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Gender Matters: Perceptions of Corporate Leadership

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GENDER MATTERS: PERCEPTIONS OF CORPORATE LEADERSHIP

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This thesis is approved as a creditable and independent investigation by a candidate for the Master of Science degree in Economics and is acceptable for meeting the dissertation requirements for this degree. Acceptance of this does not imply that the conclusions reached by the candidate are necessarily the conclusions of the major department.

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For Ann Moeller

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ABBREVIATIONS

CEO	Chief Executive officer
EMH	Efficient Market Hypothesis
CAR	cumulative abnormal return
SIC	Standardized Industry Classification
ROA	return on assets

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ABSTRACT

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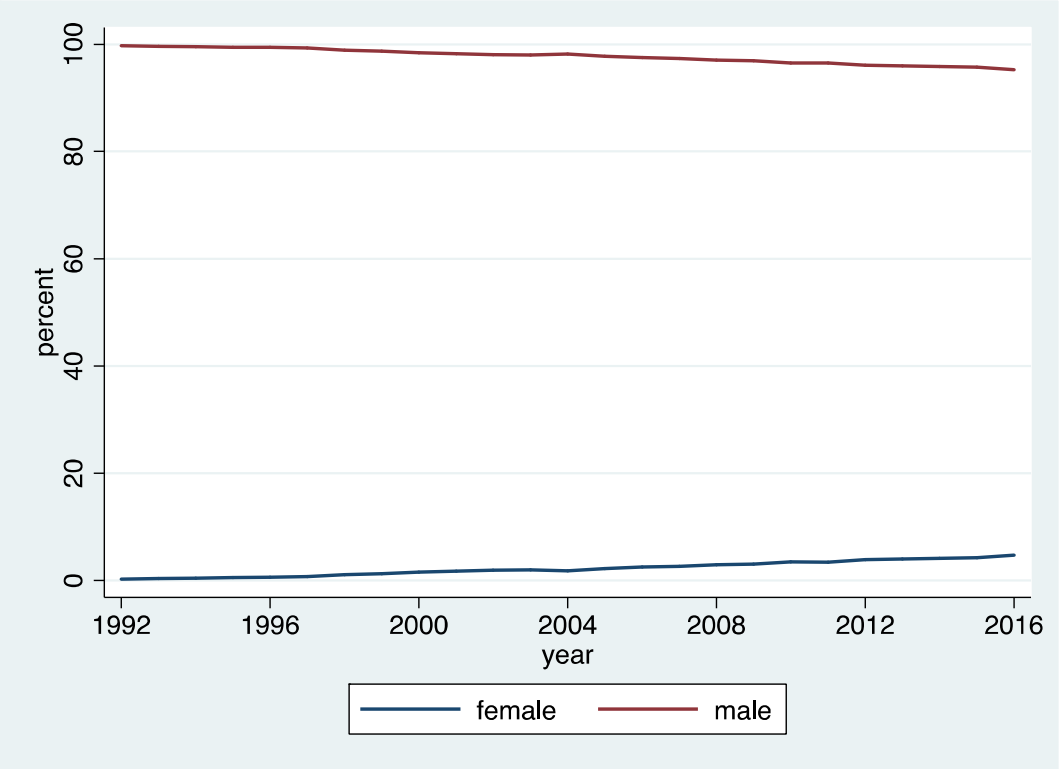
Women remain conspicuously underrepresented at the highest levels of corporate management; thus, it seems, gender matters. Gender bias in financial markets would imply an inefficient market, which necessarily constrains economic performance and social welfare more generally. To measure gender bias, I examine the cumulative abnormal returns around CEO announcements from 1992 through 2016 using a modified event study methodology. Existing event studies in this field are inconclusive as to whether or not such a bias exists. Therefore, this research contributes to the literature by extending the data, using a larger event window, and studying bias over time and firm size. I find that the market reacts differently to female CEOs in all three cases: a difference of negative 54 basis points in a pooled study, between negative 202 and positive 204 basis points when measured over time, and as much as negative 250 basis points when analyzed by firm size. Moreover, I analyze firm performance data for the same firms, concluding that returns are not conditional on gender. Market perception of difference between male and female performance is irrational.

1. Introduction

Women remain conspicuously underrepresented at the highest levels of corporate management. As Figure 1 illustrates, in 1992, only 0.25 percent of newly announced chief executive officers were female. Over 20 years later, in 2016, female CEO announcements comprised just 4.74 percent of the total newly announced executives in the EXECUCOMP database. The reasons for this continued underrepresentation are longstanding, complicated, and controversial. I surmise that gender bias in financial markets plays a role in maintaining this glass ceiling.

Figure 1: CEO Composition by Gender



The goal of this research is to determine whether financial markets react to CEO gender. I reason that if gender matters in this way, then I should be able to measure the effect of CEO gender in terms of stock returns, which reflect the financial market's

expectations of future corporate earnings; I refer to this measure as the gender bias. Such a bias, were it to exist, would question the efficiency of the market. A theory attributed to how effectively the market reacts to announcements, the Efficient Market Hypothesis (EMH), suggests that investors act rationally based on all available information. Investors attempt to maximize return, but investors cannot "beat the market" in the long run. Thus, persistent differences in returns reveal investors' systematic perceptions of CEO ability, which is conditional on gender in this study. To measure this gender bias, I examine stock returns around CEO announcements using event study methodology. Furthermore, I analyze firm performance after the announcement to measure whether returns are conditional on gender. The latter analysis allows me to put the market reaction in context of actual performance by the same CEOs. This research question is important, because a gender bias in financial markets would imply an inefficient allocation of capital, which necessarily constrains economic performance and social welfare more generally.

I use event study methodology to examine 100 female CEO announcements and a comparative random matched sample based on similar announcement dates and firm sizes for 102 male CEO announcements, all between 1992 through 2016. I obtained CEO data from EXECUCOMP, securities information from CRSP, and firm financials from COMPUSTAT. I gathered CEO announcement dates through searches of LEXISNEXIS. Some studies such as Lee and James (2007) and Lucy and Carron (2011) limited their event study investigation to a relatively short window. However, I use a methodology similar to that used in Coxbill, Sanning, and Shaffer (2009): I extend the event window to fifteen days prior to the event and ten days after the event to capture potentially more reaction to CEO announcements.

By estimating the cumulative abnormal returns using the Fama-French three-factor model, I ask three questions about market efficiency and gender bias. I define gender bias as a difference from returns associated with male CEO announcements. This bias can be in either direction from male returns, as there is no existing consensus about which direction the bias would take. First, I ask if gender bias exists when all announcements are pooled. Second, I ask if gender bias varies over time. Third, I ask if gender bias varies by firm size. A randomly matched male sample allows me to compare means (of cumulative abnormal returns) to determine whether the market reacts differently to female CEO announcements. I find the effect of gender is significant across all three dimensions. Specifically, I find that cumulative abnormal returns (CAR) associated with male matched CEO announcements are about 50 basis points greater than CARs associated with female CEO announcements; and this difference was greatest in the late 1990s, when male CEO announcements led to 702 basis point CAR versus a 230 basis point CAR for female CEO announcements. Furthermore, female CEO announcements by S&P 500 and Mid-Cap firms led to CARs that were higher than those for their male counterparts. I conclude that market participants reveal a gender bias. Furthermore, by regressing ROA on firm financial ratios and CEO gender, I conclude that returns are not conditional on gender. These regression results contextualize the event study results: the market expects female performance to be different than male, but this assumption is incorrect, irrational, and inefficient.

I contribute the extant literature in the following ways: first, I study gender bias over a relatively long period of time; doing so allows me a larger sample size and a larger sampling of firms at different asset-size levels for female CEOs and their male

counterparts. Perhaps, a drawback of Lucey and Carron (2011) was that they only focused on larger firms, those included in the FTSE 100 for example. In constrast, I identify four categories of firms by their sizes. As such, I am able to test whether gender bias affects the sampling universe of firms. Second, I extend the event study window to capture potentially more market reaction to CEO announcements, much like Coxbill, Sanning, and Schaffer (2009) do; I reason the relatively short windows used by Lee and James (2007) and Martin, Nishikawa, and Williams (2009) do not adequately capture market reaction. Third, in addition to a single aggregated event study, I study CEO announcements by time period and by firm size. This is important because it allows me to decompose the pooled data on CEO announcements and, thus, test if gender bias was a mere fad or a systematic feature of the financial market. Finally, I determine that returns are not conditional on gender.

The remainder of the paper proceeds as follows: in section two, I discuss the extant literature and what I contribute to it. In section three, I describe my datasets and methodology. In section four, I report my event-study results. In section five, I build on my results by comparing actual CEO performance of male and female executives; to do so, I estimate regressions based on the panel data of firms I analyze in my event study. Finally, in sections six and seven, I propose questions for future research and conclude.

2. Literature Review

Measuring bias of any kind is inherently difficult. Generally, people are not inclined to admit their biases; the reasons why interweave intellectual contributions from economics with those from sociology and psychology. To begin, I review the foundational literature on gender bias. Then, I review studies of gender biases in financial markets. Finally, I assess the state of event study research in corporate finance and gender bias. I conclude with a concise summary.

2.1 Evidence of Gender Bias

Gender relations—and, thus, gender biases—are, clearly, as old as the human race itself. Nevertheless, research in this area began in earnest in the 1970s as women joined the workforce in greater numbers than before. The influential sociology paper by Rosabeth Kanter of Harvard University shed light on why the bias may exist regardless of female ability. Kanter (1977) frames the problem of gender bias in the workplace as an outcome of minority-majority group dynamics, or tokenism. The author focuses on successful women in male-dominated workplaces, including those at the very top of the business world. Kanter demonstrates that when females are in a token position—one that is rare or novel, nearly alone—they are likely to face a three-fold double standard: namely, additional performance pressure, heightened group boundaries, and entrapped roles (1977). Of these standards, which increase the likelihood that a woman will reach the highest echelons of management, role entrapment is most relevant to my research, because it explains how outsiders could have warped perceptions of female CEOs. Because female CEOs are tokens, outsiders are likely to stereotype female CEOs in ways that conform to male-dominant social norms. For example, role entrapment implies,

"[M]aking adjustments in perception of the token's professional role to fit the expected position of the token's category- that is, bringing situational status in line with master status, the token's social type" (1977). As such, investors may perceive the female CEO as woman first, businessperson second—a warped view of a CEO's leadership and financial savvy. Because investors make investment decisions based on perceived risk characteristics, some of which are subjective, a systematic perception of the token femaleness of a CEO will cloud market perception of CEO ability.

Empirical findings support this theory. For example, Oakley (2000) asserts that when female executives tried to affect camaraderie with higher, male executives, they "triggered associations among male executives that prompted them to associate the female executives with other women in their lives, such as their wives, daughters, and secretaries" (2000). This finding is further evidence that role entrapment is a real phenomenon, particularly in the executive suite. Indeed, when female executives sought to gain confidence by acting chummy with their male executive counterparts, the male executives stereotyped female executives all the more.

Furthermore, other sociological research shows that when a minority is hired, they are likely to be perceived as less competent by others. In their paper regarding affirmative action and its stigma, Heilman, Block, and Stathatos (1997) note that when an individual's hiring or promotion is perceived as an affirmative action, others view the individual as less capable. The authors assert that "people resist relinquishing a negative view of those associated with affirmative action; such individuals seem to remain incompetent in the minds of onlookers unless they are proved to be competent" (1997).

This means that token individuals are not only incorrectly judged; the warped perception may be pervasive and long lasting.

Token theory lays the groundwork for understanding how gender bias could affect market perception of female CEOs. Specifically, female CEOs, simply because of their gender, are held to a different standard; and, their paucity in corporate leadership could further warp market perceptions. Therefore, it is essential to answer the question: Do female CEOs generally perform similarly to male CEOs? If women underperform relative to men, then perhaps the bias is a rational reaction to information. If perceptions are warped by gender, and women and men perform similarly, biased financial-market evaluations likely exist.

