

WOMEN ON BOARD AND FIRM PERFORMANCE

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Abstract

This paper analyzes whether having a woman on the Board of Directors can affect a North American firm's performance. We compare firms with and without female directors on the board and assess their performance. Our two contradicting results—namely, that the presence of women on board negatively affects a firm's performance and that firms with women on board outperformed ones without women on board—show that further research is needed to verify the true nature of this relationship.

Keywords: Gender on Board; Firm Performance; Directors;

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1. Introduction

In recent years, issues related to diversity and inclusion have received considerable attention in the media and by investors. Gender diversity in particular has been a widely debated topic, as women have often been excluded from society in various ways for thousands of years. However, in the last century, with the advancement of women rights across the world, and especially in the developed world, there have been calls for the inclusion of women in all facets of business life, including the running of public corporations. The proponents of women's rights suggest that women can increase value for firms by providing a fresh perspective for valuing projects and investments that differs from men and provide a more cautious—and less risky—view of the economic environment. However, whether on-board gender diversity can have a positive effect on a firm's performance is still very much an open question.

A significant volume of research shows that the corporate on-board rate of women has increased worldwide in recent years. In Canada, the percentage of women directorship was just 12.9% in 2010 but increased to 25.8% in 2017 (Catalyst, 2018). Similarly, in the United States, the percentage increased from 12.3% to 21.7% between 2010 and 2017 (Catalyst, 2018). One reason for this substantial growth is that an increasing number of companies have implemented specific ratio regulations for having more women on board. According to Catalyst (2018), the ratio of firms with such regulations (34%) is almost double compared to that of firms with no specific targets (18%). In Europe, regulators are implementing legal quotas to justify imbalances in gender ratios (Isidro & Sobral, 2015). Meanwhile, investors, rather than simply focusing on increasing profits, should consider whether having more women on board can contribute value to society, which can potentially yield a higher return to the economy at large. In light of this growing trend,

there have been questions arising regarding whether a higher ratio of women can truly have a positive impact on a firm's performance.

Our paper is inspired by previous research on this topic, particularly since two recent studies arrived at opposite conclusions. According to Sila, Gonzalez, and Hagedorff (2016), there is no significant differentiation in terms of performance between a higher female director ratio compared to a higher male director ratio; however, Isidro and Sobral (2015) found that female directors on board can indirectly boost a firm's financial performance. Although different decision-making styles between men and women can affect the level of operating risks, which in turn may affect a firm's growth (Sila et al., 2016), it cannot be ignored that ethical and social compliance is also a factor that influences a firm's value (Isidro & Sobral, 2015). Our research contributes in furthering the discussion on whether gender ratio can influence a firm's performance.

In order to test whether or not women on board contribute value, we used four approaches. The first approach analyses whether a firm's annual abnormal return is affected by having a female director on its board. The second approach divides an individual firm's return based on two different regimes, one with female directors and one without female directors, and tests the difference in the abnormal return between these two regimes. For the third approach we conducted a regression analysis that includes a women "factor" as a possible additional variable that can affect returns. Finally, the last approach involves creating two calendar time portfolios based on gender and comparing the two returns. Based on these four approaches, we found two different results: 1) the presence of women on board is a negative factor to a firm's performance and 2) firms with women on board outperformed ones without women on board.

1.1 Literature Review

There are many different aspects to conducting research on and evaluating firm performance. For instance, financial performance, such as return on assets and return on equity, are solid numbers that are easily identified. However, there are some intangible aspects, such as social responsibility and reputation, that we will ignore because they do not show up directly in a balance sheet. As the public increasingly realize how important women are to society, firms that balance the ratio of male and female employees tend to have better reputations than ones with an imbalanced ratio. A firm's reputation and social responsibility are factors that can influence a firm's value in the long run. Moreover, the different managing styles and operating behaviours of the board of directors will influence a firm's performance. For example, a risk lover investor would be willing to invest in a firm that adopts riskier operating behaviours, which can yield higher financial performance in the short run. On the contrary, investors who are looking for stable returns would focus more on building the firm's social responsibility and reputation.

