Discrimination in the Stock Market: Board Gender and Stock Performance

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Abstract

In this paper, we examine whether changes to a public firm’s board of trustees are perceived differently by investors based on the gender of the incoming board member. Scholarly findings on the effect of gender on leadership have been mixed at best. Overall, the evidence seems to indicate that women and men in comparable leadership positions are much more alike than different. Yet, the number of women in leadership positions in the United States (and globally) is still disproportionately low—a phenomenon known as the “glass ceiling.” In August 2017, Norwegian bank Nordea published a study that showed that, by investing in firms that were led by female CEOs or board chairs, an investor could have obtained a stock return that was on average 14% higher than that of the MSCI World Index. Nordea’s study suggests that female CEOs outperform their male counterparts, at least in terms of stock returns. Despite this interesting finding, the current academic literature has failed to find any consistent linkages between leadership gender and firm performance so far. Our study shows that women and men, at least in the United States, are still not created equal in the eyes of investors. Using data from BoardEx and Bloomberg on the composition of U.S. public firm boards for 1992–2017, we find that changes on a firm’s board are consistently perceived as a negative information shock by investors, but the effect of a woman entering the board is disproportionately more negative.

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1 Introduction

For ten years from 2007 to 2017, McKinsey & Company published annual “Women Matter” reports on gender diversity and consistently found a correlation between the presence of women in top management and/or governance and corporate financial performance. The McKinsey research team found a difference of 47% in return on equity between the firms with the most women on their executive committees and those with no woman on those same committees (McKinsey & Company, 2017). Similarly, in September 2016, the Credit Suisse Research Institute published its most recent report on gender diversity and corporate profitability. For a sample of more than 3,400 companies worldwide, Credit Suisse found that corporations with at least one female board member generated a compound excess return of more than 3% per year for their investors (Dawson et al., 2016). Again, in August 2017, Norwegian bank Nordea published a study that showed that, by investing in firms that were led by female CEOs or board chairs worldwide, an investor could have obtained a stock return that was on average 14% higher than that of the MSCI World Index (Nordea, 2017). Report after report from consulting firms and think tanks seem to support the idea that having more female representation on corporate boards of directors is associated with better financial performance. Yet, in the United States, women still hold only about one fifth of corporate directorships.

In September 2018, California became the first American state to follow more than a dozen European countries and adopt gender-based quotas for the boards of directors of publicly held companies in the state. By the end of 2019, all boards of directors of

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1 For example, women held about 22% of directorships at MSCI ACWI Index companies in the United States as of 2017 (Eastman, 2017) and about 18% of directorships at Russell 3000 companies as of 2019 (Green et al., 2019).

2 It is unclear what the effect of gender-based quotas have been on firm performance in the European countries that have adopted such laws. Two studies of the Norwegian quotas (Nygaard, 2011; Ahern and Dittmar, 2012) reach different conclusions. Ahern and Dittmar (2012) find large negative effects of the quota on firm values (Tobin’s $Q$), arguably because the new female directors were younger and less experienced. Nygaard (2011), on the other hand, finds that the impact on firm value was contingent on levels of firm-specific information asymmetry. Ferrari et al. (2016), in a study of Italian companies, find no impact of the quotas on firm performance, but find that markets respond
publicly held companies based in California must have at least one woman director, and by 2021, they must add more women based on the overall size of the board.\footnote{An act to add Sections 301.3 and 2115.5 to the Corporations Code, relating to corporations,” Cal. Senate. B. 826 (2017-2018), Chapter 954 (Cal. Stat. 2018).} Despite this popular push to be more inclusive of women in the corporate world, the academic literature on gender and leadership remains divided on various questions, including whether the gender of top managers (Hoobler et al., 2018) and board members (Post and Byron, 2015; Pletzer et al., 2015) actually has any impact on firm performance.