2.2 CEOs: Performance and Gender

Huang and Kisgen (2013) study leadership decisions—especially those regarding significant financial issues—by male and female CEOs. The authors discuss gender-specific behaviors and use panel data to identify differences in financial decision making between male and female CEOs. Huang and Kisgen conclude that "Firms with female executives are less likely to make acquisitions and are less likely to issue debt than firms with male executives … this empirical evidence is consistent with men being overconfident relative to women" (2013). In their study, Huang and Kisgen (2013) find that women make better, more consistent financial decisions for their shareholders.

Powell and Ansic (1997) find that women differ from men both in risk propensity and financial strategy. In a controlled experiment, the authors assign different tasks to male and female business students. They find that men and women differ by gender in risk aversion and strategies regardless of contextual influence. However, critically,

Powell and Ansic (1997) find, "[N]o significant differences between males and females in their ability to perform in financial decisionmaking. However, females were more likely to attribute their performance to good luck and were less confident than males for a similar level of prior experience and education" (1997). This study elucidates two points: first, there is no difference in performance, regardless of differences in risk aversion and strategy. Second, successful females are less confident and take less credit than their male counterparts.

Khan and Vieito (2013) also find that female leadership is positively related to firm performance. The authors study return on assets and stock volatility. The authors conclude that, "Our results reveal new insights in the area: firms with female CEOs are associated with an increase in performance compared to the firms managed by male CEOs. I also find that when the CEO is a woman, the firm risk level is smaller than when the CEO is a man" (2013). These findings are consistent with Powell and Ansic (1997), supporting the idea that female executives are more risk averse, but maintain positive firm performance.

Using a different measurement method, Dezso and Ross (2013) find that female-led companies perform as well as male-led companies that manage investment portfolios. Finding that innovative companies are also more likely to have women in the upper echelons of management, Dezso and Ross (2013) find that returns on assets, returns on equity, and Tobin's Q—total market value to total book value—are higher for firms led by female executives. This too supports the idea that female executives, while relatively rare, should not be stereotyped as financially inferior. They conclude that female-led companies perform as well as male-led companies that manage investment portfolios;

moreover, innovative companies are more likely to have women in the upper echelons of management.

In a related literature, Atkinson, Baird, and Frye (2003) assert that female fund managers invest similarly to male fund managers, underscoring similar financial competence across gender. In an analysis of fixed-income mutual fund managers, they take care to note the consensus (in the extant literature on gender risk aversion) that women are generally more risk averse and less confident in financial decisions. Based on this consensus view, they design a study of mutual fund managers that focuses on financial know-how and opportunity. The authors assert that, "Our results suggest that differences in investment behavior often attributed to gender may instead be attributable to finance knowledge and wealth constraints", which implies that females and males with similar education and career preparation should perform similarly.

The firm-performance literature finds that female-led firms grow at steadier rates (Huang and Kisgen 2013), have higher ROA and lower stock volatility (Khan and Vieito 2013), and have positive performance measures relative to men (Dezso and Ross 2008). While some papers assert that risk aversion and strategy differ by gender (Powell and Ansic 1997), others find that females invest similarly to males (Atkinson, Baird, and Frye 2003). Though the existing literature generally concludes that females are slightly more risk averse, it firmly supports that female executives are as financially capable as their male counterparts. See Appendix A for a concise summary of the comparative-performance literature.

2.3 Methods of Measuring Gender Bias

If male and female executives have equal financial ability, then market reaction should reflect this similarity. If the market reacts differently to female CEOs, it would reveal that the market misperceives ability based on gender. This difference can move in either direction; any difference in perception could be considered a bias. There are two common ways to measure gender bias in the financial market. The first way analyzes stock returns in the long run to discover if female executives are consistently viewed differently over time. The second way, which has received a fair amount of academic and popular attention in the last few years, is to study stock returns around the day a firm announces its appointment of a female CEO. This second way—the event-study method—is the one I take in my research.

2.3.1. Long-run Return Measures

An early attempt to measure stock returns conditional on CEO gender appears in Wolfers (2006). The author outlines some of the problems with measuring discrimination, and proposes a way to overcome these problems. According to Wolfers, "Although explicit prediction markets on the performance of male and female managers do not exist, in equity markets traders do take large positions based at least partly on their assessments of the ability of the CEO" (2006). In his literature review, Wolfers provides the rationale for gender discrimination research by noting that corporate finance research identifies CEO characteristics as important for returns (2006). The author analyzes Execomp data to track S&P 1500 firms from 1992-2004. Measuring long-term stock returns and using Fama-Macbeth regressions, the author is unable to reject his null hypothesis that "financial markets do not systematically under-estimate female-led firms" (Wolfers 2006). Wolfers concludes that more data are needed to find a statistically

significant relationship. The paucity of female CEOs is a widely acknowledged problem in this literature.

Wolfers (2016) is not without critics. Koley (2012) notes that Wolfers' use of calendar measurement produces significantly skewed results because calendar measures treat all months the same, regardless of how the proportion of female CEOs varies across months. Koley (2012) concludes that female CEOs consistently underperform relative to male CEOs. He suggests three reasons why: circularity in results (shareholders' price beliefs could result in a self-fulfilling prophecy), the long-term nature of the problem, and affirmative action (Koley 2012). In any case, the author dismisses bias as a possible explanation. An additional summary of this literature can be found in Appendix A.

2.3.2. Event Study Methodology

Measuring gender bias poses several econometric challenges, including measurement bias, endogeneity, and small sample sizes. Event study methodology, which was introduced by Fama et al. (1969), allows researchers to understand the repercussions of a specific event. Using stock splits as the event, Fama et al. (1969) laid out an empirical framework that changed the field of corporate finance. Event study methodology allows researchers to control for general market returns and risk factors in order to study the isolated effect of CEO announcements or other such unusual events.

The efficient market hypothesis (EMH) underpins this methodology: assuming the market uses all available information, the return patterns around an anticipated event reflect new information regarding the outcome of the event. According to Basu (1997), the efficient market hypothesis asserts that, "security prices fully reflect all available information in a rapid and unbiased fashion, and thus provide unbiased estimates of the

underlying values." In this instance, the announcement of a new CEO gives the market a plethora of new information. According to EMH, the market reacts quickly and without bias. However, a gender pricing bias, were it to exist, would imply market inefficiency because the investors would misperceive information. For gender bias to exist, the market must react systematically differently to male and female CEOs. This difference can move in either direction; the bias is defined as a *different* reaction, as the market should have no reason to assume either gender to be superior to the other.

Furthermore, Beechey, Gruen, and Vickery (2000) assert that EMH "implies that the market processes information rationally, in the sense that relevant information is not ignored, and systematic errors are not made". A systematic error, such as consistently undervaluing female CEO performance, would imply an inefficient market. Therefore, the event of a CEO announcement allows me to measure whether or not markets react rationally to announcements of female executives.

To determine whether a CEO change is a significant event that would affect firm performance and thus returns, Beatty and Zajac (1987) use advanced statistical methods and relatively large sample sizes. According to the authors, CEO succession significantly affects returns of large corporations; put differently, a change in CEO affects firm valuation.

To examine the effect on firm valuation of a female CEO announcement, Lee and James (2007) draw on the theory of tokenism developed in Kanter (1977) to explain why firms and markets would, in principle, negatively react to the announcement of a female CEO appointment. They also test a variety of hypotheses about executive appointments, and use linguistic technology to analyze the language used in female CEO

announcements. To measure abnormal returns, they use the event study method, and find a significant difference between returns around male and female announcements over the three-day cumulative return window. They also use a simple multivariate regression model to measure these returns, controlling for other factors, and find evidence to support the hypothesis that markets react more negatively to female CEO appointments. However, they recognize that there are relatively few female CEOs: thus, a small sample size makes it difficult to draw more general conclusions.

Martin, Nishikawa, and Williams (2009) also use event study methodology to analyze market reactions to CEO announcements across gender. The authors seek answers to two questions. First, does CEO gender affect valuation? Second, does it affect firm risk-taking? They measure the market reaction to a female CEO versus a male CEO to learn if there is an abnormal market reaction. (2009). Martin, Nishikawa, and Williams study announcements by compiling data from LexisNexis, CRSP, and CompuStat. They use Fama-French industry classifications to create 70 matched-sample CEO appointments in order to control for all other risk factors. They evaluate three measures: returns, beta, and idiosyncratic risk, each for a twelve-month period centered on the announcement date; they also use a three day window to test for abnormal returns. They find no statistically significant difference. Additionally, they measure CEO gender and risk. They conclude that, "[O]ur evidence supports the proposition that the market judges female CEOs as more risk averse than male CEOs … firms with relatively high total risk or relatively high idiosyncratic risk are more likely to appoint female CEOs, who may be more averse to risk, so that these risks might decrease" (2009). However, in focusing on market reactions to CEO announcements, they find no statistically significant difference.

Lucey and Carron (2011) follow up on Lee and James (2007). They use a similar methodology to examine director appointments, including CEO appointments, within the FTSE 100. They use the Capital Asset Pricing Model (CAPM) to predict expected return and use a three-day window to measure CAR. Lucey and Carron (2011) conclude, "[T]he stock market reacts against females appointed to the male-dominated roles of executive director and CEO, but that the role of nonexecutive director is regarded as suitable for either gender". According to their study results, the market perceives females as equal to males for management jobs, but it does not perceive them as equal for the very highest levels of leadership.

In contrast, Gondhalekar and Dalmia (2007) analyze Russell 3000 data (with a sample size of 50) and use a matched-sample method to find no statistically significant difference between market reactions to male and female CEO announcements. Like Lee and James (2007), Martin, Nishikawa, and Williams (2009), and Lucey and Carron (2011), the authors also use a three-day window to measure abnormal returns.

Coxbill, Sanning, and Shaffer (2009) extend the window used by most other event studies, extending the window to 20 days before and 20 days after the event. They investigate female-to-male announcements in comparison to male-to-male announcements. They use three benchmark models to measure CAR: Fama French, market, and market adjusted. Within their window, Coxbill, Sanning, and Shaffer (2009) find no difference between male and female CEO announcements. See Appendix B for a summary of the referenced event study literature.

2.4 Contribution

Gender bias is a complicated issue, especially in the context of financial markets. As I summarize in Appendix B, studies based on event-study methodology are inconclusive about the existence of a gender bias. In this thesis, I make three contributions to this literature. First, I analyze a larger data set than previous studies. Second, I posit that the three-day window used for cumulative abnormal returns is insufficient. It is possible that highly efficient markets would react to murmurings of a CEO change before it is officially announced; conversely, it is possible that if markets are less efficient, it may react to CARs with a lag following the event. Following studies like Coxbill, Sanning, and Shaffer (2009), I increase the event window to a 26-day period. A longer window is more likely to capture a financial market bias.

Finally, in addition to the larger sample size and increased window, female CEO announcements have never been analyzed across time periods, such as, say, the 1990s or the 2000s. Similarly, these announcements have not been separated into firm size groups and studied comparatively. Thus, I study market reactions to announcements segmented by firm size, as represented by their respective S&P indices. With these three contributions in mind, I propose the following hypotheses:

Hypothesis 1: If the efficient market hypothesis holds, then gender bias will not be evident in the market

This hypothesis is the general hypothesis that most researchers, including Lee and James (2007), Martin, Nishikawa, and Williams (2009), and Lucey and Carron (2011), Coxbill, Sanning, and Shaffer (2009), Gonhalekar and Dalmia (2007), test. To test this hypothesis, I use the entire sample of female CEOs and compare their CARs with those of the entire sample of male CEOs over the full sample period from 1992-2016. To reject

this hypothesis, male and female CAR must be significantly different from each other in either direction.