According to a study by Sila et al. (2016), there is no evidence to support that a higher female ratio on board affects equity risk. Their sample is based on 13,581 observations that covered 1,960 firms from 1996 to 2010. They start their study with debates on the correlation between risk-taking behaviours and gender diversity on board and found two biased resources. The first biased unobservable resource they identified is how firms respond to corporate social responsibility. Essentially, the more considerations there are about corporate social responsibility compliance, the more demand there is for female directors. Moreover, female directors are more likely to want to work for socially responsible corporations. The second biased resource is that a corporation's overall risk level can influence gender diversity while being affected by gender diversity at the same time. For instance, a higher on-board female ratio can decrease the equity risk level, while

female directors are appointed to adjust historically high equity risk by being more conservative. After eliminating biased resources, the researchers concluded that there is no evidence to support that on-board gender diversity affects equity risk. However, one interesting finding is that gender ratio is often revealed in firm-risk-related policies (Sila et al., 2016). For investors, evaluating equity risk based on gender diversity in the boardroom is a different aspect that involves decision-making other than focusing on profit numbers. A higher female ratio on board is favourable for risk-averse investors, while risk-taking investors prefer male-oriented boardrooms. However, Sila et al. study is only limited to the topic of risks and decision-making, and there are other factors that need to be evaluated regarding how gender ratio on board can influence firm performance.

One research study conducted by Isidro and Sobral (2015) indicates that women on board have an indirectly positive effect on a firm's value. With regulators implementing the required female directors on-board rate, it seems that many debates on how females can influence a firm's value never settle on a firm answer. Therefore, in an attempt to determine a clear answer, Isidro and Sobral focus on both the direct and indirect valuation models. After an estimation of large European firms, they did not find a direct causality between women on board and a firm's value. However, since return on sales, return on assets, and compliance to corporate social responsibility were positively influenced by the presence of women on board, they concluded that the presence of women on board can boost a firm's value (Isidro & Sobral, 2015). Using a different perspective that focuses on both direct value and indirect value, their research takes social responsibility and ethics into consideration as opposed to only analysing numbers. Since an increasing number of women are playing essential roles in business, their contributions can no longer be ignored by the public. Moreover, investors are paying more attention to social responsibility and ethical standards,

so it is reasonable to conclude that women on board can drive up a firm's value and attract more investors.

The two main research studies discussed above present significantly different results in terms of how women on board can influence the value of a firm. Although there is no direct evidence to support the relationship between the women on board ratio and firm value, the ratio can still benefit a firm's overall performance.

2. Theoretical Arguments

In this paper, we aim to test whether there is a positive correlation between gender representativeness on the board and a company's performance. We collected data on the on-board rate of North American companies' directors from 2008 January to 2018 December by separating companies into two groups: one with a female director on the board and the other with no female director on the board. First, we provided some summary statistics and conducted a simple t-test to check if the companies having women on board provides higher raw returns. Further, based on the market model and the four-factor model, we checked whether the companies that have women on board provide higher abnormal returns. There is an issue with using simple regression by gender group, as doing so assumes that every firm's beta is the same. However, different firms have different risks and beta. Therefore, we have to run the regression one by one to get the alpha (abnormal return) for each company and check the abnormal return, which will be introduced in the Empirical Results part of this study. In our t-test of the raw returns, we test the difference of the raw return generated from all-male-director companies and companies with women on board. Our hypothesis is the following:

Hypothesis: The firms' returns show no significant difference between those with women on board and those that are all-male.

Ha: There is a significant difference in firm performance when there are women on board.

Ho: There is no significant difference in firm performance when there are women on board.

3. Data

Generating data from BoardEx's entire North American database, we investigated the gender of directors on boards from January 2008 to December 2018. There were a total of 6,857 companies in our data. We did not limit our data only to S&P 500 companies because large firms are more profitable than smaller-size firms (Majumdar, 1997), and they also have more ability and reasons to diversify and include women compared with smaller-size firms. Therefore, to analyze an unbiased database, we include the entire database of all firms on the file.

3.1 Data and Variables Generation

3.1.1 Gender of Director Data

We generated the gender ratio, which stands for the proportion of male directors, on the analytics organizational summary from BoardEx – North America during the years 2008–2018, thus including all observations since the start of the financial crisis. Each observation is at the firm-year level, and we ended up with a total of 86,174 observations sorted by ticker and year variable.

3.1.2 Stock Performance Data

The stocks return data was retrieved from the CRSP monthly stock files. We selected the same time range, as well as the permno, cusip, date, ticker, prc (stock price), ret (stock returns), and shrou (shares outstanding) variables. There is a total of 914,153 observations sorted by ticker and year variable. We then needed to merge the above two files to combine the gender

ratio and the return statistics into one file for further analysis. The combined merge file has 4,315 year-firm observations, as some non-corresponsive data was dropped.

3.1.3 Fama-French Factors

We collected the four-factor data from the monthly Fama-French Factors database. The mktfrf (excess return on the market), smb (small-minus-big return), hml (high-minus-low return), rf, (one-month treasury bill risk-free return rate), and umd (momentum factor) are the variables generated from 2008 to 2018 per month. There is a total of 132 observations sorted by date. The Fama-French Factors file is going to be merged with the above file to run a regression.

