching procedure results in 97 firms (representing about 86 percent of the sample) for which the matched firm is identified either in the first or the second round of the search. Out of the 112 firms in the final sample, only one firm is matched with a firm from the same one-digit SIC code, while we are able to identify a matched firm from the same 2-digit SIC code for the rest of the sample firms.

Moreover, given the requirement that the control firm belongs to the same industry and is close to the sample firm in terms of asset size, a small fraction of the control firms is matched with more than one sample firm observation. For example, our algorithm yields Pacific Sunwear California Inc. (SIC code of 5651) as the control firm for Claires Stores Inc, Ann Inc, and Wet Seal Inc, although, in each of these three cases, Pacific Sunwear is represented by a different CEO with different appointment dates. Likewise, Long's Drug Stores Corp (SIC code of 5912) is the control firm for all three of the female CEO appointments at Zale Corp (occurring in 1999, 2002, and 2006), although in this instance, the same male CEO appointment at Long's Drug Stores is the control observation. Of the 112 control firm observations in our sample, four control firms are each matched with two sample firms, and two control firms (Pacific Sunwear and Long's Drug Stores) are each matched with three sample firms. In all, the sample of 112

female CEOs is represented by 107 unique firms and is matched with male CEOs at 104 unique control firms.

3.2. Sample distribution and description of firm and board characteristics

Our data sources include Execucomp, Risk Metrics, Compustat and CRSP. In cases where a particular data item is missing, we access the 10K or proxy filing in the appropriate year to obtain the missing information. The number of observations varies across different variables because in some cases the appropriate SEC filing is simply not available.

Table 1 presents the distribution of the sample firms. Panel A indicates that the number of newly appointed female CEOs increases significantly from a total of 28 appointments between 1987 and 1999 to 84 appointments during the next decade. The female CEOs in our sample represent firms in a variety of economic sectors, with about 38 percent of the sample comprising of firms in the manufacturing, transportation, communications and electric sector, and about 22 percent representing firms in the retail trade sector (see Panel B of Table 1).

Table 2 presents summary statistics on characteristics of the sample firms and the corresponding set of matched firms for the fiscal year preceding the announcement of the CEO appointment. As is evident from Table 2, the distribution of firm characteristics across the sample firms is not significantly different from that of the matched firms. For instance, the median asset size for firms appointing female CEOs is $877 million, compared to $895 million for the matched firms appointing male CEOs. Similarly, we find that profitability (ROA), level of uncertainty (standard deviation of ROA), leverage, Tobin's Q, and the median age of the firm are very similar across firms appointing female CEOs and the sample of matched firms.

Overall, the statistics in Table 2 indicate that the sample of firms appointing female CEOs is quite similar to the matched sample of firms appointing male CEOs with respect to size, profitability, leverage, investment opportunity set and age. As such, the results in Table 2 provide a reasonable degree of confidence that the determinants of female CEO appointments are unlikely to simply reflect differences in the general characteristics of firms included in the study.

3.3. Board and CEO characteristics

In addition to firm characteristics, we present evidence on characteristics of the boards and the newly appointed CEOs of the sample firms for the fiscal year preceding the appointment of the new CEO. Panel A of Table 3 indicates that the median firm in the sample has nine directors serving on the board, and that this number is similar across the firms appointing male and female CEOs respectively. The average board size of 9.22 for our sample firms is similar to the average of 9.38 reported in Adams and Ferreira (2009) and the mean of 8.92 reported in Faleye, Hoitash, and Hoitash (2011). However the average board size in our study is smaller than the average of 12.25 reported in Yermack (1996), and larger than the average of 7.5 reported in Linck, Netter, and Yang (2008).

For our overall sample, the median proportion of female directors is 11.1 percent with a mean of 12.5 percent (in the fiscal year preceding the appointment). However, firms appointing female CEOs have a significantly higher proportion of female directors on the board. Specifically, the median percentage of female representation on the board for firms appointing a female CEO is 14.3 percent, whereas the corresponding median for firms appointing male CEOs is 10 percent. We find that both parametric as well as non-parametric tests comparing the

distributions indicate a significant difference between the proportions of female representation on the boards of firms appointing female CEOs versus that for firms appointing male CEOs.

The average proportion of female directors in our study (12.5 percent) is higher than the mean of 8.5 percent reported in Adams and Ferreira (2009). A potential explanation for this difference is that half of our overall sample comprises of firms that appoint female CEOs, and that the sample in Adams and Ferreira (2009) is likely to be heavily tilted toward firms that appoint male CEOs. Given the differences in the proportion of female directors at firms appointing male and female CEOs, as reported in Panel A of Table 3, it is not surprising that the average proportion of female directors is larger in our study.

We also find a significant difference between the distributions of the number of women among the top five executives (ranked by annual total compensation) at firms appointing women as CEOs and firms appointing male CEOs. The results in Panel A of Table 3 suggest that firms appointing women as CEOs have significantly more women among the top five (mean of 1.09) in the year preceding the CEO appointment compared to firms appointing male CEOs (mean of 0.27). However, we do not find any significant differences between the proportions of independent directors at these firms. Given that the sample firms and matched firms are otherwise similar in characteristics, as indicated by the statistics in Table 2, these results suggest that the extent to which a female-friendly culture exists in the firm is likely to be an important determinant of the likelihood of appointing a female CEO, as is the presence of female executives who are potential CEO candidates. We further examine these issues in a multivariate regression framework, as reported below.

Panel B of Table 3 presents statistics on CEO characteristics across firms appointing male and female CEOs. The results indicate that newly appointed female CEOs are slightly

younger than their male counterparts and the difference is statistically significant. Similar to the findings in Huang and Kisgen (2012), the average age for newly appointed female CEOs is 48.72 years, compared to 50.53 years for male CEOs. Both sets of firms select an insider as CEO 71% of the time, and the difference is not statistically significant. Finally, 17% (14%) of male (female) CEO appointments follow the resignation of the previous CEO; the difference between these numbers is not statistically significant.

4. Multivariate analyses of female CEO appointments

In this section, we present evidence on factors influencing the likelihood of a female being appointed to the CEO position.

4.1. The determinants of female CEO appointments

We examine the determinants of female CEO appointments using a logit regression framework. The variables are defined in Appendix 2. The dependent variable in the logit regressions takes a value of one if the newly appointed CEO is a female and zero if he is a male. The key independent variables of interest are Proportion of female directors and Number of female executives in top five by annual compensation. In addition to the inclusion of firm characteristics, we control for the characteristics of the CEO and those of the board of directors. All independent variables are measured as of the fiscal year preceding the announcement of the new CEO appointment; we use lagged values to ensure that the gender distribution of the board and the executive suite is predicting the gender of the new CEO, and not vice-versa (also see Matsa and Miller, 2011a).

To account for the possibility that certain industries like retail trade might be more inclined to appoint female CEOs, and for the fact that more female CEOs were appointed during the decade after 2000 in comparison to the number of female CEO appointments in the 1980s and 1990s, we include year and industry (1-digit SIC code) fixed effects as additional controls in one specification. Given that the research design entails a one-to-one matching of sample firms and their corresponding control firms, we include pair fixed effects in some specifications to control for the effects of unobservable factors related to the pairing of each sample firm with a specific control firm on the likelihood of a female CEO appointment. As described later, we also examine the robustness of the conclusions to the use of alternate control firms.

Our initial findings, presented in Model 1 of Table 4, indicate a positive and significant coefficient on the proportion of female directors; this result is found to hold in all the models presented in Table 4. The results are consistent with hypothesis H1, and suggest that boards that are more gender diverse are more likely to appoint female CEOs. The result is consistent with the notion that a female-friendly culture mitigates the glass ceiling by improving the extent to which management and the board is informed about the unobservable but valuable attributes of female CEO candidates.

In Model 2 of Table 4, we include the number of female executives in the top 5 by annual compensation as an independent variable in the logit model. As described earlier, this variable may also proxy for the extent to which the firm has a female friendly culture in its top management team, which may in turn impact the likelihood of a female CEO appointment. Members of the board are also likely to be familiar with these female executives, thus reducing the adverse selection problem described by Cornell and Welch (1996). Female members of the top management team may also represent a supply of potential CEO candidates, which may

influence the likelihood of the appointment of a female CEO. We therefore expect the likelihood of a female being appointed CEO to be increasing in the number of females among the five highest-paid executives.

The results in Model 2 of Table 4 indicate a positive and significant coefficient on the number of female executives among the top five highest paid executives. This finding is robust across the specifications and suggests that the likelihood of a female CEO appointment depends on the availability of qualified female candidates.