Hypothesis 2: If the efficient market hypothesis holds, then gender bias will not be evident in the market when firms are grouped by years

Testing this hypothesis allows me to analyze stock market reactions in different periods of time. By measuring CAR for each gender in each year period, I am able to analyze how the gender differential changes over time. Just as in Hypothesis 1, to reject this hypothesis, male and female CAR must be significantly different from each other in either direction.

Hypothesis 3: If the efficient market hypothesis holds, then gender bias will not be evident in the market when firms are grouped by size

Hypothesis 3 is another way to measure biased stock market reactions. By grouping firms by relative size as indicated by S&P indices, I am able to measure how bias changes across firm size. For example, the CAR differential may be larger for large firms relative to small firms. Again, to reject this hypothesis, male and female CAR must be significantly different from each other in either direction.

3. Model, Methodology, and Data

Because of the scope and difficulty of the proposed research, including the econometrical challenges it poses, I closely follow the precedent set by Fama et al. (1969) event study methodology, as well as the model laid out in Coxbill, Sanning, and Shaffer (2009). As I explained in the literature review, market reaction to female-CEO announcements is unclear. Lee and James (2006) and Lucey and Carron (2011) find statistical significance to support gender bias through the mechanism of market reaction; however, other studies do not.

3.1 Conceptual Background and Event Study Methodology

The efficient market hypothesis (EMH) holds that the market reflects all available information about the prospects of firms. The central theme of information implies that market reactions are, at best, inconsequential. Investors with diverse preferences should not react uniformly to female CEOs, thus EMH implies that gender should not affect stock performance. According to Fama (1998) "apparent overreaction to information is about as common as underreaction," meaning that reactions should not affect returns in the long run. As such, CEO gender should not affect stock performance in the long run.

While the theory of EMH explains why CEO gender should not affect firm returns, the theory of tokenism in Kanter (1977) explains why stereotypes of female ability may lead to warped perceptions, creating market inefficiencies. Kanter studies the relative proportions of female and male colleagues and the effects on perception. She demonstrates that when females are underrepresented, they are likely to face a variety of difficulties, including role entrapment. According to Kanter, role entrapment is, "the distortion of the characteristics of tokens to fit preexisting generalizations about their

category" (1977). In the case of executive management, the distribution of gender is heavily skewed toward men. Investors make decisions based on all relevant information; therefore, it is likely that female stereotypes will affect perceptions of firm prospects when women lead these firms.

Given this premise, an event study methodology is sensible because it quantifies the impact of an event on firm stock performance. As I explained earlier, if the market is efficient, CEO gender should not affect market reaction to the specific event. However, there is ample evidence that warped perceptions of female ability will, in fact, create market inefficiencies when a female CEO is announced. Event study methodology allows me to analyze how the specifics of the particular event can effect investor perception and expectations.

3.2 Model

Conceptually, event study analysis relies on measures of firm-level expected and actual returns. Expected returns – also known as normal returns - are those a firm would have achieved had the analyzed event not taken place; actual returns reflect the event. The difference between an actual and an expected return is, by definition, an abnormal return. The different analytical techniques for estimating abnormal returns differ with respect to the model used for predicting the expected returns around the event date. In Equation 1, I specify the sample regression function of the Fama-French 3-Factor model that I use in this study:

$$R_{RiskModel,i,t} = R_{f,t} + \hat{\alpha}_i + \hat{\beta}_{1t}\left(R_{m,t} - R_{f,t}\right) + \hat{\beta}_{2t}SMB_t + \hat{\beta}_{3t}HML_t + \hat{\varepsilon}_{i,t} \quad (1)$$

where $R_{RiskModel,i,t}$ is the daily return of the firm, $R_{f,t}$ is the risk free rate in the market, $\hat{\alpha}_i$ is the intercept term, $\hat{\beta}_{1t}$ is the part of the systematic risk that captures the market premium, $\hat{\beta}_{2t}$ is the part of the systematic risk that captures the excess return of small over big stocks, $\hat{\beta}_{3t}$ is the part of the systematic risk that captures the excess return of stocks with high market-to-book ratios over stocks with a low market-to-book ratios. The estimated residual is represented by $\hat{\varepsilon}_{i,t}$. A notational hat denotes an estimated value. Based on Equation 1, in Equation 2 I specify the expected return for firm i.

$$\hat{R}_{RiskModel,i,t} = R_{f,t} + \hat{\alpha}_i + \hat{\beta}_{1t}\left(R_{m,t} - R_{f,t}\right) + \hat{\beta}_{2t}SMB_t + \hat{\beta}_{3t}HML_t \qquad (2)$$

The abnormal return for firm i on day t within the event window is the difference between the actual stock return on that day ($R_{RiskModel,i,t}$) and the corresponding normal return ($\hat{R}_{RiskModel,i,t}$). Abnormal return is specified in Equation 3.

$$AR_{i,t} = R_{RiskModel,i,t} - \hat{R}_{RiskModel,i,t} \qquad (3)$$

To estimate the risk model surrounding my announcement dates, I specify the length of the estimation period in trading days over which I estimate the risk model (Equation 1). My estimation period is 250 calendar days, with at least 200 days of trading activity. I also have a gap period of 20 days prior to my event window, for a total of 270 days. My event window is 15 days before to 10 days after the event, for a total of 26 days. To measure the total impact of an event over a particular period of time -- the event window – I sum the abnormal returns for the 26 days in the event window. I measure these cumulative abnormal returns as specified in Equation 4.

$$CAR_i = \sum_{t=1}^{26} AR_{i,t} \qquad (4)$$

I compute the cumulative abnormal return (CAR) for each CEO announcement either by year, firm size, or one pooled group. Finally, I run a simple comparison of means to determine whether the mean CAR for female announcements is significantly different than the mean CAR for male announcements in each study. For this mean test, I measure mean CAR for each gender group as specified in Equation 5.

$$CAR = \frac{\sum_{i=1}^{N} AR_i}{N} \qquad (5)$$

I compare the mean CAR for gender groups using a t-test mean comparison. Because it is possible that the male and female sample have unequal variances, I use Welch's Approximation for degrees of freedom.

3.3 Data

All executive-related data are from EXECUCOMP, which is the premier executive compensation database. EXECUCOMP is produced by Wharton Research Data Services (WRDS) and contains comprehensive data on the top five executives for all S&P 1500 firms, as well as some other firms. EXECUCOMP contains annual data from 1992 to 2016, as well as some observations before 1992. Securities information is from the Center for Research in Security Prices (CRSP), which I access using EVNTSTUDY software. Firm financials come from COMPUSTAT, which I access using WRDS. In addition, to examine market behavior around announcements, I gathered CEO announcement dates through searches of LEXISNEXIS using relevant Boolean search terms.

3.3.1. Data Sorting and Sample Construction

I began with full EXECUCOMP database of 273,478 observations. In this research, it is critical to compare similar firms in order to most closely study gender. Therefore, in order to study firms with relatively similar market structures, I removed utilities firms (SIC codes 4900-4999) and financial firms (SIC codes 6000-6999). I removed these firms because utilities firms have a unique financial and regulatory structure; furthermore, returns for financial firms are not appropriate for comparison with non-financial firms. After removing both utilities and financial firms, 228,048 executive observations remained. Because EXECUCOMP includes data for many top management positions, after removing irrelevant non-CEO observations, 36,249 CEO observations remained.

To construct the female sample, I removed all male announcements. I then filtered annual observations so that each executive-company combination was represented only once. Doing so produced a list of 156 female CEOs and their corresponding executive data. Finally, I dropped the records of CEOs announced before 1992 because of incomplete or inadequate information. Thus, at the start of my event study, the sample size was 152 female CEOs. However, because 52 observations were coded with incorrect CUSIPs or inadequate securities data, my final female sample size of female CEO announcements numbered 100.

To construct the male sample, I used a random matching methodology. From the pool of EXECUCOMP CEO data, I removed the 869 female observations, after which 35,560 male CEO observations remained. For each female CEO announcement, I used STATA to randomly select a male CEO appointed in the same year. Doing so resulted in

a random matched sample based on appointment year. As with the female group, some male observations did not have adequate information to complete the event study. The final male CEO announcements matched sample size numbered 102.

3.3.2 Firm Characteristics

In my dataset, the characteristics of female- and male-led firms are similar. In Table 1 I demonstrate the similarity between male and female led firms in the matched sample.

Table 1: Firm Financial Information
summary statistics on the companies with female vs. male CEOs

Mean Firm Financial Information		
	Male	Female
Total Assets	6231.39	7364.531
Return on Assets	0.029	0.029
Tobin's Q	2.147	2.309
Leverage Ratio	0.224	0.199
Number of CEOs	100	102

While female-led firms are slightly larger in this sample, the main financial ratios are very similar for both gendered samples. Return on assets (ROA) is exactly equal for male- and female-led firms. The female-led firms have a slightly higher mean Tobin's Q of 2.309 relative to the male-led-firm mean of 2.147, but the two are roughly similar. The mean leverage ratio for the female-led firms is slightly lower than that for the male-led firms; however, both near 0.20. In Table 2 I report that the female-led firms and the randomly matched male-led firms are similar for the purposes of my research in this thesis.

Comparing CARs in the male and female samples by firm industry classification is another approach. Firm industry classification is listed by SIC in EXECUCOMP. These SIC codes effectively reveal industries most commonly led by male or female executives. For the purposes of this study, I use general SIC code categories that I list in Table 2.

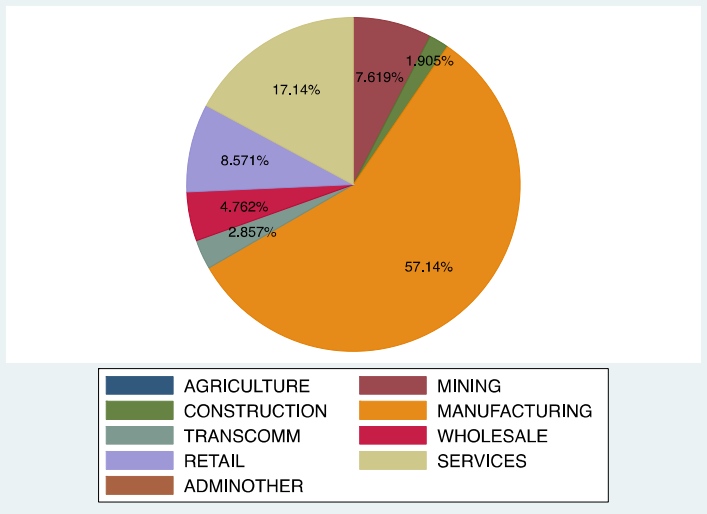
Table 2: SIC Code Categories

Industry	**SIC codes**
Agriculture & Forestry	0-0999
Mining	0999-1999
Construction	1500-1799
Manufacturing	2000-3999
Transportation & Communication	4000-4899
Wholesale Trade	5000-51999
Retail Trade	5200-5999
Services	7000-8999
Public Administration & Other	9000

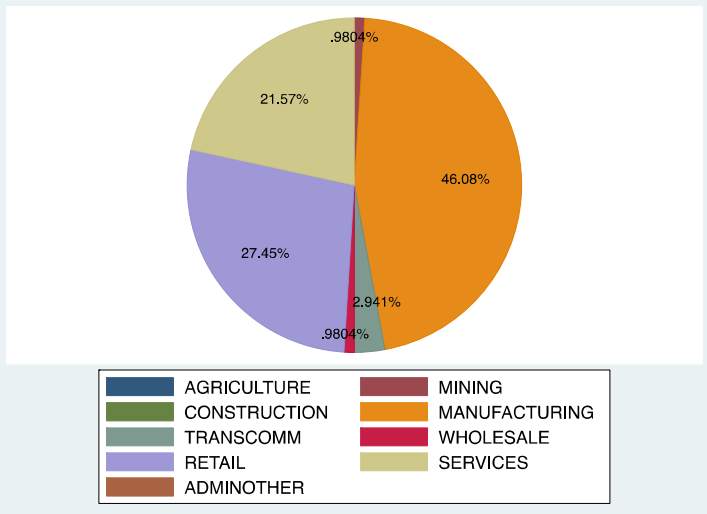
Recall that I dropped all utilities firms (SIC 4900-4999) and financial services firms (SIC 6000-6999) from the sample because the returns of these (uniquely regulated) firms would not be appropriate to compare to the returns of other firms in the market. Figures 2 and 3 illustrate the industry composition of the male and female samples.