In this paper, we hypothesize that any new appointment to a firm’s board, regardless of the person’s gender, will result in negative abnormal returns because a new board appointment is a shock, a new piece of information that investors must include in their information set. Such a shock introduces uncertainty which, in general, investors will price negatively (Savor, 2012; Epstein and Schneider, 2008). When studying the impact of a new board member’s gender on stock performance, two competing hypotheses present themselves. On the one hand, the literature tells us that men and women lead in similar ways and tend to be comparably effective. So we should expect that the gender of a new board member will be irrelevant to stock returns—overall, men and women are just as competent as leaders and the information shock of introducing a new board member is the same regardless of the gender of the person. On the other hand, the literature also tells us that prejudice remains an issue and that women, even if they may not be less competent at all in reality, may be perceived as such by some and be “penalized” based on those perceptions. If that is the case, then we should expect to find that appointing a female board member would actually result in more negative abnormal stock returns than appointing a male board member.

In line with our first hypothesis, we find that, whenever someone new is appointed positively to the announcement of new female board members for firms that had few women before the introduction of the law. In a qualitative study of France’s largest firms, Rosenblum and Roithmayr (2014) find that board members themselves thought the board decision-making process had changed, but not the ultimate board decisions, suggesting that quotas had no impact on firm performance. In reality, the authors believe that decisions have in fact been different, but because the new board members were outsiders, not because they were women.

\footnote{We define “abnormal” as the difference between status quo return and the return obtained because of an event (in this case, a new board member joining the board).}
to a board, the resulting abnormal returns are, on average, negative. Interestingly, when we break down the events into female/male board members starting their terms, we find that the abnormal returns are disproportionately more negative when a woman is appointed to a firm’s board than when a man is appointed, especially in the shorter event windows. Hypothesis tests show that the two average abnormal returns are statistically significantly different from one another in the short term, indicating that there may be some gender discrimination by investors in financial markets.

To our knowledge, this paper analyzes the most comprehensive dataset of board memberships of publicly held companies in the United States to date. We chose to study entire board of directors, and not only CEOs, because we believe it improves our ability to determine whether systematic discrimination exists in the stock market. The board of directors not only includes the entire executive team (and as such, any movements on the board will also capture movements of executives such as the CEO, CFO, CIO, and so on), but the board also plays a critical role in determining the vision and strategy of the firm, which will arguably impact firm performance in significant ways. Another contribution of this paper is that, in addition to considering stock performance during a female board member’s tenure, we examine other firm performance measures (such as earnings per share) in an attempt to determine whether negative abnormal stock returns are truly revealing poorer firm performance or whether they suggest unwarranted discrimination against women. For example, if a firm was not performing well and chose to appoint a woman to its board as a result, we should expect negative abnormal returns, but not because of the presence of this new woman. The source of the abnormal return would be the past poor performance by the company. As such, we would conclude that the market is not discriminating against women. Including different firm performance measures allows us to avoid attributing stock movements to board member gender when other causes are more plausible. Theoretically, the paper contributes to a variety of literatures in management, finance, and psychology, that are concerned with the effects of gender diversity. Practically, it reveals that, although we have come a long way, gender-based discrimination is still alive and well in the
2 Literature Review

The basic premise of our argument is that investors like certainty. When a company changes something, for instance the members on its board of directors, it creates an information shock. Suddenly, uncertainty increases and the firm’s future decision-making is less predictable. Therefore, we expect investors to respond negatively initially (Savor 2012; Epstein and Schneider 2008).

Hypothesis 1. Any new person (regardless of gender) joining the board of directors of a firm will result in negative abnormal stock returns for the firm.

Our main value of interest in this paper, however, is the gender of this new board member. Does the fact that the new board member is a woman lead to a different response in terms of stock return? Below, we discuss the literature on gender diversity in leadership and draw some hypotheses from its findings.

2.1 Do women and men lead differently? Are women more or less effective leaders than men?

Some popular books aimed at managers explicitly argue that men and women do lead differently (Helgesen 1990; Hennig and Jardim 1976; Rosener 1993; Book 2000). However, in the academic literature, many scholars conclude that men and women leaders are not that different at all, and that the few differences that separate them tend to be quite small in practice (Dobbins and Platz 1986; Donnell and Hall 1980; Eagly and Johnson 1990; Powell 1990; Van Engen et al. 2001; Gipson et al. 2017). Characteristics on which studies find no difference across female and male leaders include initiating structure/task-oriented style and consideration/people-oriented style (Dobbins and Platz 1986; Eagly and Johnson 1990) and leadership frame orientation
(Bolman and Deal 1991, 1992). That does not mean that scholars find absolutely no differences across men and women in leadership roles. For example, contrary to popular expectations, some studies have shown that women tend to be more assertive and task-oriented than their male counterparts (Eagly and Carli 2003, Kaiser and Wallace 2016). Women also tend to adopt a more democratic/participatory style of leadership (Eagly and Johnson 1990) and tend to be more transformational leaders than men (Eagly et al. 2003, Bass et al. 1996). But again, those differences tend to be small in practice.