Given that the presence of both female directors on the board and females among the five highest paid executives has a positive influence on the likelihood of female CEO appointments, we examine the incremental effects of these variables in Model 3 through Model 5 of Table 4. The findings reported in these models are from the second stage of a two-stage procedure, designed to address the positive relation between the proportion of females on the board and the number of females in the set of five highest-paid executives, documented by Bilimoria (2006) and Matsa and Miller (2011a). We first regress the number of females in the top five on lagged values (i.e. values for year t=-2 relative to the CEO announcement) of the proportion of female directors; this specification includes industry (1-digit SIC code) and year fixed effects. This data series for proportion of female directors has 30 missing observations, and we backfill these with data for year t=-1; backfilling seems appropriate because board data are sticky, and the correlation between the year t=-1 and t=-2 data is 0.87. The results from the first stage regression are as follows (p-values are reported in parentheses):

(Number of female executives in top five by annual compensation)$_{t-1}$	=	*-0.199* *(0.55)*	+	*2.064 (Proportion of female directors)$_{t-2}$* *(0.00)*

We use the residual from this regression to isolate the unexplained variation in the number of females in the top five, and include this as an explanatory variable in the second stage regression shown in Model 3. The results indicate that the coefficients of both variables are positive and significant at the one percent level. These findings support our hypotheses and reinforce the notion that holding board size and other economic factors constant, both the proportion of female directors on the board and the number of females among the highest paid executives are important in influencing the likelihood of female CEO appointments.

Models 4 and 5 use the same specification as Model 3. We use these models to verify the robustness of our results with respect to the alternative fixed effects specifications, and find results that are very similar to those reported for Model 3.[10]

Among the control variables, board size has a negative coefficient and is statistically significant in two of the five models, suggesting that firms with smaller boards are more likely to appoint female CEOs. We also find a positive and significant coefficient on Ln (Total assets) in three of the five models, suggesting that all else equal, female CEOs are more likely to be appointed at larger firms. Furthermore, the negative and statistically significant coefficient for CEO age is consistent with the finding in Huang and Kisgen (2012) that female CEOs are generally younger than their male counterparts. Finally, the explanatory power of the models presented in Table 4 appears to be reasonable based on the percent of correctly predicted outcomes being consistently above 70 percent.[11]

[10] The number of observations in Model 1, Model 2, and Model 3 are smaller than in the last two models of Table 4 because some observations are dropped by the logit model due to perfect prediction of the outcomes by the pair fixed effects terms.

[11] To compute the Percent correctly predicted statistic, an observation is classified as correctly predicted if its predicted probability based on the logit model is greater than or equal to 0.5.

4.2. The marginal impact of an additional female director

In this section, we test hypothesis H2 by examining how each additional female on the board impacts the marginal probability of a female CEO appointment. Our empirical approach is to first re-estimate Model 3 in Table 4 using the number instead of the proportion of female directors. We then use this version of Model 3 as the benchmark and estimate the marginal probabilities by allowing the number of female directors to start at zero and then increase in increments of one, while holding all control variables at their mean values. As described earlier, Model 3 represents the second stage of a two-stage procedure. We modify the first stage regression slightly by replacing the proportion of female directors with two explanatory variables - the number of female directors and board size. This regression is estimated using lagged values of the number of female directors and board size, with the 30 missing observations backfilled using data for year t=-1 relative to the CEO announcement.

Estimating the models using the number instead of the proportion of female directors yields results that are qualitatively similar. The coefficients for number of female directors and board size are 0.254 and -0.067 in the first stage regression, and both variables are statistically significant at the 1 percent level. In the second stage logit regression, using a specification similar to that in Model 3, we find that the coefficients for the number of female directors and the number of female executives in the top five are both positive, and both variables continue to be statistically significant at the 1 percent level. We also re-estimate Models 4 and 5 using this alternate specification and find similar results.

We modify the methodology used to estimate marginal probabilities to allow for the use of a matched sample of CEO appointments, because the proportion of sample firms with female CEOs overstates the true proportion of such firms in the population (i.e. in Execucomp). In

particular, since the occurrence of female CEOs is larger in our sample than it would be in a random sample of CEOs, the maximum likelihood estimate of the logit regression intercept is biased, although the slope coefficients are not affected (Cosslett, 1981; Manski and McFadden, 1981; Palepu, 1986; Shivdasani, 1993; King and Zeng, 2001). Following the approach in Shivdasani (1993), we correct for the bias in the intercept as follows:

$$\beta_0 = \widehat{\beta_0} - \left[ln\left({}^{n_1}/_{N_1}\right) - ln\left({}^{n_2}/_{N_2}\right)\right]$$

where $\widehat{\beta_0}$ is the estimated intercept from the logit regression, β_0 is the bias-corrected intercept, n_1 is the number of female CEO appointments in the sample (112), n_2 is the number of male CEO appointments in the sample (112), N_1 is the number of female CEO appointments in the population (125), and N_2 is the number of male CEO appointments in the population (6427).[12] Intuitively, the estimated intercept from the logit regression is corrected for the extent by which firms appointing female CEOs are over-sampled relative to firms appointing male CEOs.

We then compute the marginal probability of a female CEO appointment at different values of the number of female directors, holding other independent variables in the logit regression at their respective means. Specifically, the marginal probability, π, is computed as:

$$\pi = \frac{1}{1 + e^{-(\beta_0 + X\beta')}}$$

where, β_0 is the corrected intercept from above, X is the vector of independent variables, and β' is the vector of corresponding coefficients. The marginal probabilities presented in Table 5 are based on the coefficients from Model 3 in Table 4, with the number instead of the proportion of female directors as one explanatory variable, using the procedure described above.

As seen in Table 5 and Figure 1, the probability of a female being appointed CEO is almost zero at firms with all-male boards. The probability increases with the addition of one or

[12] The number of male and female CEO appointments in the population is based on data in Execucomp.

two females to the board, but the changes are quite small; the probability of a female being appointed CEO is 1.28% at firms with one female on the board and 6.12% with two female board members. These findings are consistent with Moss Kanter's (1977) theory of tokenism and decision outcomes in skewed groups, whereby "…even if there are two tokens in a skewed group, it is difficult for them to generate an alliance that can become powerful in a group (Moss Kanter, 1977, pp. 966)."

The addition of a third female to the board results in a significant increase in the probability of a female being appointed CEO, from 6.12% to 24.66%. This sharp increase in the marginal probability indicates that the incremental impact of adding one additional female to the board is not constant; in particular, the addition of a third female member has a dramatic impact on the CEO-selection decision before the board of directors. This result is consistent with the arguments in Moss Kanter (1977), whereby a ratio of 65:35 tilts the 'tokens' within the group towards a minority status such that the minority members are able to form coalitions and affect the culture of the group.[13] In the framework of Cornell and Welch (1996), one explanation for the significant increase in the marginal probability at firms with three female directors is that these directors perhaps have a stronger collective voice in the boardroom, and hence are able to help the board overcome the potential information problems associated with the unobservable attributes of the female candidates. Finally, the marginal probability of a female being appointed CEO increases to 62.16% for firms with four females on the board; there are however, only five firms in our sample that have four female directors, and all of these appointed female CEOs.

Our findings on Moss Kanter's critical mass hypothesis are consistent with some recent studies suggesting that the presence of at least three female directors on the board has a material impact on corporate decisions. Schwartz-Ziv (2012) finds that boards with a critical mass of at

[13] The median board size in our sample is nine, and three female members imply a male to female ratio of 67:33.

least three women directors are more active in monitoring; in particular, she finds that these boards are more likely to seek information and take action based on such information, in comparison to boards with fewer than three women on the board. Similarly, based on interviews of 50 women directors, Konrad, Kramer, and Erkut (2008) find that it takes at least three women on the board to effect fundamental changes in the boardroom. Our study contributes to this growing stream of research on gender balance in the boardroom by suggesting that the critical mass required on the board to have an impact on the appointment of a female CEO is at least three female directors.

4.3. Robustness checks using a larger set of control firms

We examine the robustness of the results from the logistic regressions presented in Table 4 by using a larger sample of control firms rather than a single control firm for each sample firm that appointed a female CEO. We identify the alternate set of control firms as follows. For each sample firm appointing a female CEO, we identify all firms in the Execucomp database that appoint a male CEO in the same year as that of the female CEO appointment and that belong to the same 2-digit SIC code (or 1-digit SIC code if no control firms exist at the 2-digit level) as that of the sample firm. We find that of the 112 sample firms, 99 have a matched set of control firms at the two-digit SIC code level, and the remaining 13 sample firms are matched with control firms at the one-digit level, with both sets of control firms having the same year of the CEO appointment as that of the sample firm. This procedure results in an initial control sample of 1,032 male CEO appointments. While this approach does not incorporate firm size as a criterion to identify control firms, we control for differences in firm size by including the log of total assets as a control variable in the multivariate tests.