Figure 2: Industry Composition by SIC

Male Sample



Female Sample



As I illustrate in Figure 2, the largest industry sector in both the male and female samples is manufacturing. At 57.14 percent, this sector comprises a slightly larger component of the male sample than the female sample, for which the value is 46.08 percent. For the male sample, the next largest sector is services, while the second largest

for the female sample is retail. However, services comprise a larger percentage of the female sample, at 21.57 percent; the corresponding male sample value is 17.14. Figure 2 illustrates that industry composition differs slightly between the male and female samples; this is primarily because female CEOs are more concentrated in manufacturing, retail, and services, while the male sample is concentrated largely in manufacturing.

3.3.3 CEO Characteristics

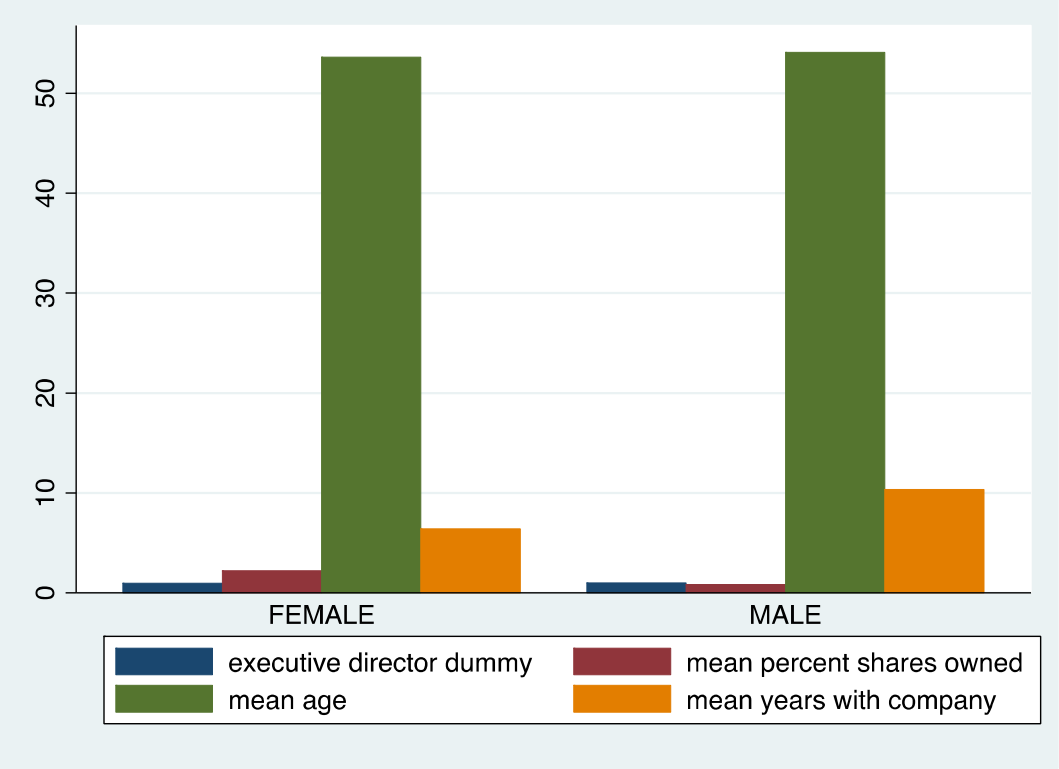
When measuring gender bias in an event study, not only is it important to have similar firm characteristics; executive characteristics and compensation should also be comparable. In Table 2, I summarize relevant CEO characteristics and compensation data found in EXECUCOMP. For more detailed explanation of each characteristic, see Appendix C.

Table 3: Executive Summary Data

	Female Sample			Male Sample			Male Sampling Population		
	mean	median	Std.Dev.	mean	median	Std.Dev.	mean	median	Std.Dev.
salary	772.6	698.9	402.1	778.5	715.9	346.5	709.8	650.0	393.7
bonus	234.5	0.0	615.2	303.9	0.0	691.0	397.0	0.0	1131.0
age	53.6	54.0	6.5	54.1	54.0	7.8	54.9	55.0	7.2
total compensation	5259.5	2949.8	6256.4	5269.2	3701.8	4883.6	5151.9	2975.0	8967.5
length	6.4	2.6	8.0	10.3	6.8	11.2	9.4	5.1	10.7
all other compensation	54.4	13.7	92.0	244.5	10.4	976.8	168.3	17.3	1230.3
change CEO payment	15132.5	5505.8	26534.2	14708.6	9309.6	16971.3	13109.6	7279.7	19978.0
equity incentive plan value	3704.8	265.4	7343.6	4410.8	403.3	7745.5	2849.2	0.0	7490.3
fair value of options	809.9	0.0	1970.1	1115.8	312.9	1964.5	1170.6	247.1	2558.8
executive director	1.0	1.0	0.2	1.0	1.0	0.1	1.0	1.0	0.2
other compensation	220.2	57.2	593.4	245.1	56.1	655.0	265.5	46.9	1676.2
value of stock awards	2739.9	893.0	3633.0	2524.5	1420.9	3309.2	2142.7	1037.7	3421.0
pct. shares outstanding	2.2	0.5	8.0	0.8	0.4	1.2	2.7	1.0	6.4
estimated termination payment	7430.0	2401.9	11049.2	5104.5	1066.7	8876.1	6841.1	2000.0	16062.8
percent increase in salary	70.2	4.7	331.1	30.7	5.4	96.3	26.2	4.9	242.8
compensation in SEC filing	6517.8	3528.6	7046.1	6572.8	4304.7	5942.0	6083.1	4018.3	7028.5

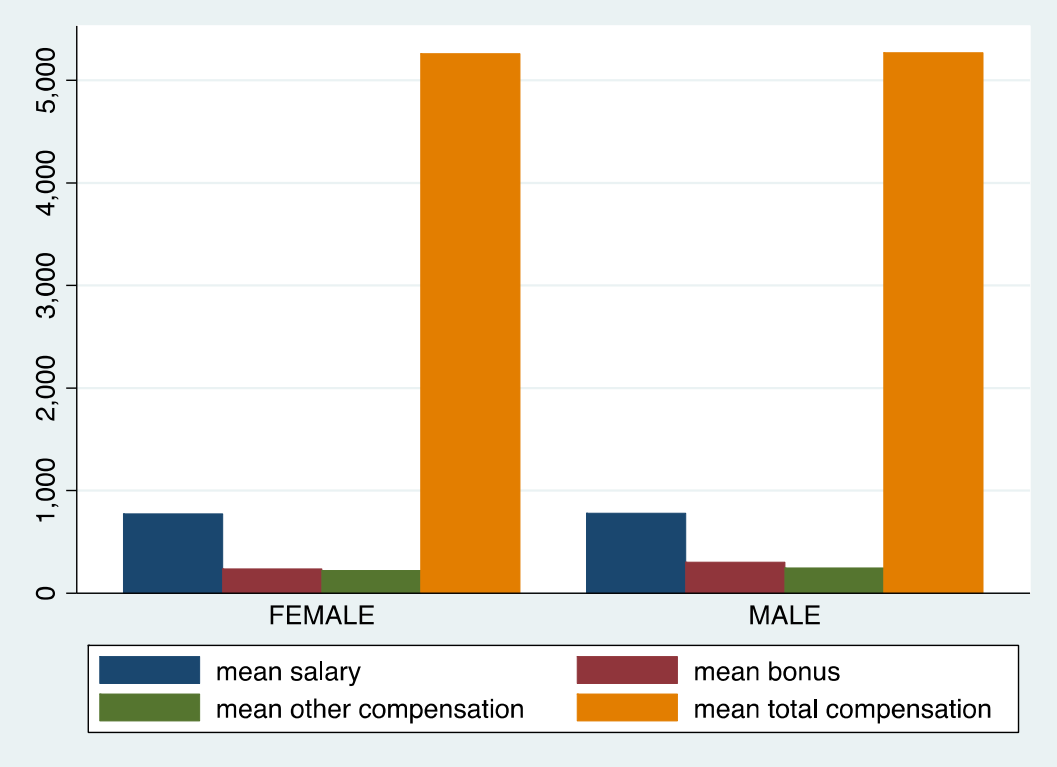
Table 3 is a comprehensive summary of executive compensation data from EXECUCOMP. For simplicity, I break these data into two sections: personal CEO characteristics and compensation characteristics. CEO characteristics in this dataset are similar across genders. For example, the mean age of female CEOs is 53.6 years, which is almost identical to the mean age of male CEOS of 54.1 years. Similarly, male and female CEOs are equally likely to serve as executive directors. However, male CEOs have more average years of experience with a firm, which is a noteworthy result. In addition, female CEOs own a mean of 2.22 percent of total shares outstanding. In contrast, male CEOs own a mean of just 0.83 percent of total shares outstanding. See Figure 3 for an illustration of CEO characteristics.

Figure 3: CEO Characteristics by Gender



Some of the measures of CEO compensation reveal male and female CEOs to be similar; for example, mean female CEO annual salary is $772.59 thousand compared to the male mean salary of $778.47 thousand. Similarly, “other compensation” is similar between genders, with the female average of $220.20 thousand compared to the slightly higher male average of $245.32 thousand. Female bonuses are slightly lower than male bonuses, at $234.48 thousand versus $303.88 thousand respectively. Moreover, total compensation, as reported in EXECUCOMP, is nearly identical for the two genders. See Figure 4 for an illustration.

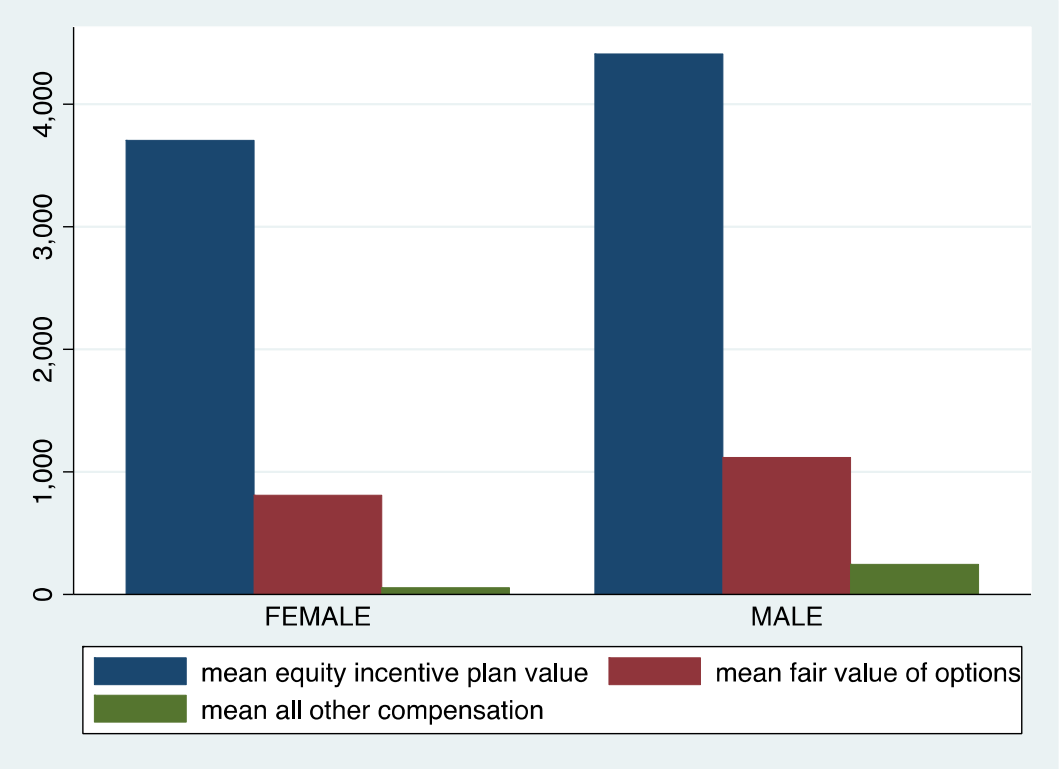
Figure 4: CEO Compensation Similarities



However, there are some interesting differences in compensation between genders. Interestingly, both equity incentive plan and fair value of options are higher for

male CEOs. This is especially interesting in light of the aforementioned fact that female CEOs typically own a higher percentage of outstanding shares. In addition, "all other compensation" was much higher for male CEOs, with a mean of $244.49 thousand compared to the female mean of $54.43 thousand. See Figure 5 for an illustration of the differences between male and female CEOs in the sample.