In terms of leadership effectiveness, the argument has been made in the literature that the transformational style of leadership is more effective than the transactional and laissez-faire styles (Lowe et al. 1996). Since, as we discussed above, research shows that women leaders tend to be more transformational than men, one could conclude that women tend to be more effective leaders (Eagly and Carli 2003, Eagly et al. 2003). Eagly et al. (1995) argue that context matters for effectiveness though: both men and women are less effective in leadership roles that are not congruent with their gender roles. Another factor that one must consider is the “glass cliff” phenomenon: women (and minorities) tend to achieve high-profile positions (including board seats (Mulcahy and Linehan 2014)) in companies that are already performing poorly. Ryan et al. (2011) find that people see feminine traits as more desirable for the ideal manager or a company that is failing (what the authors refer to as “think crisis–think female”), with the implication that the women will be at a disadvantage in demonstrating effectiveness before they even begin their work and will likely be blamed for organizational failure.

In finance, leadership effectiveness is often measured through various measures of firm financial performance: exceptional leaders will lead their firms to outperform other firms on indicators such as return on assets (ROA), returns on equity (ROE), Tobin’s $Q$, and stock returns. Studies of CEO gender’s impact on firm performance, unsurprisingly, find mixed results depending on the measures and methods they use (Hoobler et al. 2018, Gipson et al. 2017). Wolfers (2006) finds no differences in stock returns for female-headed firms in the United States while Lee and James (2007) find
a negative reaction by investors. Many other studies use measures other than stock returns to proxy for firm performance. Studies of large U.S. firms find, respectively, that having a female CEO is associated with higher price to earnings, ROI, and ROA (Jalbert et al., 2013) and a higher ROA (Khan and Vieito, 2013). Smith et al. (2006) in Denmark and Shrader et al. (1997) in the United States both find a mix of positive and insignificant effects. In a study of Indonesian firms, Darmadi (2013) finds a negative effect of female representation on both accounting and market performance, a result that could be explained in part by the country’s culture, which is less egalitarian in terms of gender (Hoobler et al., 2018). Dezsö and Ross (2012) focus on how contextual factors moderate the relationship between women top managers and firm performance and conclude that women benefit firm performance only when firms’ strategies are focused specifically on innovation.

A large literature also focuses on the connection between female board representation and firm financial performance. Generally, the business case made for gender diversity on the board of directors is that women bring different experiences, knowledge, values, and networks to the board, affecting both the information that the board possesses as well as the way in which the board makes decisions. The additional information and increased deliberativeness and critical thinking are hypothesized to improve firm outcomes. Yet, Post and Byron (2015), in a meta-analysis of 140 studies, conclude that female board representation only has a small positive effect on accounting returns, and overall no effect on market performance. They do find, though, that gender parity in a country mediates the relationship with market performance: when there is more gender parity in a country, female board representation is positively related to market performance. A different meta-analysis, this time of 20 studies (Pletzer et al., 2015), finds that the mere presence of women on boards of directors has no significant effect on firm performance. In sum, it appears that female representation on boards has little to no effect on firm performance. But although increasing the number of women on boards does not improve firm performance in any meaningful way, it also does not

5Some also make the ethical case that gender parity is a worthwhile goal in and of itself.
affect performance negatively.

In sum, the evidence seems to suggest that female leaders are no less skilled or effective than their male counterparts. For the most part, gender of the leadership team does not appear to have a consistent significant impact on firm performance. Based on this conclusion, we propose the following hypothesis:

**Hypothesis 2.** Whether a new woman or a new man joins a firm’s board of directors will make no difference in the magnitude of negative abnormal stock returns for the firm.