In the next step, we obtain firm characteristics for the control firms from Compustat, for the fiscal year prior to the year in which the male executive became CEO. In addition, we obtain board characteristics including the number of female directors, the number of independent directors, and board size from Risk Metrics. Lastly, we obtain the number of female executives among the top five highest paid (by annual compensation) from Execucomp. For this alternate set of control firms, we do not include CEO characteristics at the time of the appointment (CEO age, Insider CEO, Prior CEO resigned) as these variables require hand collected data from public announcements of the CEO appointment, and because the main analysis suggests that the conclusions are unchanged with or without the inclusion of these CEO characteristics as additional control variables in the regression.

We repeat the analysis reported in Model 4 and Model 5 of Table 4 using this alternate set of control firms. To be consistent with the specification in Table 4, we conduct a first stage OLS regression (using this larger set of control firms and the sample firms) of Number of female executives in the top five by annual compensation on the one-year lagged value of Proportion of female directors, and include year and industry (one-digit SIC) fixed effects. The coefficient of the lagged Proportion of female directors in this first stage regression is positive and significant at the one percent level, similar to the findings reported earlier in the context of the specification in Table 4. We use the residual from this regression as the proxy for Number of female executives in the top five by annual compensation in the second stage logit regression.

The requirement of non-missing values for all variables used in the analysis yields 610 observations for the logit regressions.[14] While we do not tabulate the results from these robustness checks for the sake of brevity, our primary finding in this section is that the

[14] A majority of firm-years for the control sample that drop out of the analysis are not in the Risk Metrics database in the fiscal year preceding the year in which the male executive became CEO. The Risk Metrics database begins coverage in 1996.

conclusions reported above regarding the likelihood of female CEO appointments are unchanged. Controlling for firm and board characteristics, using the equivalent of Model 4 of Table 4, we find a positive and significant coefficient on Proportion of female directors (coefficient of 5.746 with a p-value of 0.00), and also on Number of female executives in top five by annual compensation (coefficient of 1.375 with a p-value of 0.00). We also find that the coefficient of the proportion of independent directors is positive and significant, with a p-value of 0.04. These results are generally consistent with the findings of Matsa and Miller (2011a), and confirm our earlier finding that both the presence of female board members and the availability of qualified females in the executive suite are independently associated with the likelihood of female CEO appointments. Finally, the conclusions are robust when we use the year and industry fixed effects terms. The coefficients of both the key independent variables in the logit regression are positive and significant at the one percent level when fixed effects are included in the regression.

5. Consequences of female CEO appointments

In this section, we examine whether and how the gender of the newly appointed CEO influences the (i) stock market reaction at the announcement, and (ii) the operating performance of firms following the CEO appointment.

5.1. Abnormal stock returns around female CEO appointments

Table 6 presents the distribution of abnormal stock returns at the announcement of the new CEO appointment. The abnormal returns are measured using the market-adjusted approach, with the return on the CRSP value-weighted index serving as the proxy for market returns.

The results indicate that abnormal returns for the full sample of CEO succession announcements are not significantly different from zero. In addition, we find that the mean abnormal return (for the -1,+1 event window) for firms appointing female CEOs (-0.09%) is not significantly different from that for firms appointing male CEOs (0.13%). Moreover, as shown in Table 6, the p-values from the non-parametric Wilcoxon rank-sum test confirm that the distribution of returns for the two groups of firms is statistically indistinguishable. While the literature on price reactions to CEO appointments finds mixed results (see Warner et al., 1988; Borokhovich et al., 1996; Huson et al., 2004), our findings suggest that the CEO's gender does not matter to investors' assessment of expected firm performance under the new CEO.[15]

These results are in contrast to the significant negative stock price reaction to announcements of female CEO appointments reported in Lee and James (2007). For a sample of 17 female CEO appointments, Lee and James report a statistically significant mean three-day (-1,+1) abnormal return of -2.47%. They also report that the negative average abnormal return for female CEO appointments is significantly different from the small negative mean abnormal return (-0.50%) for male CEO appointments. Lee and James interpret their findings as indicating that investors have a downward bias regarding the competence of women appointed as CEOs.

[15] Four firms do not have public announcements of the CEO appointment. As a result, these four observations are excluded from the event study. Four firms have missing returns and hence, have missing abnormal returns. In addition, one firm had the announcement of the CEO appointment on September 18, 2001. As this event was very close to the September 11, 2001 tragedy, which had a significant impact on the entire market, we exclude this observation from the event study analysis. However, we note that including this observation does not change our conclusions. Furthermore, given the small population of firms appointing female CEOs, we include 29 sample firms that appoint a female CEO and have contemporaneous announcements (such as earnings or dividends) coinciding with the announcement of the CEO appointment. However, we verify that excluding these observations does not change our conclusions on the abnormal returns for female versus male CEO appointments. For instance, the mean (median) three-day CAR for the 74 firms that appoint female CEOs and have no other contemporaneous announcement is 0.05% (-0.02%), which is very similar to the results reported in the study. Also, we repeat the analyses using the market model approach and find that the results are qualitatively similar to those reported in the study and that the conclusions are unchanged using this alternative method to compute abnormal returns. For the market-model approach, we use the CRSP value-weighted index as a proxy for the market index and estimate beta using the 255 trading-day window ending 46 days before the announcement date (day 0). We require a minimum of three days for the estimation window.

However, using a larger sample of observations (103 female CEO appointments), we find that investors do not expect the performance of firms appointing female CEOs to differ from that of firms appointing male CEOs.

We further examine the role of CEO gender in explaining the stock price response to the announcement of the appointment using a multivariate regression framework. The regressions control for firm, CEO and board characteristics, and include a dummy variable, Female, that takes a value of 1 if the CEO is a female and is zero otherwise. The results, presented in Table 7, indicate that controlling for other factors, the coefficient of Female is statistically insignificant with the three-day (-1,+1) abnormal return as the dependent variable. Among the control variables, we find a significant negative coefficient on Tobin's Q, suggesting that the change in CEO is value-enhancing for firms that were poorly managed. Collectively, the results in Table 6 and Table 7 suggest that investors do not expect firms appointing female CEOs to perform any differently from firms appointing male CEOs.[16] These findings are inconsistent with the implications of prior studies that question the ability of women executives to be successful corporate leaders.

5.2. Operating performance following female CEO appointments

In this section we present evidence on the operating performance of firms following the appointment of female CEOs, and compare the results with the performance of firms following the appointment of male CEOs.

[16] The results in Model 3 of Table 7 are from the second stage of a two stage regression, where the first stage is the same as for Models 3 through 5 of Table 4. We also repeat the regression analysis explaining the abnormal returns by including the Inverse Mills ratio from a probit regression with specifications similar to those reported in Table 4. Regardless of the specification used to estimate the Inverse Mills ratio, we find no evidence of a significant relation between the gender of the newly appointed CEO and the announcement abnormal return using specifications reported in Table 7. Thus, our conclusion that investors do not perceive female CEOs as being less effective than male CEOs is robust with respect to concerns regarding endogeneity arising from omitted variables.

Table 8 presents the sample medians for various measures of firm performance during the years surrounding the appointment of the new CEO. In this analysis, year zero corresponds to the fiscal year in which the new CEO began her/his term. Panel A of Table 8 presents the medians for firms appointing female CEOs, whereas Panel B presents the medians for firms appointing male CEOs. In Panel C of Table 8, for each year, we present the p-values from the Wilcoxon rank-sum test comparing the distributions of the variables reported in Panel A with those reported in Panel B.

The results in Panel A of Table 8 indicate a slight improvement in performance from year 0 to year +3 for firms appointing female CEOs. For instance, the median ROA improves from 11.75% in year 0 to 13% in year +3. Likewise, the profit margin also improves from 3.94% to 4.40% during the same event window. Moreover, we find that Tobin's Q is relatively unchanged from year 0 to year +3. Collectively, these results suggest that firm performance does not decline following the appointment of female CEOs.

The results in Panel B indicate a similar pattern for the matched firms that appoint a male CEO. The results indicate that firm performance does not change significantly following the appointment of the new CEO. Furthermore, we find that for the most part, the p-values in Panel C are almost uniformly greater than 0.10, indicating that the performance of firms that appoint female CEOs is largely similar to those appointing male CEOs. The patterns described above are summarized in Figure 2 (showing ROA) and Figure 3 (showing Tobin's Q), indicating no significant difference between the performance of the two sets of firms. These results are consistent with the earlier results on abnormal stock returns at the announcement of the new CEO appointment.