Figure 5: CEO Compensation Differences



For this matched sample, the differences in firm and executive data are minor. The explanation of the male and female data samples show that the random sample methodology is appropriate for this analysis. Minor differences in CEO compensation would not be taken into account by investors in the market; therefore, these discrepancies

should not affect firm valuation upon CEO announcement. Our female CEO sample and matched male sample are appropriate for the event study.

4. Results

To test my three hypotheses, I perform an event study, conditional on gender, to estimate the cumulative abnormal return over a 26-day event window—from 15 days prior to the event to 10 days after the event. An extension of the event window beyond the norm of generally 7 days—from 3 days prior and 3 days after the event—such as in Lee and James (2007) and Martin, Nishikawa, and Williams (2009) is most appropriate in this study because market rationality or irrationality is more likely revealed in a longer event window. If markets are highly efficient, they may react to rumors of an announcement or leaked information before the official announcement. On the other hand, it is possible that the reaction plays out over a few days after the announcement is made. For dividend-paying firms, I minimized the valuation effects of dividends because I excluded dividend gains from the returns of those firms.

4.1 Pooled event study

Hypothesis 1: If the efficient market hypothesis holds, then gender bias will not be evident in the market

This hypothesis follows the research of other event study methodologies by measuring market reaction to CEO announcements for the entire pooled sample. This approach is followed by every event study I reference in this paper. Furthermore, the extant literature is divided on the test results of this hypothesis; see Appendix B for a summary of papers that accept or reject the existence of gender bias in the market.

I reject Hypothesis 1. To test this hypothesis, I performed a pooled event study for all female and matched-male CEO announcements for the period of 1992 through 2016. As I report in Table 2, the CAR for female CEO announcements shows the market reacted negatively; in this case, a decrease of about 15 basis points within the 26 days

event window. However, for the same event window, matched-male CEO announcements garnered positive sentiment in market; in this case, the market reacted with a 34 basis point increase in CAR.

Furthermore, I perform a mean test of the CAR for both genders to ascertain if the differences shown in Table 4 are statistically different. As I report in the difference column of Table 4, the difference between the CARs is statistically significant at the 99 percent level with a difference of male CEO to female CEO announcement of almost 50 basis points.

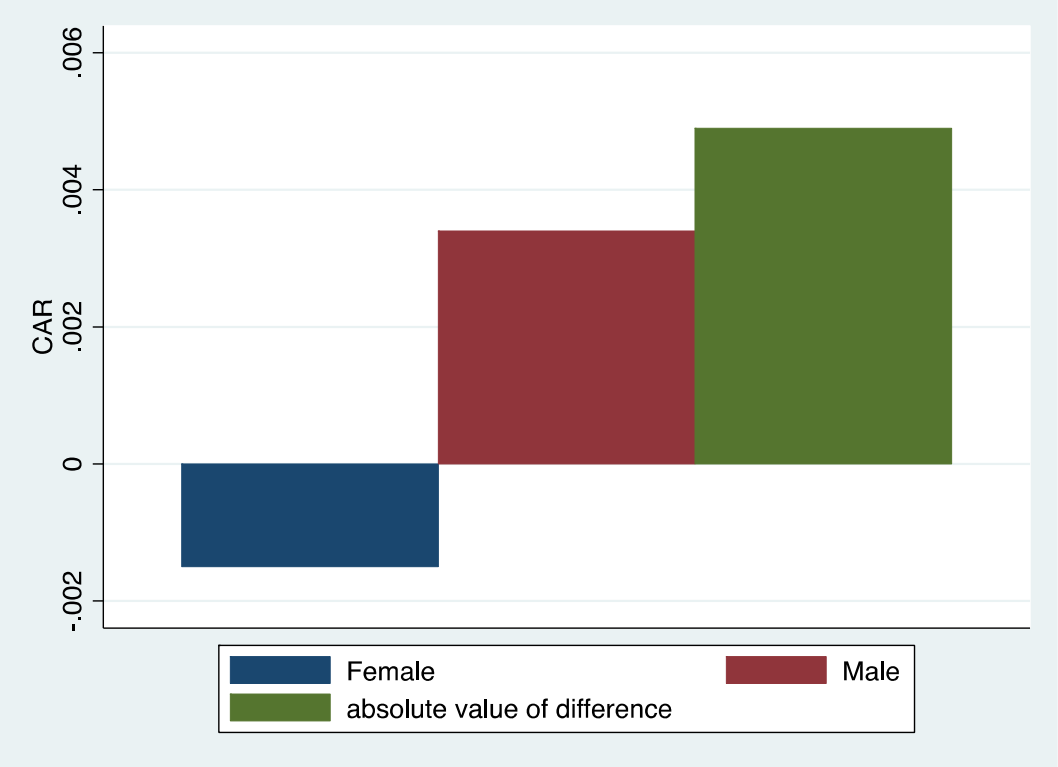
Table 4: Testing Gender bias in CEO Announcements
A sample of 104 female CEO announcements is compared with a matched sample for male CEO announcement for the period of 1992 through 2016. This table shows that gender is priced in the market as company that elect female CEO at an average of 26 days after such an announcement lose about 50 basis points compared to their pairs that announce a male as its next CEO. CARs are estimated using the event study methodology by applying the Fama-French 3 factor model. I perform a mean test and estimating the Welch degrees of Freedom. Standard-errors are in parentheses. ***, **, and * denote significantly different from zero at the 1, 5, and 10 percent level.

Female		Male			Difference	
mean CAR	mean AR	mean CAR	mean AR	N=	CAR	AR
-0.0015	0.000	0.0034	0.000	100 F	0.0049***	0.0004
(0.0013)	(0.0056)	(0.0009)	(0.0006)	102 M	(0.0016)	(0.0008)

These results indicate that, overall, the market reacts to female CEO announcements more negatively than it reacts to male CEO announcements. According to the EMH, these results imply that the market is inefficient because these results reveal a difference in price, and therefore preferences, based on an irrational bias against female CEOs. In my test of this hypothesis, I include every female CEO announcement in my sample between 1992-2016 (n = 100) and every male CEO announcement in the matched sample (n = 102). With such a large sample size relative to previous papers (see

Appendix B), these results convincingly show that the market reacts differently to female CEO announcements; moreover, the market reacts *negatively* to announcements of female versus male CEOs. In Figure 6 I illustrate these hypothesis-test outcomes.

Figure 6: Hypothesis 1 Results



Following Lee and James (2007) and Lucey and Carron (2011), I find that the market reacts negatively to female CEOs, especially when I measure results against their male counterparts. In contrast to the findings of Gondhalekar and Dalmia (2007), Martin, Nishikawa, and Williams (2009), and Coxbill, Sanning, and Shaffer (2009), I find that over the entire sample period (of XYZ years), market reactions to female CEOs are negative. While this finding does not how the bias may change over time and firm size, it

shows that the bias exists overall. I conclude that, overall, the market reacts negatively to female CEOs relative to male CEOs.

4.2 Event study with firms grouped by years

Hypothesis 2: If the efficient market hypothesis holds, then gender bias will not be evident in the market when firms are grouped by years

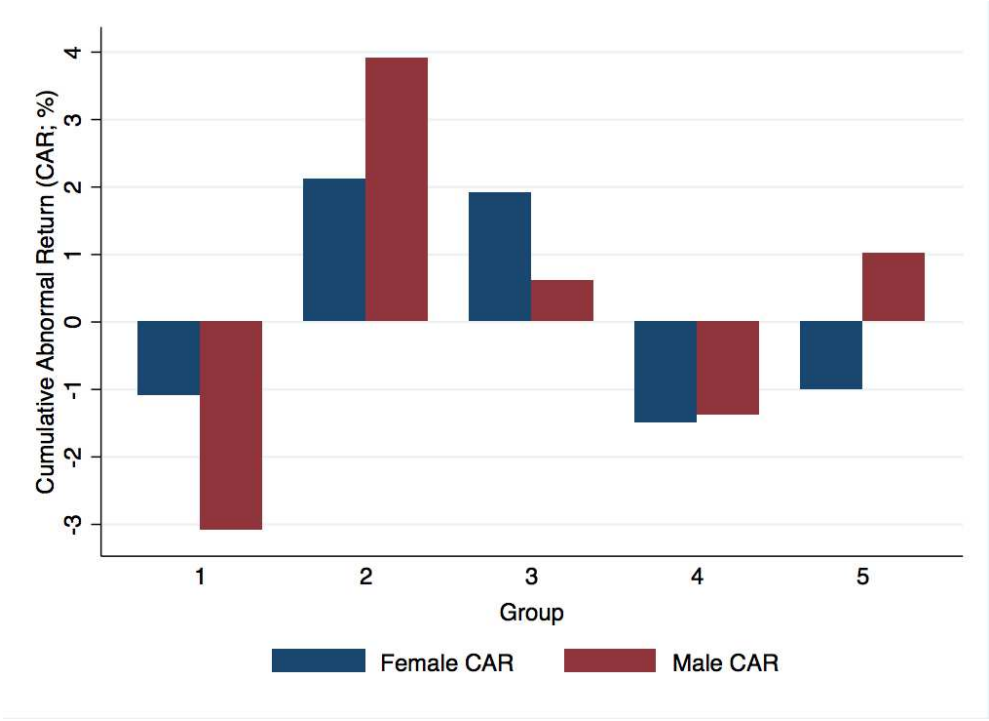
I generate five distinct year groups for CEO announcements for my sample between 1992 and 2016 so that I can investigate how, if at all, the bias changes over time. The results I report in Table 5 lead me to reject Hypothesis 2. These results show that mean cumulative abnormal returns vary over time. The difference between male mean CAR and female mean CAR is significant during some, but not all periods; moreover, the sign of the difference differs.

Table 5: Year Effect: Gender Bias and CEO Announcements
Female CEO announcements are compared with a matched sample for male CEO announcement for five periods between 1992-2016. CARs are estimated using the event study methodology by applying the Fama-French 3 factor model. I perform a mean test and estimating the Welch degrees of Freedom. Standard-errors are in parentheses. ***, **, and * denote significantly different from zero at the 1, 5, and 10 percent level.