2.2 Is there prejudice/discrimination against female leaders?

Despite evidence that women and men tend to behave similarly in leadership positions and that women are no less effective as leaders, gendered perceptions of leadership ability still persist. In general, stereotypes about gender roles depict men as more “agentic” (rational, confident, decisive) and women as more “communal” (kind, helpful, caring, sensitive) (Deaux and Kite, 1993). Stereotypes not only describe male and female traits, but also prescribe which traits men and women should display (for instance, an aggressive woman is often viewed negatively because she is not being “feminine enough”). Because executive and management positions are seen as “male” jobs and are defined overwhelmingly in masculine terms (Schein, 1973), women’s abilities and skills are seen as a bad “fit” for the job description (Heilman, 1983; see also Eagly and Karau, 2002). Both management students and managers ascribe fewer leadership abilities to women than to men and see masculine traits as more desirable (Sczesny, 2003; Ryan et al., 2011; Schein, 2001). Lee and James (2007), in a study similar to the one we are proposing here, find that investors react more negatively to the announcement of a female CEO than to the announcement of a male CEO.

Along the same lines, much research concludes that female leaders tend to receive lower evaluations than their male counterparts for the same behaviors (Eagly et al., 1992; Kulich et al., 2007; Heilman, 2001, 1983; Eagly and Karau, 2002). Identical
behaviors by women and men also tend to be interpreted differently. Yet, some scholars find that subordinates do not evaluate their leaders differently based on gender (Carless, 1998) and others even find a slight bias in favor of female leaders from coworkers (Kaiser and Wallace, 2016; Paustian-Underdahl et al., 2014; Gipson et al., 2017) also note that, when we reach more senior-level positions, women tend to be evaluated more positively than their male colleagues. It is possible that those differences in findings may be due at least in part to a changing perception of women and their leadership abilities over time, as more women reach upper management levels and stereotypes change (Duehr and Bono, 2006; Eagly and Carli, 2003; Schein, 2001).

Based on this literature, we propose the following hypothesis:

**Hypothesis 3.** A new woman joining the board of directors of a firm will result in more negative abnormal stock returns for the firm than a new male board member joining.

### 3 Model

We are interested in determining whether the information shock caused by the entry of new members onto boards of public corporations is perceived negatively by investors. Perhaps more interesting, however, is the question of whether the entry of women onto boards of public corporations results in negative abnormal returns that are different from those of male entrants. The model for this paper, therefore, is one of information shocks and whether those information shocks (by way of male vs female board members) are priced differently by investors in the stock market.

\[^{6}\text{Heilman (2001) gives the example of frequent phone conversations. If a woman talks frequently on the phone, it is assumed she is “slacking off” whereas a man who is frequently on the phone is “productive.”}\]
3.1 Information shocks

The concept that a firm’s stock will be “shocked” by new members joining the board of directors is nothing new (Denis and Sarin, 1999; Dah et al., 2014; Lin et al., 2003). The question here is whether the gender of the person entering the board changes the information shock in any way.

We can think of asset prices using the following pricing equation:

\[ P_{i,t} = E_t[m_{i,t+1}x_{i,t+1}] \]  

(1)

where \( P_{i,t} \) is the current stock price for firm \( i \) at time \( t \), \( E_t \) is the expectation of the individual pricing the asset at time \( t \), \( m_{i,t+1} \) is called the stochastic discount factor which acts as the uncertainty and discount factor for the pricing equation for firm \( i \), and \( x_{i,t+1} \) is the future payout of firm \( i \). When deciding the price of an asset, the investor takes into consideration the amount of time between the moment she is pricing the asset, say \( t \), and the future, say \( t + 1 \), as well as the uncertainty that will exist between those two time periods (captured by stochastic discount factor \( m_{t+1} \)). This is multiplied by the future payment that the firm will make to the investor. In other words, this equation adjusts payments in the future to take the riskiness of future payoffs and the time value of money into consideration. The investor, however, will price her asset using an information set that is available to her at time \( t \) when she is pricing the asset. As such, we can re-write equation (1) to reflect that information set as follows:

\[ P_{i,t} = E_t[m_{i,t+1}x_{i,t+1}|I_t] \]  

(2)

where we condition the expectation on the investor’s information set at time \( t \) which is depicted by \( I_t \). As part of \( I_t \), information about the firm’s board is available to the investor. A change in a firm’s board would be viewed as a change in the investor’s information set. This change is likely to affect the uncertainty of future payoffs, which will be reflected in the pricing equation. Two questions follow: 1) is this “additional”
information viewed positively or negatively by the market? and 2) is the information set adjusted if, for example, a woman enters the board and not a man?