In Panel D of Table 8 we present findings from statistical tests for pre- versus post-appointment changes in operating performance. Our tests reveal no systematic differences in performance for firms appointing either male or female CEOs. For instance, among firms appointing female CEOs, although the median ROA is smaller following the appointment, the post-appointment medians for ROE, Profit margin, and Tobin's Q are not significantly different from the pre-appointment levels. Similarly, while firms appointing female CEOs have a significantly larger pre-appointment profit margin than firms appointing male CEOs, there is no significant difference among these firms in ROA, ROE or Tobin's Q. Taken as a whole, our findings on the consequences of female CEO appointments indicate that there are no discernible gender-based differences in performance expectations for new CEOs, and that post-appointment operating performance is comparable for firms run by male versus female CEOs.

6. Conclusions

In this paper we focus on S&P 1500 firms that have appointed female CEOs, and ask three broad questions. First, are there identifiable differences between the boards of directors of firms that appoint female vs. male CEOs? We focus in particular on the degree of gender diversity of the board, and document a positive relation between the likelihood of a female being appointed to the CEO position and the proportion of females on the board. We interpret this finding as suggesting that the appointment of females to the board brings, among other things, valuable gender-specific insights that make it easier for directors to assess and evaluate the performance potential of female executives.

Probing further, we find that the positive influence of female directors on the likelihood of a female CEO appointment depends on the number of women on the board. Specifically, we

find that at firms with zero or one female on the board the probability of a female being appointed CEO is negligible; this probability rises to 6.12 percent at firms with two female directors. However, the probability of a female CEO appointment rises substantially to 24.66 percent at firms with three female directors. These findings are consistent with the ideas of "tokenism" and "critical mass" proposed by Moss Kanter (1977), in the context of the board's decision to appoint female versus male CEOs.

Second, are there identifiable firm characteristics that influence the availability of qualified female candidates for the CEO position? Controlling for the proportion of women on the board, we find a positive relation between the likelihood of a female CEO appointment and the number of women among the five highest paid executives at the firm. This result suggests that the appointment of females to the CEO position depends on the culture of gender diversity at the firm and on the number of women represented in the potential supply of CEO candidates at the firm.

We also ask whether the gender of the new CEO affects firm performance. We find that announcements of female CEO appointments are associated with insignificant average abnormal stock returns, but so are announcements of male CEO appointments. We find no significant difference between the abnormal stock returns associated with announcements of female CEO appointments and those for male CEO appointments. These findings contrast the evidence of a significant negative stock price reaction to announcements of female CEO appointments reported in the literature. Furthermore, consistent with our results on stock returns, using multiple measures of firm performance, we find that the performance of firms appointing female CEOs is similar to that of firms appointing male CEOs for a period of three years following the new CEO

appointment. Collectively, the results suggest that firms led by female CEOs perform just as well as firms led by male CEOs.

In recent decades female executives have made slow progress up the corporate hierarchy, but they remain heavily under-represented in both boardrooms and executive suites at U.S. corporations. This slow progress is surprising, considering the evidence that females have excellent leadership qualities (Eagly et al. 2003), are less overconfident and often make better financial decisions that their male counterparts (Huang and Kisgen, 2012, Levi, Li and Zhang, 2012)), can bring new and valuable strategic insights to the table (Adams and Funk, 2012, Hillman et al. 2007), and can provide valuable monitoring at firms with poor governance (Adams and Ferreira, 2009). The results in our study suggest that the lack of gender diversity in corporate boardrooms and in top management might be one reason for the disproportionately low number of women CEOs. In this respect, the empirical evidence in our study supports calls by prominent female corporate leaders, such as Indra Nooyi of PepsiCo and Anne Mulcahy of Xerox Corporation, to increase the representation of women in the boardroom. More specifically, our findings support the seminal prediction of Moss Kanter (1977) that a lone woman on a corporate board is likely to be considered a token and have little influence on board practice, and that a critical mass of 35 percent (translating into at least three female directors on a nine-member board) is necessary to effect meaningful change in gender diversity at higher levels of public corporations.

References

Adams, Renée B., and Daniel Ferreira, 2009, Women in the boardroom and their impact on governance and performance, Journal of Financial Economics 94, 291-309.

Adams, Renée B., and Patricia Funk, 2012, Beyond the glass ceiling: Does gender matter? Management Science 58, 219-235.

Agars, Mark D., 2004, Reconsidering the impact of gender stereotypes on the advancement of women in organizations, Psychology of Women Quarterly 28, 103-111.

Agnew, Julie, Pierluigi Balduzzi, and Annika Sundén, 2003, Portfolio Choice and Trading in a Large 401(k) Plan, American Economic Review 93, 193-215.

Ahern, Kenneth R., and Amy K. Dittmar, 2012, The changing of the boards: The impact on firm valuation of mandated female board representation, Quarterly Journal of Economics 127, 137-197.

Atkinson, Stanley M., Samantha B. Baird, and Melissa B. Frye, 2003, Do female mutual fund managers manage differently? The Journal of Financial Research 26, 1-18.

Becker Gary S., 1957, The Economics of Discrimination, University of Chicago Press.

Bertrand, Marianne, 2009, CEOs, Annual Review of Economics 1, 1.1-1.29.

Bertrand Marianne and Kevin F. Hallock, 2001, The gender gap in top corporate jobs, Industrial Labor Relations Review 55, 3-21.

Bilimoria, Diana, 2006, The relationship between women corporate directors and women corporate officers, Journal of Managerial Issues 18 (Spring), 47-61.

Book, E. W., 2000, Why the best man for the job is a woman, New York: Harper Collins.

Borokhovich, Keneth A., Robert Parrino and Teresa Trapani, 1996, Outside directors and CEO selection, Journal of Financial and Quantitative Analysis 31, 337-355.

Bowen, C.C., J.K. Swim, and R.R. Jacobs, 2000, Evaluating gender biases on actual job performance of real people: A meta-analysis, Journal of Applied Social Psychology 30, 2194-2215.

Byrnes, James P., David C. Miller, and William D. Schafer, 1999, Gender differences in risk taking: A meta-analysis, Psychological Bulletin 125, 367-383.

Caliper Corporation, 2005, The qualities that distinguish women leaders.

Charness, Gary, and Uri Gneezy, 2012, Strong evidence for gender differences in risk taking, Journal of Economic Behavior & Organization 83, 50-58.

Cornell, Bradford, and Ivo Welch, 1996, Culture, information, and screening discrimination, Journal of Political Economy, 104, 542-571.

Cosslett, Steven R., 1981, Efficient estimation of discrete-choice models, in: C.F. Manski and D. McFadden, eds., Structural analysis of discrete data with econometric applications, (MIT Press, Cambridge, MA).

Croson, R., Gneezy, Uri, 2009, Gender differences in preferences, Journal of Economic Literature 47, 448–474.

Daily, Catherine M., and Dan R. Dalton, 2003, Women in the boardroom: A business imperative, The Journal of Business Strategy 24, 8-9.

Dezso, Cristian L., and David G. Ross, 2012, Does female representation in top management improve firm performance? A panel data investigation, Strategic Management Journal 33, 1072-1089.

Eagly, Alice H., and B.T. Johnson, 1990, Gender and leadership style: A meta-analysis, Psychological Bulletin 108, 233-256.

Eagly, Alice H., M.G. Makhijani, and B.G. Klonsky, 1992, Gender and the evaluation of leaders: A meta-analysis, Psychological Bulletin 111, 3–22.

Eagly, Alice H., S.J. Karau, and M.G. Makhijani, 1995, Gender and the effectiveness of leaders: A meta-analysis, Psychological Bulletin, 117, 125–145.

Eagly, Alice H., and S.J. Karau, 2002, Role congruity theory of prejudice toward female leaders, Psychological Review 109, 573-598.

Eagly, Alice H., Mary C. Johannesen-Schmidt, and Marloes L. van Engen, 2003, Transformational, transactional, and laissez-faire leadership styles: A meta-analysis comparing women and men, Psychological Bulletin 129, 569–591.

Eckel, Catherine C., and Philip J. Grossman, 2002, Sex differences and statistical stereotyping in attitudes toward financial risk, Evolution and Human Behavior 23, 281-295.

Ertac, Seda, and Mehmet Y. Gurdal, 2012, Deciding to decide: Gender, leadership and risk-taking in groups, Journal of Economic Behavior & Organization 83, 24-30.

Faleye, Olubunmi, Rani Hoitash, and Udi Hoitash, 2011, The costs of intense board monitoring, Journal of Financial Economics 101, 160-181.