	Female		Male			Difference	
Years	mean CAR	mean AR	mean CAR	mean AR	N=	CAR	AR
1992-1995	-0.0106 (0.0032)	-0.0010 (0.0020)	-0.0311 (0.0093)	-0.0029 (0.0042)	8 female 5 male	-0.0204** (0.0099)	-0.0019 (0.0046)
1996-1999	0.0207 (0.0049)	-0.0003 (0.0023)	0.0391 (0.0043)	0.0027 (0.0027)	7 female 11 male	0.0184** (0.0065)	0.0030 (0.0034)
2000-2005	0.0191 (0.0025)	0.0002 (0.0013)	0.0065 (0.0012)	0.0007 (0.0011)	27 female 26 male	-0.0126*** (0.0028)	0.0005 (0.0017)
2006-2010	-0.0153 (0.0020)	-0.0007 (0.0008)	-0.0144 (0.0029)	-0.0015 0.0006)	28 female 29 male	0.0010 (0.0035)	-0.0009 (0.0011)
2011-2016	-0.0100 (0.0017)	-0.0007 (0.0008)	0.0102 (0.0021)	0.0002 (0.0009)	30 female 31 male	0.0202*** (0.0027)	0.0009 (0.0013)

My rejection of Hypothesis 1 indicates that the market reacts differently to female CEOs over the entire sample. And, my rejection of Hypothesis 2 supports this and goes further, showing that the bias varies over time. In Table 5, the bias is evident in every subsample except one. Interestingly, while the cumulative abnormal returns are different for males and females in nearly every period, the direction of the bias is not consistent. In Figure 7 I illustrate these hypothesis-test outcomes.

Figure 7: Hypothesis 2 CAR Results



In the first and second subsamples, female CAR is smaller in magnitude than male CAR. In the third subsample (2000 to 2005), female CAR is more positive than male CAR. In the fourth subsample (2006 to 2010), there is no significant difference in CAR by gender. In the fifth subsample (2011 to 2016), female CEO announcements

induce a negative CAR relative to male announcements, but the two are of similar magnitude.

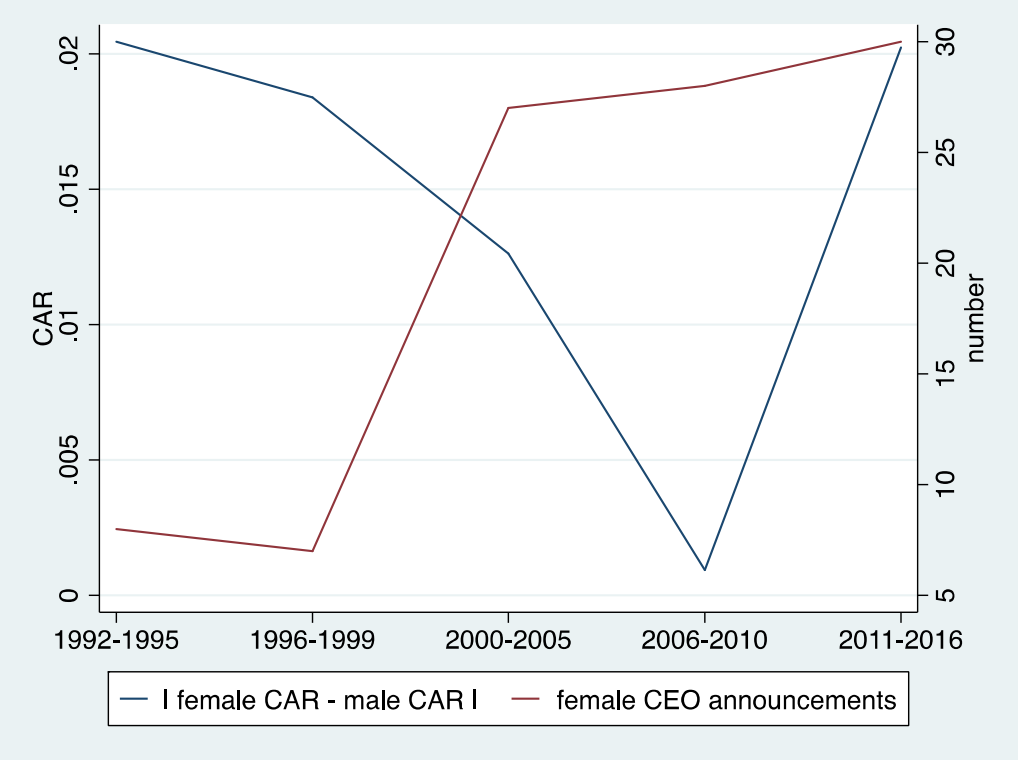
For the first subsample (1992 to 1995), both male and female CEO announcements result in negative cumulative abnormal returns over the 26-day window. The female CAR of negative 106 basis points is smaller than the male CAR of negative 311 basis points. However, in the second subsample (1996 to 1999), the market reacts positively to both male and female CEO announcements, but the male CAR increase from the first to the second subsample is much more dramatic than the female CAR. In absolute terms, the change in male CAR from the first to the second period is 702 basis points, while the change in female CAR is only 230 basis points. See Figure 8 for an illustration of the variation over subsamples.

Figure 8: Hypothesis 2 Results across Time Periods

In the first and second subsamples, the male CAR reveals much stronger negative and positive responses, respectively, while the female CAR reveals smaller responses. In the third subsample (2000 to 2005), female CEO announcements have a larger effect on CAR than male CEO announcements do; this result is different from those of the first and second subsamples.

As I illustrate in Figure 6, the market reacted quite differently to male and female CEOs in the early years of the full sample, while the gap appears to shrink in the latter years before growing again. To understand this pattern, it is helpful to look at the number of CEO announcements in each time period. In Figure 9 I illustrate the difference in CAR and the number of female CEO announcements for each subsample.

Figure 9: CAR Difference and Number of Female CEO Announcements



While there were just eight female announcements between 1992 and 1995 and seven between 1996 and 1997, there were 27 female CEO announcements between 2000 and 2005. This large increase in female CEO announcements coincides with a change in market reaction to the announcements. In Figure 7 I illustrate the CAR difference between male and female announcements; this difference is highest between 1992 and 1995. As the number of female CEO announcements grows, the difference appears to shrink until the fourth subsample (2006-2010).

This supports the ideas put forth in Kanter (1977) and Karsten (1994). The gender bias is relatively pronounced when female CEOs are rare. As the number of female CEOs grows, the effect of token status should decline. The decline in the CAR difference, concurrent with an increase in the number in female CEO announcements, supports the idea that bias changes with the proportion of female announcements. Though, the data from 2011 to 2016 do not follow the pattern.

4.3 Event Study with firms grouped by size

Hypothesis 3: If the efficient market hypothesis holds, then gender bias will not be evident in the market when firms are grouped by size

Does firm size matter? The extant literature demonstrates that, in general, it does: see, for example, Baker and Hall (2004), Moeller, Schlingemann, and Stulz (2004), and Lee (2009). However, on CEO announcements, no papers have considered this effect. Rather than presume that the Fama-French 3 or 4 factor models intrinsically control for size, I separate the female and matched male CEO samples into four groups based on the associated firms' market capitalizations—that is, firm size. I group firms as follows: those that comprise the S&P 500 (SP) as coded by EXECUCOMP; those that comprise

the Mid-Cap (MD) designation; those that comprise the Small-Cap (SM) designation; and those that do not belong to any of the aforementioned groups (EX). Based on these groups, I reject Hypothesis 3, because the effect of gender bias varies across firm size.

Table 6: Size Effect: Gender Bias on CEO Announcements
Female CEO announcements are compared with a matched sample for male CEO announcement for each S&P index between 1992-2016. CARs are estimated using the event study methodology by applying the Fama-French 3 factor model. I perform a mean test and estimating the Welch degrees of Freedom. Standard-errors are in parentheses. ***, **, and * denote significantly different from zero at the 1, 5, and 10 percent level.

	Female		Male			Difference	
index	mean CAR	mean AR	mean CAR	Mean AR	N=	CAR	AR
SP	0.0058 (0.0013)	0.0006 (0.0010)	-0.0130 (0.0063)	-0.0005 (0.0070)	18 F 29 M	-0.0188*** (0.0018)	-0.0011 (0.0013)
MD	0.0227 (0.0060)	0.0010 (0.0012)	-0.0025 (0.0027)	-0.0009 (0.0091)	12 F 20 M	-0.0252*** (0.0029)	-0.0019 (0.0015)
SM	0.0023 (0.0020)	0.0006 (0.0013)	0.0259 (0.0015)	0.0011 (0.0014)	14 F 26 M	0.0235*** (0.0025)	0.0006 (0.0019)
EX	-0.0017 (0.0017)	-0.0004 (0.0011)	-0.0043 (0.0064)	-0.0003 (0.0013)	40 F 25 M	-0.0026 (0.0021)	0.0001 (0.0018)

Like my results across subsamples, the effect of gender varies across firm size as well. The difference in mean CAR between genders is significant for all S&P 1500 indices. Firms with the EX code, or firms that are not in the S&P 1500, did not reveal a statistically significant difference between genders. Over the period 1992 to 2016, there were 18 usable female CEO announcements and 29 randomly matched male announcements in the S&P 500 (SP). In this firm size group, female CAR was a positive 58 basis points while male CAR was negative 130 basis points, a difference of 188 basis points. For the MD sample, the market reacted positively to female CEO announcements

and negatively to male announcements, with average female CAR equal to 227 basis points and the average male CAR equal to negative 25 basis points.

Results for SM firms contrast strongly from the results for the other firm-size groups. For these relatively small firms, male CEO announcements were greeted with a 259 basis point increase in CAR, while CAR equaled just 23 basis points in reaction to female announcements. In Figures 10 and 11, I summarize mean CAR by gender.

Figure 10: Hypothesis 3 CAR Results

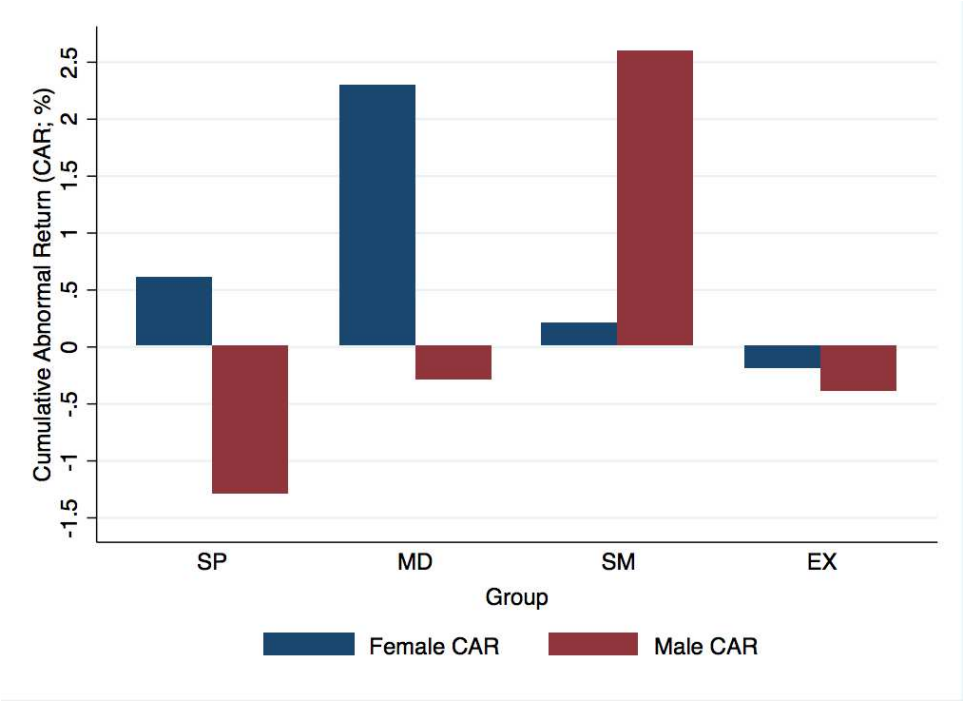
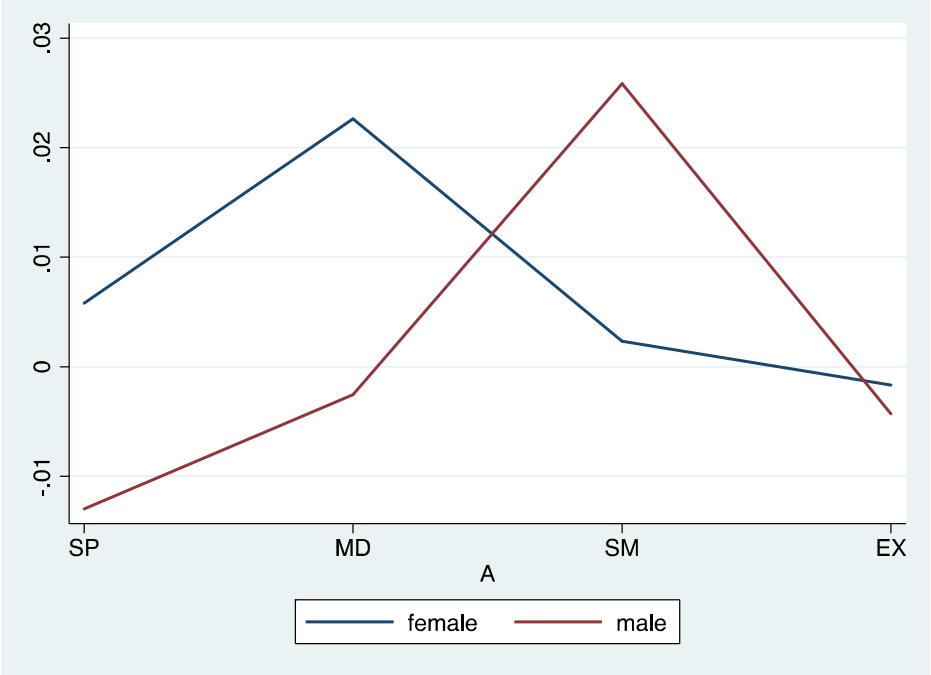