In addition, we ask whether the investor’s information set is consistent with the reality of the firm. Ultimately, we are interested in whether the firm performed better after introducing a new board member. We test the model using event studies, which we discuss in the next section.

3.2 Event study

Event studies are commonly used in finance (MacKinlay, 1997; Fama, 1998; Kothari and Warner, 2007) as a way to isolate the effects of a specific event over a certain time frame. They offer a way to treat an event like a natural experiment. In social science, it is very difficult for researchers to conduct natural experiments where they can control for all outside factors. Event studies are the closest means to determine the effect of a single event while limiting the possibility of other factors affecting the variable of interest. In this paper, we use event studies to determine the short-term effect of adding a new board member (male or female) to the board of a public firm on the firm’s stock return.

We first use the market model, which assumes a linear relationship between the market’s return and the return of an individual’s assets as follows:

\[ R_{i,t} = \alpha_i + \beta_i R_{m,t} + \epsilon_{i,t} \]  

where \( R_{i,t} \) is the return for asset \( i \) at time \( t \), \( \beta_i \) is a firm’s exposure to the overall market return, and \( R_{m,t} \) is the return of the market at time \( t \) where the market return was defined as the value-weighted return of the market indices. The market model is a simple representation of a firm’s expected return as it relates to the overall market’s return. Every asset’s return is, in essence, going to be a function of the overall market and characteristics (or riskiness) that are unique to the firm. This “uniqueness” is represented by the beta coefficient in the regression. Using the market model, we can
then define our measure of abnormal return as follows:

\[ AR_{i,t} = R_{i,t} - \hat{\alpha}_i - \hat{\beta}_i R_{m,t} \quad (4) \]

where \( AR_{i,t} \) is the abnormal return for firm \( i \) at time \( t \), \( R_{i,t} \) is the realized return of asset \( i \) at time \( t \), and the last part of the right hand side of the equation, \( \hat{\beta}_i R_{m,t} \), is the expected return from the asset that we obtained from the market model in equation 3.

Using the market model is only one possible way to define abnormal returns. We also conduct robustness checks by estimating “normal” returns using both the capital asset pricing model (CAPM) (French 2003; Sharpe 1964; Lintner 1965; Mossin 1966) and the Fama-French three-factor model (Fama and French 1993). We can define the CAPM similarly to the market model as follows:

\[ R_{i,t} - r_{f,t} = \alpha_i + \beta_i (R_{m,t} - r_{f,t}) + \epsilon_{i,t} \quad (5) \]

In equation 3, we are examining the relationship between an individual asset’s return and the return on the market. In equation 5, we are relating the excess return of an individual asset, \( R_{i,t} - r_{f,t} \), to the excess return on the market, \( R_{m,t} - r_{f,t} \). The excess return is defined as the difference between the return of a given asset and that of a riskless asset \( r_{f,t} \).

We also estimate expected returns using the Fama-French three-factor model as follows:

\[ R_{i,t} - r_{f,t} = \alpha_i + \beta_{i,1} (R_{m,t} - r_{f,t}) + \beta_{i,2} SMB_t + \beta_{i,3} HML_t + \epsilon_{i,t} \quad (6) \]

where equation 6 is the same as equation 5 plus controls for certain characteristics known to affect asset returns (“small-minus-big” or SMB and “high-minus-low” or HML). These two variables represent the size effect and the value effect of stock returns, respectively. Overall, equations 3 through 6 each give us a different measure of “normal” returns that we can then use to characterize abnormal returns in our event
study.