Gneezy, Uri, Muriel Niederle, and Aldo Rustichini, 2003, Performance in competitive environments: gender differences, Quarterly Journal of Economics 118, 1049–1074.

Gneezy, Uri, and Aldo Rustichini, 2004, Gender and competition at a young age, American Economic Review 94, 377–381.

Heilman, M. E., 2001, Description and prescription: How gender stereotypes prevent women's ascent up the organizational ladder, Journal of Social Issues, 57, 657–674.

Hillman, Amy J., Christine Shropshire, Albert A. Cannella Jr., 2007, Organizational predictors of women on corporate boards, Academy of Management Journal 50, 941-952.

Huang, Jiekun and Darren J. Kisgen, 2012, Gender and corporate finance: Are male executives overconfident relative to female executives? Journal of Financial Economics, Forthcoming.

Huber, P. J., 1967, The behavior of maximum likelihood estimates under nonstandard conditions, In Proceedings of the Fifth Berkeley Symposium on Mathematical Statistics and Probability, Berkeley, CA: University of California Press, vol. 1, 221-233.

Huson, Mark R., Paul H. Malatesta, and Robert Parrino, 2004, Managerial succession and firm performance, Journal of Financial Economics 74, 237-275.

Hymowitz, Carol and Sarah Frier, 2011, IBM's Rometty Breaks Ground as 100-Year-Old Company's First Female Leader, http://www.bloomberg.com/news/2011-10-25/ibm-names-rometty-to-succeed-palmisano-as-its-first-female-chief-executive.html.

King, Gary and Langche Zeng, 2001, Logistic regression in rare events data, Political Analysis 9, 137-163.

Konrad, Alison M., Vicki W. Kramer, and Sumru Erkut, 2008, Critical mass: The impact of three or more women on corporate boards, Organizational Dynamics 37, 145-164.

Lee, Peggy M., and Erika H. James, 2007, She'-e-os: Gender effects and investor reactions to the announcements of top executive appointments, Strategic Management Journal 28, 227-241.

Levi, Maurice, Kai Li, and Feng Zhang, 2012, Men are from Mars, women are from Venus: Director gender and mergers and acquisitions, SSRN Working Paper.

Linck, James S., Jeffry M. Netter, and Tina Yang, 2008, The Determinants of board structure, Journal of Financial Economics 87, 308-328.

Manski, Charles F. and Daniel McFadden, 1981, Alternative estimators and sample design for discrete choice analysis, in: C.F. Manski and D. McFadden, eds., Structural analysis of discrete data with econometric applications, (MIT Press, Cambridge, MA).

Matsa, David A., and Amalia R. Miller, 2011a, Chipping away at the glass ceiling: Gender spillovers in corporate leadership, American Economic Review 101, 635-639.

Matsa, David A., and Amalia R. Miller, 2011b, A female style in corporate leadership? Evidence from quotas, Northwestern University Working paper.

Mohan, Nancy J., and Carl R. Chen, 2004, Are IPOs priced differently based upon gender? Journal of Behavioral Finance 5, 57-65.

Moss Kanter, Rosabeth, 1977, Some effects of proportions on group life: Skewed sex ratios and responses to token women, The American Journal of Sociology 82, 965-990.

Niederle, Muriel, Lise Vesterlund, 2007, Do women shy away from competition? Do men compete too much? Quarterly Journal of Economics 122, 1067–1101.

Parrino, Robert, 1997, CEO turnover and outside succession: A cross-sectional analysis, Journal of Financial Economics 46, 165-197.

Palepu, Krishna, 1986, Predicting takeover targets: A methodological and empirical analysis, Journal of Accounting and Economics 8, 3-35.

Phillips, Katherine W., Katie A. Liljenquist and Margaret A. Neale, 2009, Is the pain worth the gain? The advantages and liabilities of agreeing with socially distinct newcomers, Personality and Social Psychology Bulletin 35, 336-350.

Reuben, Ernesto, Pedro Rey-Biel, Paola Sapienza, and Luigi Zingales, 2012, The emergence of male leadership in competitive environments, Journal of Economic Behavior & Organization 83, 111-117.

Rosener, Judy B., 1995, America's competitive secret: Utilizing women as management strategy, New York: Oxford University Press.

Sapienza, Paola, Luigi Zingales, and Dario Maestripieri, 2009, Gender differences in financial risk aversion and career choices are affected by testosterone, Proceedings of the National Academy of Sciences U.S.A., 106: 15268-15273.

Schein, V. E., 2001, A global look at psychological barriers to women's progress in management, Journal of Social Issues 57, 675–688.

Schwartz-Ziv, Miriam, 2012, Does the gender of directors matter? Harvard University and Northeastern University Working Paper.

Shivdasani, Anil, 1993, Board composition, ownership structure, and hostile takeovers, Journal of Accounting and Economics 16, 167-198.

Shrader, Charles B., Virginia B. Blackburn, and Paul Iles, 1997, Women in management and firm financial performance: An exploratory study, Journal of Managerial Issues 9, 355-372.

Simon, Rita J. and Jean M. Landis, 1989, Women's and men's attitudes about a woman's place and role, Public Opinion Quarterly 53, 265-276.

van Knippenberg, Daan, Carsten K. W. De Dreu and Astrid C. Homan, 2004, Work group diversity and group performance: an integrative model and research agenda, Journal of Applied Psychology 89, 1008-1022.

Warner, Jerold, Ross Watts, and Karen Wruck, 1988, Stock prices and top management changes, Journal of Financial Economics 20, 461–492.

White, H., 1980, A heteroskedasticity-consistent covariance matrix estimator and a direct test for heteroskedasticity, Econometrica 48, 817-830.

Wiersema, Margarethe F., and Karen A. Bantel, 1992, Top management team demography and corporate strategic change, Academy of Management Journal 35, 91-121.

Wolfers Justin, 2006, Diagnosing discrimination: stock returns and CEO gender. Journal of the European Economic Association 4, 531–41.

Yermack, David, 1996, Higher market valuation of companies with a small board of directors, Journal of Financial Economics 40, 185-212.

Yermack, David, 2006a, Golden handshakes: Separation pay for retired and dismissed CEOs, Journal of Accounting and Economics 41, 237-256.

Yermack, David, 2006b, Flights of fancy: Corporate jets, CEO perquisites, and inferior shareholder returns, Journal of Financial Economics 80, 211-242.

Zhang, Xiaomeng, and Kathryn M. Bartol, 2010, Linking empowering leadership and employee creativity: the influence of psychological empowerment, intrinsic motivation, and creative process engagement, Academy of Management Journal 53, 107-128.

Table 1
Distribution of female CEOs in the sample

Panel A: Female CEO appointments by year of becoming CEO

Year	Number of female CEO appointments	Percent of sample
1987	1	0.89
1992	3	2.68
1993	1	0.89
1994	5	4.46
1995	2	1.79
1996	3	2.68
1997	4	3.57
1998	4	3.57
1999	5	4.46
2000	9	8.04
2001	9	8.04
2002	8	7.14
2003	8	7.14
2004	5	4.46
2005	8	7.14
2006	12	10.71
2007	9	8.04
2008	6	5.36
2009	5	4.46
2010	5	4.46
TOTAL	112	100

Panel B: Female CEO appointments by industrial sector

Sector	2-digit SIC code	Number of female CEOs	Percent of sample
Manufacturing	20-39	43	38.39
Transportation, Communications, Electric, Gas, And Sanitary Services	40-49	10	8.93
Wholesale Trade	50-51	1	0.89
Retail Trade	52-59	25	22.32
Finance, Insurance, and Real Estate	60-67	11	9.82
Services	70-89	22	19.64
All Sectors		112	100

Table 2
Firm characteristics for fiscal year preceding the announcement of the new CEO

The sample comprises of 112 female CEO appointments between 1987 and 2010, and a control sample of 112 male CEO appointments by firms in the same industry (2-digit SIC code) and of similar size (assets). The last column reports the p-values from the t-test comparing the means of the two groups and from the Wilcoxon rank-sum test comparing the distributions of the two groups (in parentheses). The number of observations varies with data availability. All variables are defined in Appendix 2.