Figure 10 clearly demonstrates that the effect of gender on CAR after a CEO announcement varies by firm size. For the larger firms, S&P 500 and MidCap 400, the market reacted positively to female CEOs, while SmallCap male CEOs were greeted far more positively by the market. The difference in CAR following CEO announcements for

the smallest firms, those that are not on the major indices, were not statistically significant.

Figure 11: Hypothesis 3 Results Across Firm Size



In Figure 11 I illustrate how CAR changes with firm size. Female CAR is higher for both SP and MD indices, but the pattern is starkly reversed for the SM index, where male CAR is much higher than female CAR.

5. CEO Performance Analysis

5.1 Introduction

In my event study, I provide evidence that gender bias exists in the sense that the market's expectation of a firm's future performance is conditional on the gender of that firm's CEO. Overall, my evidence implies that the market expects female CEOs to generate relatively low returns. In this section, I test whether such an expectation is warranted; that is, I answer the fundamental question, "Do female CEOs generate relatively low returns?" I compare male and female CEO performance for firms in the same dataset. To do so, I regress return on assets (ROA) on a variety of firm factors that presumably drive ROA and I include a dummy variable for gender. In this way, I determine whether returns are conditional on gender. Furthermore, I analyze differences in the drivers of ROA under male versus female CEO leadership.

In section 2.2 I review the literature on female CEO performance. The general consensus is that female CEOs are as capable as male CEOs; that is, firm performance is independent of CEO gender (See, for example, Huang and Kisgen 2013, Deszo and Ross 2008, and Khan and Vieto 2013). Female executives may lead differently, but such differences do not generally affect firm performance (See, for example, Powell and Ansic 1997, Atkinson, Baird, and Frye 2003, and Khan and Vieto 2013).

Using panel data similar to mine, Smith, Smith, and Verner (2006) find that a higher proportion of female executives—CEO and otherwise—positively affects firm performance (2006). I follow the authors' approach and rely on the extant literature for the drivers of ROA, a common measure of firm performance (See, for example, Amore and Garofalo 2016 and Khan and Vieto 2013). In my panel regression, the dependent

variable is firm ROA and the independent variables are the firm-specific drivers of ROA, for the period 1993 to 2001. Following Deszo and Ross (2008), I include, as independent variables, the debt-to-asset ratio (DEBT), research-and-development investment (RnD), the natural log of the market value of the firm (Khan and Vieto 2013), the ratio of cash to total assets, CASH (because a higher ratio indicates conservatism), invested capital to assets, ICAP (as a measure of capital investment), and MTOB as a measure of market-to-book value (Huang and Kisgen 2013).

5.2 Data

Because the purpose of this section is to analyze firm performance conditional on gender, I use my sample of firms from EXECUCOMP and financial information from COMPUSTAT. Generally speaking, the event study measures bias based on expectations of future firm performance; in this section, I measure actual firm performance. Nevertheless, the dataset I use for this analysis differs in some ways from my event study dataset.

First, for the purpose of this section, I use a panel dataset of firm performance over time. I analyze performance by the same company for at least five years before the female CEO is announced, during which time the incumbent CEO is male, and for at least three years afterwards, when the CEO is female. I drop firms that do not have adequate or complete information before and after the female CEO began her tenure. My panel is unbalanced.

Once again, I begin with the full EXECUCOMP dataset, and follow the same steps as before: I drop observations associated with utilities and financial firms (SIC codes 4900-4999 and 6000-6999); I drop all observations associated with non-CEO

executives; and I drop all observations associated with firms that had only male CEOs. Scrubbing the data this way leaves me with the same 156 observations associated with female CEOs to which I referred earlier in the context of my event study. I drop observations associated with CEOs announced before 1992 because of inadequate and inconsistent data; doing so results in a sample size 152 observations (of male to female firm-leadership transitions). Finally, I combine the EXECUCOMP data with each firm's COMPUSTAT financial information.

Next, I drop observations associated with CEOs appointed after January 2014, because these events do not have three years of post-female-CEO-appointment returns; I drop 19 appointments based on this filter. Similarly, I drop observations that do not have financial data available either five years before or the three years after the announcement; I drop 28 executives based on this filter. Some companies have two female CEOs during the sample period (1992 to 2016). Because my analysis requires five years of male data compared with three years of female data, some of companies with two female appointments do not satisfy my criteria. I drop five CEOs based on these criteria. One company, HP, remains in the dataset with two female CEOs because both fulfilled the 5-year-pre, 3-year-post returns requirement. Furthermore, some firms did not have sufficient information on COMPUSTAT and, so, I did not include these firms in my analysis. The final sample includes 53 firms. This means there are 53 male CEOs succeeded by 53 female CEOs, or a total of 106 executives.

5.3 Model and Methodology

For this analysis, I use panel regression. The dependent variable is return on assets, or ROA. The general regression model is specified in Equation 6.

$$ROA_{it} = x_{i,t}\beta + \delta gender_t + c_i + u_{it} \quad (6)$$

Where ROA_{it} is the performance measure for firm i at time t; x_{it} is a vector of the observable (ROA-driver) variables that vary across firms (that is, i), across time (that is, t), or some combination of both firms and time; c_i captures unobserved heterogeneity across firms; δ is the coefficient on the dummy variable $gender$ that takes the value of 1 if the CEO is female and a value of zero otherwise; u_{it} is an idiosyncratic error that varies across i and t.

I model the unobserved heterogeneity as fixed effects based on the results of the Hausman test, with which I reject the null hypothesis that a random-effects specification is appropriate.

In Model 1, I estimate Equation 6 with firm fixed effects only. In Model 2, I estimate the equation with both firm and year fixed effects. In Model 3, I estimate male only (Model 3M) and female only (Model 3F) subsamples to compare performance across gender; in both cases, I include firm and year fixed effects. In Model 4, I estimate male only (Model 4M) and female only (Model 4F) subsamples and include only firm fixed effects.

To determine if CEO gender affects ROA, I test if the coefficient on $GENDER$ (δ) is significant. To determine if the coefficients on the drivers of firm performance $\left(x_{i,t}\right)$ –namely, R&D, Market Value, Cash, Invested Capital, Debt, and Market to Book value— are significantly different for male and female CEOs. In Table 7, I report my regression results.

Table 7: Regression Results

VARIABLES	(1) Model 1	(2) Model 2	(3) Model 3M	(4) Model 3F	(5) Model 4M	(6) Model 4F
RnD	-1.323***	-1.357***	-1.319***	-0.949***	-1.340***	-0.962***
	(0.0674)	(0.0644)	(0.0751)	(0.0877)	(0.0700)	(0.192)
LNMV	0.0338***	0.0426***	0.0209***	0.0312***	0.0266***	0.0636***
	(0.00738)	(0.0101)	(0.00528)	(0.00486)	(0.00840)	(0.0154)
ICAP	0.0135	-0.0342	-0.0294	0.141*	-0.0598	0.139
	(0.0687)	(0.0534)	(0.0494)	(0.0762)	(0.0631)	(0.138)
CASH	-0.0193	0.00177	0.0426	0.179***	-0.0164	0.0964
	(0.0522)	(0.0510)	(0.0488)	(0.0348)	(0.0543)	(0.0839)
DEBT	-0.182***	-0.160***	-0.177***	-0.0163	-0.218***	-0.0570
	(0.0567)	(0.0547)	(0.0303)	(0.0482)	(0.0495)	(0.0743)
MTOB	0.000107*	9.36e-05*	0.000234***	6.26e-05	0.000117	-5.68e-05
	(6.32e-05)	(5.23e-05)	(7.84e-05)	(6.50e-05)	(8.74e-05)	(4.33e-05)
GENDER	-0.0349***	-0.00513				
	(0.00911)	(0.0138)				
Constant	-0.0478	-0.00527	0.112*	0.00482	0.0667	-0.470**
	(0.107)	(0.116)	(0.0667)	(0.0808)	(0.102)	(0.178)
Observations	1,175	1,175	745	430	745	430
R-squared	0.576	0.599	0.638	0.418	0.623	0.345
Number of gvkey	53	53	52	50	52	50
Firm FE	YES	YES	YES	YES	YES	YES
Year FE		YES	YES	YES		

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

5.4 Results

In Table 7, I report that gender has no significant effect on ROA. In Model 1, the coefficient estimate for $GENDER$ (δ) is negative and significant; however, this model includes only firm (as opposed to firm and year) fixed effects. Because the effects of time are likely to be non-random, fixed effects for both firm and year are appropriate and necessary. Model 2 shows that including year fixed effects causes the gender variable to be insignificant. When correctly specified, the model indicates that CEO gender cannot explain any movement in ROA.

While gender has no effect on ROA, as I report in Table 7, several coefficient estimates on the conventional drivers of ROA are significant, implying that several factors drive ROA across my models. R&D, a measure of research and development costs to total assets, is significant in every regression. In Model 2, R&D is significant and has a negative effect on returns. In the male-subsample regressions, the coefficients for R&D are -1.319 (Model 3M) and -1.340 (Model 4M). In the female-subsample regressions, the coefficients are -0.949 (Model 3F) and -0.962 (Model 4F). R&D expenditures under the leadership of a male CEO are significantly different from those under the leadership of a female CEO. Specifically, the effect of R&D expenditure on returns is larger in absolute value during a male CEO's tenure than during a female CEO's tenure.

Similarly, the log market value variable, LNMV, is significant in all regressions. The coefficient estimates for the male subsamples are 0.0209 (3M) and 0.0266 (4M), while the coefficient estimates for the female subsamples are 0.0312 (Model 3F) and

0.0636 (Model 4F). These male and female coefficient estimates are significantly different from one another at the 99 percent level in every regression model. Specifically, the effect of market value on ROA is larger when a female is CEO.