To determine the overall effect of the event (i.e. arrival of a new board member) on a stock, we need to define the cumulative abnormal effect on that stock. We can define cumulative abnormal returns by summing all abnormal returns during the time interval of interest as follows:

\[ CAR_i(T_1, T_2) = \sum_{t=T_1}^{T_2} AR_{i,t} \]  

(7)

where \( AR_{i,t} \) is defined as the abnormal return for company \( i \) at time \( t \). This measure is only an estimate and does not tell us whether or not it is statistically significantly different from zero. If the effect of our event (change in board members) were zero (meaning that the average abnormal return was equal to zero), we would conclude that there was no effect overall from introducing a new board member. We test the null hypothesis of zero cumulative abnormal returns using the following z-test:

\[ Z = \frac{CAR(T_1, T_2)}{\left(\sigma^2_i(T_1, T_2)\right)^{1/2}} \]  

(8)

The results from any single firm are not particularly enlightening when we are trying to determine the average effect of changing board members on a stock’s return. Instead, we want to know the average effect for all firms. We take the average of the cumulative abnormal returns for all events and all firms in the sample. To do this, we define the average cumulative abnormal return as follows:

\[ CAAR(T_1, T_2) = \frac{1}{N} \sum_{i=1}^{N} CAR_i(T_1, T_2) \]  

(9)

where \( N \) is the number of firms in the sample and \( CAR \) is the cumulative abnormal return defined in equation [7]. We can use the cumulative average abnormal return (CAAR) to perform a hypothesis test using, again, a simple z-score test determining whether the average cumulative abnormal return across all firms is statistically
significantly different from zero as follows:

$$Z = \frac{CAAR(T_1, T_2)}{s(CAAR(T_1, T_2))} \quad (10)$$

where $CAAR$ is the cumulative average abnormal return defined in equation [9] and $s()$ is the standard deviation of the CAAR. We define the standard deviation of the CAAR as follows:

$$s(CAAR(T_1, T_2)) = \sqrt{\frac{1}{N^2} \sum_{i=1}^{N} s_i^2(T_1, T_2)}$$

where $s_i^2(T_1, T_2)$ is the firm’s variance. Once we have determined if the cumulative abnormal return is different from zero, we can turn to comparing the results for men to the results for women. To do so, we need to derive the unpaired two-sample t-test which is defined in the next section.

### 3.3 Unpaired two-sample test

When a man joins the board of a public company, is it different from when a woman joins for investors? Since the cumulative average abnormal return results are unbalanced (we have means for two samples that are of different sizes), we need to use an unpaired two-sample t-test [Greene 2003]. The unpaired two-sample t-test is defined as follows:

$$t = \frac{CAAR_M - CAAR_F}{s^2\left(\frac{1}{n_M} + \frac{1}{n_F}\right)} \quad (11)$$

where $CAAR_M$ is the cumulative average abnormal returns for men, $CAAR_F$ is the cumulative average abnormal return for women, $n_M$ is the sample size for the CAAR of the male board members, $n_F$ is the sample size for the CAAR of the female board members, and finally the $s^2$ is the variance of the two sample means. We define the variance, $s^2$, as follows:

$$s^2 = \frac{\sum_{i=1}^{n_1}(CAAR_{i,M} - \bar{CAAR}_M)^2 + \sum_{j=1}^{n_1}(CAAR_{j,F} - \bar{CAAR}_F)^2}{n_1 + n_2 - 2} \quad (12)$$
where all of the variables are defined in the same way as before. The only new variables are the averages for the CAAR of men and women, \( \overline{CAAR_M} \) and \( \overline{CAAR_F} \), respectively.

4 Data and Results

4.1 Overview of data

Three major types of data are necessary to conduct this analysis: firm board data, firm investment performance data, and other firm performance data. All data were obtained from the Wharton Research Data Services (WRDS). Board data originated from the BoardEx database. Investment performance data came from the Center for Research in Security Prices (CRSP) database. Finally, firm performance data, such as earnings-per-share (EPS) and revenue, came from the Compustat database. Notice here that we distinguish between firm performance as it relates to a firm’s stock price and firm performance as it relates to a firm’s EPS and revenues. We use both to ensure that our results are robust to the realities of the stock market and not simply a function of the environment. For example, if, on average, we find that investors appear to value a woman entering the board negatively, but that firm’s EPS or revenue also decreases in the same event window, then we would argue that discrimination did not actually take place because the valuation was not about the gender of the board member, but about actual firm performance.

The datasets span from January 1, 1992 to August 1, 2017. During the sample period, we analyzed all board movements (male or female). When a new board member enters the firm, this creates a “start date” for that particular individual in that particular firm. If the individual leaves the firm or their term ends, it creates an end date for that individual at that firm. Individuals can be on the boards of several firms at any given time. We subset the sample to analyze only public firms in the United States. Since we are interested in gender-based discrimination, we create two subsamples: one where the events are women entering the boards and one where the events are men.
entering the boards.