3.1.4 New Variables

To intuitively demonstrate our gender types, we generated wob (women on board ratio) = 1 - gender ratio; therefore, we defined type 0 as having no females on board and type 1 as having at least one female on board. As shown in Table 1 (on page 15), 37% of firms in the pool have no women on board, 33% of the firms have only 1 woman on board, 19% of the firms have 2 women on board, and only 10% of the firms have more than 2 women on board. There are 193,397 observations for type 0 and 324,399 observations for type 1. The total observations are unchanged at 517,778.

4. Methodology Approaches

Before implementing the four different methods to test the relationship between gender effects on stock returns, we conducted the raw returns statistics analysis. The market capitalization was generated by the stock price times the shares outstanding and then divided by a thousand ($mkt = \frac{prc * shrout}{1000}$) to get the market value of a million dollars. Since the stock returns were downloaded in decimal form, we converted them into percentage form by multiplying the return by a hundred. The data was sorted by type and date variable. Most importantly, we defined the firms based on gender diversity at year T and tested the abnormal return in year T+1 throughout. This allowed the analysis to be out of sample, which in turn should allow us to also test the benefits of using gender diversity for trading strategies. By conducting a simple t-test, we compared the average of raw return (r_{t+1}) of the two different type groups to see some summary statistics.

To test the hypothesis that the firms with and with no women on board have significant statistically different mean raw returns, we firstly conducted the two-sample t-test with equal variances. As we can see from the results presented in Table 2 on page 16, the firms with all-male directors on board ($N=193,379$) have a raw return of 0.81% ($SD=18.36$). By comparison, the firms with women directors on board ($N=324,499$) have a numerically higher raw return of 0.83% ($SD=13.33$). Although the mean of the raw return with the women-on-board firms is numerically higher than the all-male firms, there is no statistical difference ($t=0.48$) between the two types of firms. The raw return descriptive statistics with the two types are shown in Table 2. All differences of means in this paper are defined as mean of Type 1 firm minus mean of the Type 0 firm. We implemented the following methodologies to see if there is any significant relationship between the two types of firms.

4.1 Different Methodologies

4.1.1 Year-Firm Approach

The women on board ratio has been increasing year by year, so the probability of firms' inclusion of women also increases from year to year. Our first approach therefore is to estimate the alpha for every year of each company using monthly returns that year. The alpha stands for the measure of abnormal return for the year-company. We sorted the companies based on gender at year T and measured the abnormal return in year T+1.

$$r_{i,t} - rf_t = \alpha_t + b * (r_m - r_f)_t + s * SMB_t + h * HML_t + u * UMD_t + \varepsilon_t$$

On the left-hand side, $r_{i,t}$ is the monthly return of the company at month t, and rf_t is the risk-free rate. The left side of the equation stands for the excess return of each company in every month during the year. On the right-hand side, α_t is the abnormal return at month t, the return that cannot be explained by the four factors. $(r_m - r_f)_t$ is the market risk premium in month t, SMB_t is the size factor, HML_t is the high minus low factor, and UMD_t is the momentum factor that measures the monthly premium on winners minus losers (Carhart, 1997). ε_t is the random error component, which is uncorrelated with the dependent and other factors, as it essentially captures the idiosyncratic risk.

The results of this approach are presented in Table 3 on page 17. All-male directors on board firms (N=17046) have a return of 0.02% (SD=0.1589), and the firms with women directors on board (N=28058) have a numerically lower return of -0.23% (SD=0.4549). The t statistic is 0.69. Therefore, the t-test shows there is no significant evidence that firms which have women on board are statistically different from firms that do not.

4.1.2 Board Type Approach

For the second approach, we run the regression for each company based on gender. That leads to a longer period for measuring alpha, and we end up with at most two alphas for each firm. That is, one alpha for the period that had all-male boards, and one for the period in which the company had at least one female on the board. A company may end up with one or two alphas, and we use t-tests for difference of means.

The second method has a similar result as approach 1, shown in Table 3 (page 17): all-male directors on board firms (N=3800) have a return of -0.11%, compared with firms with women directors on board (N=4832), which have a numerically lower return of -0.14%. The t statistic is 0.20, which cannot reject the null hypothesis that there is no difference between the firms' returns with or without women on board.

4.1.3 Compare Alphas Across Gender Groups

Besides running regressions for each company by gender, for approach 3 we also ran a regression in the following expression form for the firms with or with no women on board. Then we checked whether the firms with women on board have a significant relationship relating to the firms' performance using a t-test. The regression we ran to observe the coefficient of women on board for each firm is the following:

$$r_t - rf_t = \alpha_t + b * (r_m - r_f)_t + s * SMB_t + h * HML_t + u * UMD_t + c * women + \varepsilon_t$$

where c is the coefficient on women on board for each firm, t is year, and *women* represents the indicator for whether there are any women on the firm's board; the other factors have already been explained in section 4.1.1.