ICAP is only significant at the 90 percent level in one female-subsample regression, Model 3F. This indicates that invested capital likely has little or no significant effect on returns for either gender subsample. Similarly, CASH is significant in only Model 3F. It is significant at the 99 percent level, indicating that cash holdings may affect returns when a CEO is female. CASH represents cash to total assets, ROA is more sensitive to cash on hand when a female is CEO and both firm and year fixed effects are included in the model. Therefore, both ICAP and CASH are insignificant drivers of ROA for male subsamples, but may play a role in explaining returns for female subsamples.

Interestingly, debt is only significant in regressions with male executives included: that is, debt is significant at the 99 percent level in Models 1 and 2, and the male-subsample regressions. The estimates imply that male executives' use of debt explains some movement in ROA: the coefficient varies between -0.160 and -0.218. The variable MTOB varies in significance; it is significant at the 99 percent level only in Model 3M, or the male-subsample regression with firm and year fixed effects.

Based on these results, I conclude that gender does not affect firm performance. R&D expenditure and market value have the greatest effects on ROA, while invested capital, debt, and cash on hand have relatively weak effects. These findings, in context of the event study results, indicate that market perception of female CEO performance is both irrational and inefficient.

6. Discussion, implications, and questions for further research

As suspected, market reaction to female CEO announcements changes over time and with firm size. My findings are in line with those of Lee and James (2007) and Lucey and Carron (2011), who find that the market reacts negatively to female CEO announcements relative to male CEO announcements overall. However, my breakdown of the data by time periods and by firm size allows me to segment the gender effect and study its effect on cumulative abnormal returns. Thus, my findings go further than the results of earlier work in this field.

My rejection of Hypothesis 1 notes that, overall, female CEOs are reacted to negatively by the market. Within the 26-day window surrounding the event, cumulative abnormal returns for female announcements were negative, while the cumulative abnormal return for matched male announcements were positive. This finding directly supports those of Lee and James (2007) and Lucey and Carron (2011) and contradicts those of Gondhalekar and Dalmia (2007), Martin, Nishikawa, and Williams (2009), and Coxbill, Sanning, and Shaffer (2009), who all found no difference.

My rejection of Hypotheses 2 and 3 contribute significantly to the extant literature. To my knowledge, no study has analyzed the effect of gender over time or by firm size. My relatively large sample size allowed me to perform separate event studies for five time periods and four firm-size categories. The comparison of these results is especially important for the field because it shows that bias is dynamic and varies across firm sizes. Revealed bias in the market over time fluctuates greatly; the effect of gender on CAR was especially significant in the periods from 1992 to 1995 and 1996 to 1999. The third period corresponded to a significant increase in female CEOs; at the same time,

the bias measured by CAR seemed to decrease. Before 2000, male CEO announcements created large fluctuations in returns and the effect of female announcements was much smaller. After 2000, female CEO announcements were greeted with a CAR of a similar magnitude to that associated with male CEO announcements.

Furthermore, female CEOs for larger firms are greeted more positively by the market than were their male peers. One reason for this could be the effect of public CEO announcements. The largest companies have highly publicized corporate announcements, so the market may have access to more information about the new CEO. Increased information about the previous experience and qualifications could mitigate the stereotyping and information problems that cause gender bias. For small firms, announcements often take the form of one-line press releases. This could mean that the market sees nothing but a woman's name; the market may be more likely to generalize and make biased assumptions about her ability. Further research into this question could elucidate why the gender difference varies across firm size.

My comparison of female-to-male CEO performance for the same company concludes that gender has no effect on returns; thus, the perceived difference in gender upon CEO announcement is irrational and inefficient. This finding supports the idea that while male and female executives may have some differences in risk preference and investment style, the gender of the CEO has no bearing on the returns of the firm. The results of the event study indicate that the market expects performance to be conditional on gender and this assumption is incorrect.

6.1 Implications

The broader impact of this research is not simply to demonstrate whether or not financial markets are efficient; they are not. According to my work in this thesis, market participants systematically misperceive the capabilities of female CEOs. Rather the broader impact is to compel society to solve the social problem of gender bias (in corporate leadership and everywhere else).

Many people—financial-market participants included—deny that gender bias exists. Indeed, my thesis is motivated by the widely held assumption that markets are generally efficient and, thus, rational investors equipped with all extant and accurate information, do not generally err systematically on, say, the basis of gender. The first step to eliminating this inefficiency—and the misallocation of capital it necessarily provokes—is to own up to it.

As I explain in my literature review, the proximate cause of gender bias is tokenism. Token theory explains why investors perceive women to be less capable than men as corporate leaders. Karsten suggests that, to shed their token status, a minority group must grow to at least 35-40 percent of the total population (1994). Thus, to eliminate gender bias caused by the paucity of female corporate leaders, more women must ascend to such roles. The reasons why women have not done so are, of course, deeply institutionalized. And, to make matters worse, affirmative actions to address the problem may inadvertently contribute to it (Heilman, Block, and Stathatos 1997).

So, the problem remains. Female CEOs are rare. Because they are rare, the market misperceives them as different from male CEOs. If there were more female CEOs, this misperception might abate. However, women are not likely to ascend to CEO if the

market misperceives them as less capable. This negative feedback loop is seemingly impossible to break; it is not. I propose a two-pronged approach. One, investors admit to their irrational bias (and, thus, correct it before it effectively misallocates financial capital). And two, firms implement hiring practices that empower women, thus cultivating a corporate culture that does not favor male-centric behavioral stereotypes in leadership roles.

6.2 Questions for further research

Although my study benefited from a larger sample of data, the small number of female CEOs still limits research in this field. This is both the motivation for this research and its biggest limitation. As time passes and more females are appointed to CEO positions, researchers will gain context. Trends will reveal themselves over time, and bias is easier to measure in retrospect. As I mentioned in the implications section, bias should abate over time as more female CEOs are appointed. Therefore, the time-period methodology that I use in this paper could be extended in the future. Measuring how the bias changes over time is a valuable way to gain insight into why it exists and the mechanisms through which it manifests.

In addition, this research included multiple contributions at once. Future research could compare the individual explanatory power of each. For example, I could utilize the extended event window with an older sample; measure the event study with the small sample window and my larger dataset; etc. Furthermore, I employ a semi-randomly matched male sample. In future research, I hope to utilize propensity score matching methodology to determine if results are conditional on matching methodology.

Finally, linguistic analysis of CEO announcements could shed light on market misperceptions of female CEO ability. My event study shows that the market reacts differently to female CEOs; my performance analysis shows that returns are not dependent on gender. Analyzing the announcements themselves could indicate whether the published information implies anything about future CEO performance. It is possible that press releases use gendered language and phrasing that may cause the market to stereotype the female CEO, contributing to gender-conditional perception of ability.

7. Conclusion

Gender bias is incredibly difficult to study. Because implicit bias may exist unrecognized even by the individual, it is critical to find the correct mechanism to study this irrational perception. In my theoretical framework in this thesis, I use the sociological theory of tokenism and gender bias as well as the Efficient Market Hypothesis to understand how firm returns can reflect investor expectations of female CEOs. Because the EMH asserts that investors act rationally based on all available information, I propose three hypotheses based on market efficiency. Furthermore, I find that returns are independent of CEO gender.

I contribute to the existing literature in three ways. First, I study a larger sample size of female CEOs than previous studies do. Second, I use an extended event study window similar to that of Coxbill, Sanning, and Shaffer (2009). Finally, I conduct event studies in three different ways: by full sample, over time periods, and by firm size. Furthermore, I compare actual male and female performance for these firms, and show that CEO gender has no affect on firm performance.

By studying stock market reactions to CEO announcements through cumulative abnormal returns, I show that gender bias does indeed exist in financial markets. I reject the first hypothesis, concluding that gender bias is evident in the market when the sample is analyzed as a whole. I reject the second hypothesis, concluding that gender bias is evident in the market when firms are grouped by years. Gender bias is evident in nearly every year grouping; moreover, the bias varies over time. Then, I reject the third hypothesis, concluding that gender bias is evident in the market when firms are grouped by size. The bias varies across firm sizes, and female CEOs are reacted to most positively

when they are heading large firms. Finally, I demonstrate that returns are not conditional on gender, concluding that market perception of women is based on incorrect assumptions, not rational expectations of future performance.

While gender bias is inherently difficult to study because of the small number of female CEOs, there remain opportunities for future research. There are more female executives now than ever before, and female CEO announcements are more common. My empirical findings support the idea that token status, or rarity, causes markets to react negatively. While this is currently a problem, because there are still relatively few female CEOs, it could be ameliorated in the future. If female CEOs grow more common, the bias should decrease accordingly. To close, I propose two ways to solve the problem of gender bias in the corporate world.

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APPENDIX

Appendix A: Summary of comparative performance literature

Author	Year	Female n=	Data	Methodology	Findings
Powell and Ansic	1997	unspecified	experiment	psychological experiment	females more risk averse
Atkinson, Baird, and Frye	2003	72	Principia	one and three index models	male and female similar behavior
Wolfers, Justin	2006	64	S&P	portfolio analysis	no difference
Dezső and Ross.	2008	firm-years, unspecified	S&P	regression	males overconfident relative to females
Kolev	2012	64	S&P	portfolio method, risk-adjusted returns	females underperform relative to risk
Huang and Kisgen	2013	116	S&P	measures of risk aversion/confidence	males overconfident relative to females
Khan and Vieito	2013	141	S&P	OLS	females risk averse, better firm performance
Faccio, Marchica, and Mura.	2016	firm-years, unspecified	Amadaeus 250,000	use a variety of matching types	females more risk-averse
Amore and Garofalo	2016	firm-years, unspecified	S&P	OLS	females more risk averse

Appendix B: Summary of existing event study results

Author	Year	Female n=	Data	Methodology	Findings
Lee and James	2007	17	S&P	event study: standard, convenience sample	negative difference
Gondhalekar and Dalmia	2007	50	Russell 3000	event study: Fama-French 3-factor model, random sample	no difference
Martin, Nishikawa, and Williams	2009	70	S&P	event study: single index market model, matched sample	no difference
Coxbill, Sanning, and Shaffer	2009	33	S&P	event study: market, market adjusted, and Fama-French 3-factor model	no difference
Lucey and Carron	2011	77	FTSE	event study: CAPM, random sample	negative difference for female CEO and executive director appointments

Appendix C: EXECUCOMP Abbreviations

Term	Abbreviation	Definition
salary	salary	base salary, in thousands
bonus	bonus	bonus earned during the fiscal year, in thousands
age	age	age as reported
total compensation	tdc1	Total Compensation (Salary + Bonus + Other Annual + Restricted Stock Grants + LTIP Payouts + All Other +Value of Options) in thousands
length		calculated - prior years of service with company
all other compensation	allothtot	All other unspecified compensation, including signing bonuses, life insurance premiums, debt forgiveness, 401k contributions. Valued in thousands
change CEO payment	chgctrlpmt	estimated payment in case of termination to change control in thousands
equity incentive plan value	eip-unearn_val	value of performance-based shares, in thousands
fair value of options	option_awards_FV	fair value of options awarded in the fiscal year, valued in thousands
executive director	execdir	Dummy variable - serves as executive director (1) otherwise (0)
other compensation	othcomp	other compensation benefits like tax reimbursements,discounted stock purchases, gross ups, etc valued in thousands
value of stock awards	stockawards	value of all non-option stock awards in thousands
pct. of total shares outstanding	shrown_tot_pct	percent ownership of outstanding shares (if greater than 1%)
estimated termination payment	term_pmt	estimated payment in case of involuntary termination, in thousands
percent increase in salary	sal_pct	percentage increase in salary from year-to-year
total compensation in SEC filing	total SEC	total compensation reported in SEC filings, in thousands