4.2 Descriptive statistics

We use a daily time interval for the analysis. The total sample size for this analysis is 21,347,981 total daily observations. The descriptive statistics for the stocks and market returns are in Table 1 below.

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<th>(4)</th>
<th>(5)</th>
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Table 1: Stock Summary Statistics

Stock price represents the descriptive statistics for all of the stock prices in our sample, stock returns represent the stock returns for all of the firms in our sample, and market return is the descriptive statistics for the value-weighted market returns used in our market model. The summary statistics show that, as we would expect, on average, the stock return and the standard deviation are higher than for the market return because the market does not price unsystematic risk.

Next, we turn to summary statistics for board member entries and exits. In total, we analyzed the boards of 8,049 public firms in the United States. In our sample, there were 2,680 individual events of women entering boards and 5,287 individual events of men entering boards. “Individual events” here refer to instances where at least one woman (or man) is entering the board on a given day. As such, if twenty women entered the board of a single company on a given date, that would be coded as a single event. Figure 1 shows a graph of the cumulative events of women entering boards.
Figure 1: Cumulative Events – Female Board Members

Figure 1 starts in the 1970s to show the dramatic increase over time. As we would expect, with time, the number of women entering the boards of directors of public companies increased significantly. These numbers coincide with the participation rates of women in the workforce (albeit with a lag). According to the Bureau of Labor Statistics, the percentage of women in the workforce has increased steadily from around 30% in the 1950s to the current 65%. As the number of women in the workforce increases, we would expect an increase in women on firm boards.

4.3 Empirical results

For an event study, we first use a model to calculate an expected return (or status quo return), which is referred to as the estimation window. Then, when an event happens (in this case, a new board member starts), we estimate the return that is considered to be “abnormal” (above or below the expected return from the estimation window). From there, we can conduct a hypothesis test to determine if the abnormal return that we obtained in our event window is statistically significantly different from zero.
We include event windows over different horizons to capture the immediate, medium, and long-term effects of appointing a new person to a board. The event windows are: 2 days, 30 days, 90 days, 180 days, and 360 days. All event windows also include the day of the event and two days prior to the event. For example, for the 2-day event window, we are conducting the analysis on 5 days total (two days before, the day of the event, and 2 days after the event) (Boehmer et al., 1991; McWilliams and Siegel, 1997). The following diagram explains the estimation procedure graphically.

![Figure 2: Event Window](image)

where the period in figure 2 from $T_0$ to $T_1$ is the estimation window and the period around the event (at time 0) between $T_1$ and $T_2$ is the event window.

The first set of results examines appointments of women to firm boards. The second set of results analyzes appointments of men to firm boards. We choose to also analyze the appointment of men to firm boards because we want to know if the effect of appointing a women is different from that of appointing a man.

The tests are defined as follows:

$$H_0 : CAAR(T_1, T_2) = 0$$

$$H_1 : CAAR(T_1, T_2) \neq 0$$

We are testing whether or not the cumulative average abnormal return is significantly different from zero. From there, we can estimate whether the expected abnormal return is positive or negative.
4.3.1 Market Model

As noted above, we expect that appointing a new person (regardless of gender) to a board will cause increased uncertainty. That should be reflected in the information set that investors and analysts use to forecast the future performance of a firm, leading to a negative shock in pricing. However, we don’t know if investors will react differently if the new person on the board is a woman. On the one hand, research tells us that women leaders are as, if not more, qualified and competent as men leaders, which suggests that investors should be indifferent about the gender of new board members (or even possibly favor women). On the other hand, research also tells us that stereotypes about women persist, suggesting that the appointment of women to boards of directors might be perceived more negatively than the appointment of men and affect stock prices accordingly. This is what this subsection aims to investigate. The first set of results (shown in table 2) are for the 2-day event window.\(^7\)