		All firms	Firms appointing Female CEOs	Firms appointing Male CEOs	p-value from t-test (Wilcoxon rank sum test)
Total assets ($millions)	Mean	4366.16	4698.41	4033.91	0.59
	Median	895.62	877.15	895.62	(0.64)
	N	222	111	111	
ROA	Mean	11.78%	11.24%	12.31%	0.72
	Median	13.92%	13.76%	14.00%	(0.90)
	N	217	108	109	
Standard deviation of ROA	Mean	5.71%	6.23%	5.20%	0.42
	Median	3.00%	2.92%	3.05%	(0.78)
	N	213	106	107	
Leverage	Mean	17.28%	17.44%	17.11%	0.91
	Median	9.59%	9.17%	10.23%	(0.53)
	N	220	110	110	
Tobin's Q	Mean	2.11	2.25	1.98	0.40
	Median	1.49	1.48	1.64	(0.94)
	N	211	103	108	
Firm age (years)	Mean	22.50	22.24	22.77	0.82
	Median	16.00	15.00	17.50	(0.47)
	N	224	112	112	

Table 3
Board and CEO characteristics

The sample comprises of 112 female CEO appointments between 1987 and 2010, and a control sample of 112 male CEO appointments by firms in the same industry (2-digit SIC code) and of similar size (assets). The last column reports the p-values from the t-test comparing the means of the two groups and from the Wilcoxon rank-sum test comparing the distributions of the two groups (in parentheses). The number of observations varies with data availability. All variables are defined in Appendix 2.

Panel A: Board and executive characteristics for fiscal year preceding the announcement of the new CEO

		All firms	Firms appointing Female CEOs	Firms appointing Male CEOs	p-value from t-test (Wilcoxon rank sum test)
Board size	Mean	9.22	8.98	9.47	0.21
	Median	9.00	9.00	9.00	(0.26)
	N	193	97	96	
Proportion of	Mean	0.125	0.155	0.095	0.00
female directors	Median	0.111	0.143	0.100	(0.00)
	N	193	97	96	
Number of female	Mean	0.68	1.09	0.27	0.00
executives in top five by	Median	0.00	1.00	0.00	(0.00)
annual compensation	N	198	99	99	
Proportion of	Mean	0.70	0.71	0.68	0.15
independent	Median	0.71	0.75	0.70	(0.17)
directors	N	193	97	96	

Table 3 (continued)

Panel B: CEO characteristics at the announcement

		All firms	Firms appointing Female CEOs	Firms appointing Male CEOs	p-value from t-test (Wilcoxon rank sum test)
CEO age	Mean	49.63	48.72	50.53	0.02
	Median	49.00	48.00	50.00	(0.01)
	N	222	110	112	
Insider CEO	Mean	0.71	0.71	0.71	0.92
	Median	1.00	1.00	1.00	(0.92)
	N	223	111	112	
Prior CEO resigned	Mean	0.16	0.14	0.17	0.54
	Median	0.00	0.00	0.00	(0.54)
	N	220	111	109	

Table 4
Logit regressions explaining the likelihood of a female CEO appointment

The dependent variable equals one if the newly appointed CEO is female, and zero if it is a male. In Models 3, 4, and 5, Number of females in top five by annual compensation is measured as the residual from a regression of Number of females in top five by annual compensation on the lagged value of Proportion of female directors, with year and industry fixed effects (using 1-digit SIC code) included in the regression. The p-values reported in parentheses are based on heteroskedasticity-consistent standard errors, as in Huber (1967) and White (1980). The pair fixed effects are based on each pair of sample and matched control firms.

	Model 1	Model 2	Model 3	Model 4	Model 5
Board and Executive characteristics					
Proportion of female directors	11.327***		13.200***	6.067***	6.430***
	(0.00)		(0.00)	(0.00)	(0.01)
Number of female executives in top five by annual compensation		2.778***	2.278***	1.389***	1.810***
		(0.00)	(0.00)	(0.00)	(0.00)
Board size	-0.442***	-0.258	-0.267	-0.197**	-0.193
	(0.01)	(0.15)	(0.11)	(0.03)	(0.15)
Proportion of independent directors	2.287	3.265	3.426	1.541	1.450
	(0.24)	(0.26)	(0.20)	(0.26)	(0.44)
Firm characteristics					
Ln (Total assets)	3.416**	3.175**	2.776*	0.184	0.186
	(0.02)	(0.02)	(0.05)	(0.20)	(0.32)
Tobin's Q	-0.315	-0.181	-0.269	-0.057	-0.074
	(0.32)	(0.59)	(0.46)	(0.62)	(0.64)
ROA	0.910	2.903	0.803	-1.581	-2.358
	(0.77)	(0.40)	(0.81)	(0.26)	(0.14)
Standard deviation of ROA	6.459	4.780	5.046	0.321	-1.138
	(0.38)	(0.53)	(0.50)	(0.94)	(0.80)
Leverage	-0.899	0.178	-0.557	0.470	0.996
	(0.58)	(0.92)	(0.75)	(0.60)	(0.38)
Firm age	0.019	0.026	0.024	0.002	-0.003
	(0.36)	(0.28)	(0.30)	(0.85)	(0.87)

Continued below

Table 4 (continued)

	Model 1	Model 2	Model 3	Model 4	Model 5
CEO characteristics					
CEO age	-0.154***	-0.102*	-0.093*	-0.067*	-0.086*
	(0.01)	(0.08)	(0.10)	(0.09)	(0.05)
Insider CEO	0.228	-0.621	-0.498	-0.486	-0.829
	(0.70)	(0.36)	(0.44)	(0.23)	(0.12)
Prior CEO resigned	-0.760	-1.149	-1.679	-0.497	0.030
	(0.43)	(0.37)	(0.20)	(0.36)	(0.96)
Constant	-12.926	-16.254	-12.747	2.689	3.072
	(0.24)	(0.12)	(0.23)	(0.24)	(0.25)
Observations	156	156	156	178	178
Percent correctly predicted	71.79	83.33	82.05	74.16	79.21
Pseudo R-squared	0.260	0.420	0.385	0.239	0.361
Pair Fixed effects	YES	YES	YES	NO	NO
Year Fixed effects	NO	NO	NO	NO	YES
Industry Fixed effects (1-digit SIC)	NO	NO	NO	NO	YES

Table 5
Marginal effect of additional female directors on the probability of female CEO appointment

This table presents the marginal impact of female directors on the probability of a female CEO appointment for different numbers of female directors on the board. The estimates presented in the table are based on the coefficients from a logit specification that is similar to that reported in Model 3 of Table 4 (including the pair fixed effects). The only exception is that for this table, we use Number of female directors as the key independent variable in place of Proportion of female directors. Accordingly, in the first stage OLS regression, we regress Number of female executives in the top five by annual compensation on Number of female directors, Board size, and Year and SIC (one-digit) fixed effects indicators. There is one firm with 5 female directors and one firm with six female directors. Both firms appointed female CEOs.

Number of female directors	Marginal probability of female CEO appointment
0	0.26%
1	1.28%
2	6.12%
3	24.66%
4	62.16%

Table 6
Distribution of new CEO announcement abnormal stock returns

The sample comprises of 112 female CEO appointments between 1987 and 2010, and a control sample of 112 male CEO appointments by firms in the same industry (2-digit SIC code) and of similar size (assets). Four sample firms do not have public announcements of the CEO appointment. As a result, these four observations (along with their control firms) are excluded from this analysis. In addition, one sample firm and two control firms had the announcement of the CEO appointment within ten days of the September 11, 2001 tragedy. As this event had a significant impact on the entire market, we exclude these observations from the event study analysis. Finally, four sample firms and two control firms have missing returns on CRSP and hence, have missing abnormal returns. The abnormal returns are measured using the market adjusted approach, with the CRSP value-weighted index used as a proxy for the market portfolio. The last column reports the p-values from the t-test comparing the means of the two groups and from the Wilcoxon rank-sum test comparing the distributions of the two groups (in parentheses).

Announcement window	Statistic	All firms	Firms appointing Female CEOs	Firms appointing Male CEOs	p-value from t-test (Wilcoxon rank sum test)
-1,+1	Mean	0.02%	-0.09%	0.13%	0.79
	Median	-0.41%	0.04%	-0.74%	(0.53)
	N	207	103	104	
-1,0	Mean	0.54%	0.71%	0.37%	0.58
	Median	0.07%	-0.06%	0.12%	(0.99)
	N	207	103	104	
0,+1	Mean	-0.29%	-0.39%	-0.19%	0.79
	Median	-0.17%	0.28%	-0.61%	(0.23)
	N	207	103	104	

Table 7
Multivariate regressions explaining the announcement abnormal returns

The dependent variable is the three-day (-1,+1) cumulative abnormal return (CAR), measured using the market-adjusted approach. We use the CRSP value-weighted index return as the proxy for the market return. The p-values reported in parentheses are based on heteroskedasticity-consistent standard errors, as in Huber (1967) and White (1980). The industry fixed effects are based on 1-digit SIC codes. All variables are defined in Appendix 2.