<table>
<thead>
<tr>
<th></th>
<th>(1)</th>
<th>(2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>CAAR</td>
<td>M</td>
<td>F</td>
</tr>
<tr>
<td>Constant</td>
<td>0.000532</td>
<td>-0.00405**</td>
</tr>
<tr>
<td></td>
<td>(0.00127)</td>
<td>(0.00204)</td>
</tr>
<tr>
<td>Observations</td>
<td>5,287</td>
<td>2,680</td>
</tr>
</tbody>
</table>

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 2: 2-Day Event Window

For the 2-day event window, the CAAR (cumulative average abnormal return) for the men and the women in our study are quite different. The coefficient for the women’s CAAR is statistically significant and quite economically significant: it represents a yearly abnormal return of approximately -50.4%. In other words, a public firm adding a woman to its board can expect to get a stock return that is about half of the return it

\(^7\)Recall that our 2-day event window includes a total of five days: two days before, one day during, and two days after the event.
would have gotten if it had not changed the board members, all else equal. The men’s 
CAAR for the 2-day window is not statistically significant.

The second set of results (shown in table 3) is for the 30-day event window. The 

\[
\begin{array}{cc}
(1) & (2) \\
CAAR_M & CAAR_F \\
\hline
\text{Constant} & -0.00553 & -0.0140** \\
 & (0.00391) & (0.00564) \\
\text{Observations} & 5,275 & 2,671 \\
\end{array}
\]

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

Table 3: 30-Day Event Window

For the 30-day event window, the two CAARs are again quite different. The coefficient for the women’s CAAR is statistically significant at the 5% level while the coefficient for the men’s CAAR is still not statistically significant. The coefficient for the women’s CAAR is quite substantive at approximately 1.4%. This is a substantive amount when we consider that, on average, the market has a return of approximately 10% per year.

The third and final set of results (shown in table 4) is for the 90-day event window. The 

\[
\begin{array}{cc}
(1) & (2) \\
CAAR_M & CAAR_F \\
\hline
\text{Constant} & -0.0296*** & -0.0437*** \\
 & (0.00972) & (0.0138) \\
\text{Observations} & 5,259 & 2,659 \\
\end{array}
\]

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

Table 4: 90-Day Event Window

8Recall that our 30-day event window includes a total of 33 days: two days before, one day during, and 30 days after the event.
9Recall that the 90-day event window includes a total of 93 days: two days before, one day during, and 90 days after the event.
For the 90-day event window, the gap between the two CAARs is starting to narrow. Both coefficients are now statistically significant. The men have a CAAR of about 3% while the women have a CAAR of about 4.4%. In other words, the coefficient for the women is about 1.5 times larger than that of the men. Although this is still a sizable difference, the gap between the two is getting smaller.

Next, we turn to the results for the unpaired two-sample t-test. For the 2-day event window, we can reject the null that the mean of both samples are equal (p-value = 0.0474). For the 30-day and 90-day windows, we fail to reject the null that the two means are equal. In simple terms, this means that men’s and women’s abnormal returns are statistically significantly different immediately after a new person enters the board. However, that difference dissipates as the event window becomes longer. As such, it would appear that there is some discrimination in the stock market initially against women entering the boards of directors of public companies. However, that discrimination goes away as investors see that, on average, women are not the information shock that they initially perceived them to be.

### 4.3.2 Capital Asset Pricing Model

–section to be completed–

### 4.3.3 Fama–French Factor Model

–section to be completed–

## 5 Application

Perhaps the most striking way to illustrate the significance of the results above is to present a real-world application. Let us assume that we short a company’s stock two days before a woman board member starts her new position. We simulate holding the investment for durations that mimic our event windows. Figure 2 shows the timing of
the investments. In that figure, $T_1$ represents when we invest in the firm (in our case, with a negative investment or “short”) and $T_2$ is when we divest from our investment. The goal is to “capture” the pricing anomaly of the event being studied in this paper. We can complete the same exercise for men starting new board positions and use an unpaired two-sample t-test to determine whether the profits/losses from the strategy are statistically significantly different from each other. Ultimately, we are showing that, by leveraging investors’ discriminatory behavior, we can obtain large positive returns.

–section to be completed–

6 Conclusion

Next steps:

• Divide our sample into shorter time periods to determine if perceptions of women have become more positive over time

• Study the effects of gender on revenue and earnings per share

• Robustness check: recalculate “(ab)normal” returns using the CAPM and the Fama-French factor model

–section to be completed–
References