Independent variables	Model 1	Model 2	Model 3
Female	0.003	0.001	0.006
	(0.77)	(0.90)	(0.57)
Firm characteristics			
Ln (Total assets)	0.004	0.005	0.004
	(0.21)	(0.22)	(0.35)
Tobin's Q	-0.005**	-0.006*	-0.006**
	(0.01)	(0.07)	(0.05)
ROA	-0.028	-0.056	-0.054
	(0.30)	(0.12)	(0.14)
Standard deviation of ROA	0.025	-0.054	-0.040
	(0.79)	(0.71)	(0.78)
Leverage	-0.033	-0.027	-0.031
	(0.28)	(0.42)	(0.36)
Firm age	-0.000	-0.000	-0.000
	(0.77)	(0.80)	(0.77)
CEO characteristics			
CEO age	-0.001	-0.001	-0.001
	(0.43)	(0.50)	(0.50)
Insider CEO	-0.019*	-0.018	-0.013
	(0.08)	(0.14)	(0.29)
Prior CEO resigned	-0.004	-0.003	-0.003
	(0.72)	(0.84)	(0.82)

Continued below

Table 7 (continued)

Board & Executive characteristics	Model 1	Model 2	Model 3
Board size		-0.002	-0.002
		(0.23)	(0.19)
Proportion of female directors		0.038	0.034
		(0.50)	(0.55)
Proportion of independent directors		0.003	0.014
		(0.94)	(0.65)
Number of female executives in top five by annual compensation			-0.008
			(0.28)
Constant	0.004	0.062	0.064
	(0.93)	(0.33)	(0.31)
Observations	195	175	174
Adjusted R-squared	0.082	0.083	0.095
Year fixed effects	YES	YES	YES
Industry fixed effects	YES	YES	YES

Table 8
Operating performance following CEO appointments

Panel A: Firms appointing Female CEOs								
Fiscal year relative to CEO taking office	ROA	N	Profit Margin	N	ROE	N	Tobin's Q	N
-3	14.30%	102	6.01%	104	11.47%	104	1.45	97
-2	14.82%	106	6.27%	108	12.06%	108	1.53	101
-1	13.44%	108	5.57%	110	11.79%	111	1.44	104
0	11.75%	108	3.94%	110	9.32%	111	1.46	107
1	11.35%	106	4.25%	109	9.81%	109	1.51	105
2	12.05%	96	4.48%	99	10.94%	99	1.53	96
3	13.00%	88	4.40%	91	12.38%	91	1.44	88
Panel B: Firms appointing Male CEOs								
Fiscal year relative to CEO taking office	ROA	N	Profit Margin	N	ROE	N	Tobin's Q	N
-3	14.71%	104	4.00%	107	12.24%	107	1.56	104
-2	13.95%	107	3.85%	109	11.08%	109	1.60	106
-1	13.75%	109	3.17%	110	9.82%	111	1.45	108
0	12.91%	110	4.14%	112	11.33%	112	1.47	111
1	13.64%	106	4.96%	108	11.69%	108	1.54	107
2	14.01%	99	4.78%	101	12.31%	101	1.53	100
3	13.38%	86	4.60%	88	12.65%	88	1.36	87
Panel C: p-values from Wilcoxon rank sum test of the equality of distributions between firms with Female CEOs and firms with Male CEOs								
Fiscal year relative to taking office	ROA		Profit Margin		ROE		Tobin's Q	
-3	0.86		0.11		0.59		0.68	
-2	0.44		0.02**		0.22		0.96	
-1	0.93		0.07*		0.66		0.57	
0	0.37		0.79		0.52		0.97	
1	0.14		0.68		0.52		0.58	
2	0.43		0.99		0.67		0.82	
3	0.57		0.91		0.83		0.29	

Table 8 (continued)
Operating performance summary comparing the pre-appointment period (-3,-1) and the post-appointment period (+1,+3) for firms appointing female and male CEOs

Panel D: Medians for Pre-appointment (-3,-1) and Post appointment (+1,+3) periods and p-values from Wilcoxon rank sum test

ROA

Firms appointing	Pre appointment	Post appointment	p-value of difference
Female CEO	14.10%	11.91%	0.02**
Male CEO	14.15%	13.75%	0.80
p-value of difference	0.43	0.17	

Profit Margin

Firms appointing	Pre appointment	Post appointment	p-value of difference
Female CEO	5.83%	4.40%	0.17
Male CEO	3.78%	4.84%	0.07*
p-value of difference	0.00***	0.86	

ROE

Firms appointing	Pre appointment	Post appointment	p-value of difference
Female CEO	11.83%	11.06%	0.27
Male CEO	11.24%	12.20%	0.32
p-value of difference	0.21	0.42	

Tobin's Q

Firms appointing	Pre appointment	Post appointment	p-value of difference
Female CEO	1.48	1.50	0.42
Male CEO	1.55	1.48	0.29
p-value of difference	0.99	0.91	

Figure 1
This figure depicts the probability of female CEO appointments, as reported in Table 5. Given that few firms have four or more female directors on the board, the figure only shows the marginal probabilities for up to three female directors.

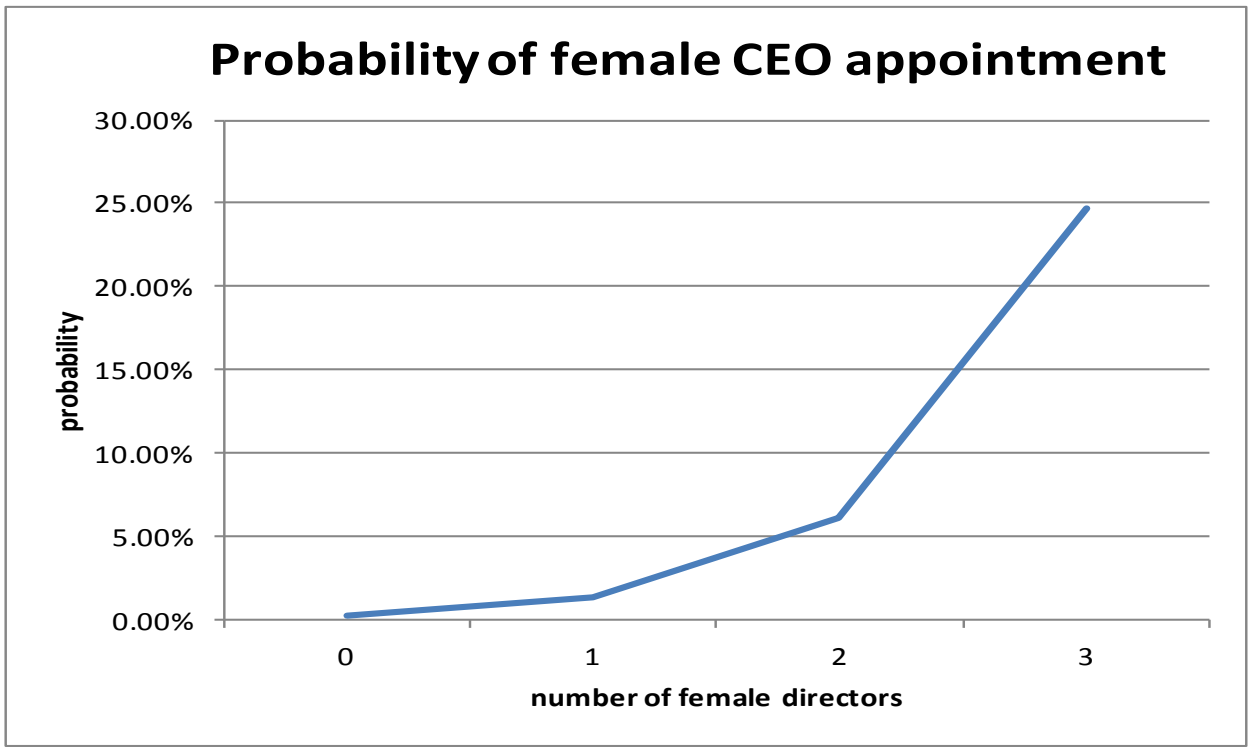


Figure 2
Median ROA around CEO appointment

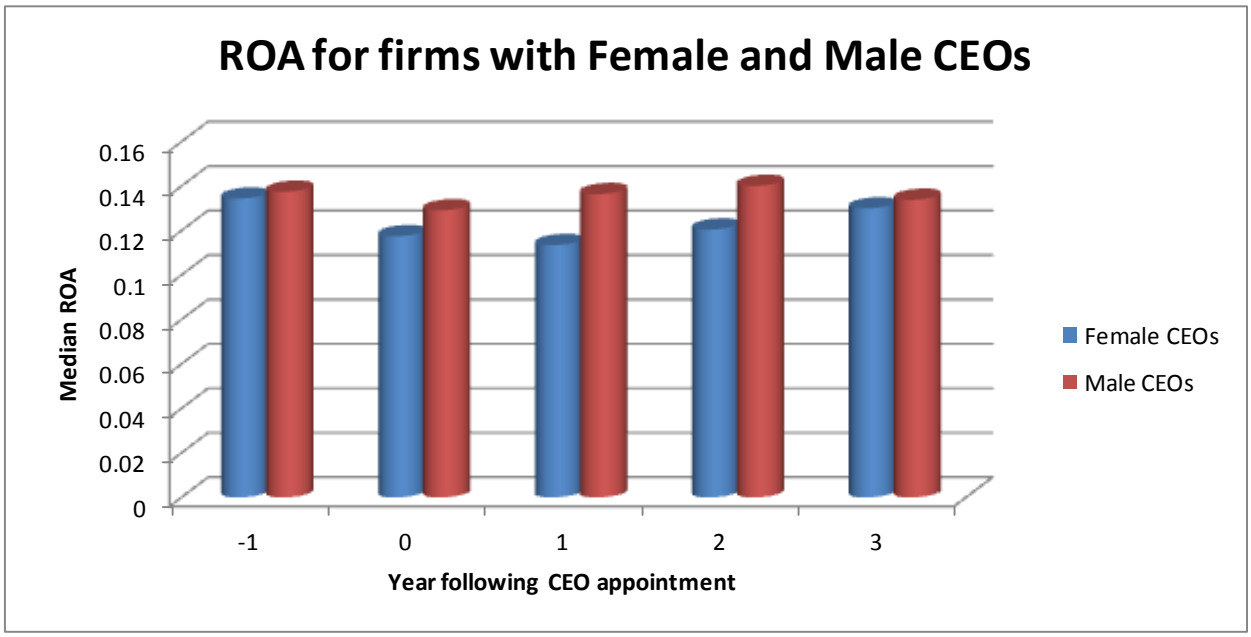
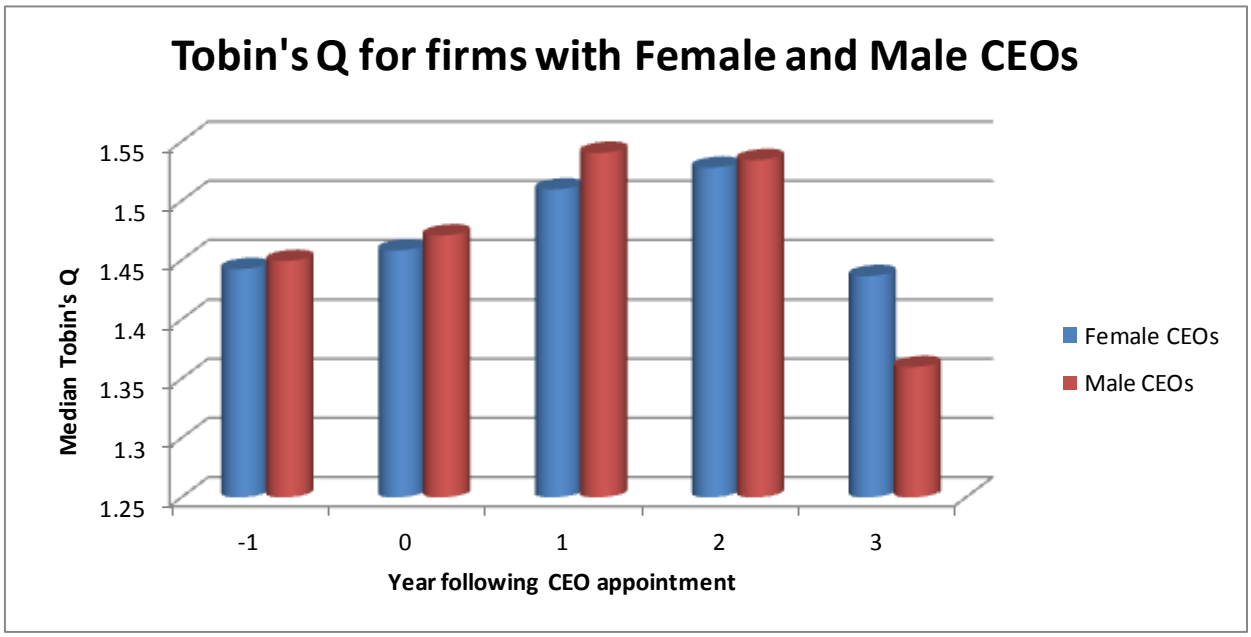


Figure 3
Median Tobin's Q around CEO appointment



Appendix 1: Description of procedure used to identify matched firms

For each firm appointing a female CEO (hereafter, sample firm), we first identify a population of potential matched firms that appointed male CEOs using the Execucomp database. Thus, both the sample firms as well as the matched firms are identified from the Execucomp database. We then apply the following algorithm. For example, if we do not find a matched firm in step 1, we use step 2, and so forth.

step	criteria
1	a. Same 2-digit SIC code b. Same fiscal year in which CEO took office c. Absolute value of percent difference between matched firm assets and sample firm assets is less than or equal to 20%
2	a. Same 2-digit SIC code b. Fiscal year in which male CEO took office is within 3 years of and prior to the fiscal year in which female CEO took office (i.e., -3,0 window, where year 0 refers to the fiscal year in which female CEO took office) c. Absolute value of percent difference between matched firm assets and sample firm assets is less than or equal to 20%
3	a. Same 2-digit SIC code b. Absolute value of percent difference between matched firm assets and sample firm assets is less than or equal to 20%
4	a. Same 2-digit SIC code b. Smallest absolute value of percent difference between matched firm assets and sample firm assets
5	a. Same 2-digit SIC code b. Chose the matched firm with the smallest difference between the year in which male CEO took office and the year in which female CEO took office.
6	a. Same 1-digit SIC code b. Smallest absolute value of percent difference between matched firm assets and sample firm assets

Appendix 1 (continued)

After going through the steps in Round 1 above, for each matched firm, we search the Lexis Nexis Academic database for the earliest public announcement date of the male CEO appointment. If this date also includes announcements of other corporate news (e.g., earnings, mergers, other restructuring or financing events), we look for an alternate matched firm in the next round of search using the following criteria:

a. Same 2-digit SIC code
b. Fiscal year in which male CEO took office being within +/- 5 years of the year in which the female CEO took office
c. Smallest absolute value of percent difference between matched firm assets and sample firm assets.

If this matched firm is also associated with a contaminated announcement, we repeat steps 5 and 6 (in the table above) as necessary and again search for the public announcement date for the matched firm. This process is repeated until a matched firm (without a contaminating announcement) is identified for each sample firm. The following table provides the number of rounds of search required to identify a matched firm for the sample firms in this study.

Round in which matched firm is identified	Number of sample firms	Percent of sample
1	71	63.39
2	26	23.21
3	8	7.14
4	5	4.46
5	1	0.89
6	1	0.89
	112	

Appendix 2: Variable definitions and data sources

Variable	Definition/Compustat item	Data source
Female	Equals one for female CEO and zero for male CEO	Lexis Nexis; Execucomp
Total assets	at	Compustat
ROA	oibdp/at	Compustat
Standard deviation of ROA	Standard deviation of ROA during the period from fiscal years -5 to -1 relative to the announcement	Compustat
Leverage	dltt/at	Compustat
Tobin's Q	((prcc_f*cshpri)+at-ceq)/at	Compustat
Firm age	Year of announcement minus the first year of listing on Compustat	Compustat
CEO age	CEO age at the time of the appointment	Lexis Nexis; Bloomberg Businessweek
Insider CEO	Equals one if newly appointed CEO is an insider, and zero otherwise	Lexis Nexis
Prior CEO resigned	Equals one if outgoing CEO resigned, and zero otherwise	Lexis Nexis
Board size	Number of directors on the board	Risk Metrics; sec.gov/edgar
Proportion of female directors	Number of female directors/Board size	Risk Metrics; sec.gov/edgar
Proportion of independent directors	Number of unaffiliated directors/Board size	Risk Metrics; sec.gov/edgar
Number of female executives in top five by annual compensation	Number of female executives in a list of top five executives ranked by TDC1	Execucomp
Cumulative abnormal return (CAR)	Computed using market adjusted returns, with CRSP value-weighted index as the market portfolio.	Eventus, CRSP
ROE	ni/ceq	Compustat
Profit margin	ni/sale	Compustat