There will be many regression results for each firm, and Table 4 (page 18) shows the t statistics for testing the average coefficient on *women* across all regressions for individual firms.

The average coefficient is -0.15% (SD=0.038, N=6668), so we can conclude that the firms with women on board significantly (t=-3.28) underperformed those with no women on board.

4.1.4 Portfolio Approach

After we observed a significant negative relationship between firm with women on board and firm performance, we used the portfolio approach, which is considered a better approach to see if investing in the firms with no women on board can provide a statistically higher return-trading strategy. Suppose we choose to invest in the companies that have no women on board, we would have a portfolio for every month during the year. We then calculated the equal-weighted and value-weighted return of the portfolio moving forward compared to the return of the two portfolio types. Each portfolio type should have a zero abnormal return, as all idiosyncratic risk is diversified away ($\epsilon = 0$). The equal-weighted return is just the mean of the excess return of each firm, which is calculated by $\frac{ret_{i,t} - r_{f,t}}{N_t}$, where ret is the return of the firm during time t , r_f is the risk-free rate at time t , and N is the total number of observations at time t . The value-weighted return is the return based on the company's market value size, which is calculated by the following equation:

$$vweightret_i = \sum_{i=1}^i \frac{mktw_i}{mval_i} * retrf_i$$

where $mktw_i$ is the market capitalization weight of each firm in each month during time t , and $retrf_i$ is the excess return of each firm (which was already defined previously).

We then conduct the four-factor regression for equal-weighted return and value-weighted return portfolio respectively; the formula expressions are as follows:

$$Ewret_{p,t} = \alpha_p + b * (r_m - r_f)_t + s * SMB_t + h * HML_t + u * UMD_t$$

$$Vwret_{p,t} = \alpha_p + b * (r_m - rf)_t + s * SMB_t + h * HML_t + u * UMD_t$$

This is the one-time series regression where α_p is the abnormal return of each portfolio of each month during time t. $Ewret_p$ is the equal-weighted portfolio excess return and $Vwret_{p,m}$ is the value-weighted portfolio excess return. The other factors are defined in Section 4.1.1.

Because our result in 4.1.3 was that firms with no women directors on board outperformed firms with women on board, we conduct our portfolio strategy by long the firms with no women directors on board and shorting the firms with women directors on board. We then do the equal- and value-weighted regression analysis for this strategy to see whether the portfolio return is positive and significant. We also do the equal- and value-weighted method for long women and long no-women portfolios respectively.

The equal-weighted and value-weighted long-short portfolio regression result is shown in Table 5 on page 19. The number of observations of both methods is 132. Surprisingly, the alpha for the equal-weighted portfolio is a negative of 0.14% with t=-1.34, which is not significant enough. The alpha for the value-weighted portfolio is also a negative of 0.3% with t=-2.48; this means under a value-weighted long short strategy, we can make a significant negative return, which contradicts our expectations—namely, that no-women-on-board firms outperformed those that do have women. According to the R-squared ratio, the value-weighted portfolio (0.39) explains better than the equal-weighted portfolio (0.199) in this case.

5. Final Results

In Table 2 (page 16), the difference of raw return means is 0.02%, a number that is not significant. We cannot conclude there is a relationship between the gender on board and firm performance, but we can see if the following approaches can show some significant results.

For approach 1, Table 3 (page 17) illustrates the difference in mean between women-on-board firms and no-women-on-board firms is -0.25% with $t=-0.69$. There is no significant relationship between the gender on board and firm performance. As shown in Table 3, approach 2 has a similar result: the difference of the mean between women-on-board firms and no-women-on-board firms is -0.3% with $t=0.2$; there is no statistically significant relationship between the gender on board and firm performance. For approach 3, the result of the t-test shows the means of the women on board coefficients are -0.15% with $t=-3.28$, so we can conclude that there is a negative and significant effect of the women on board and firm performance.

To further justify our conclusion, we implement the long no women on board firm and short women on board firm approach to see if we can generate positive alphas. However, this approach generates negative alphas with either an equal-weighted or value-weighted long short strategy. The value-weighted portfolio negative alpha (-0.3%) is significant ($t=-3.28$), and the adjusted R-squared (36.80%) of this model is higher than the equal-weighted strategy (17.38%), which means the value-weighted method can better explain the regression. The result of long no women and long women for equal- and value-weighted portfolios are shown in Table 5 (page 19) as well. When testing the no-women-on-board firm for equal-weighted return, the alpha is -0.02% while the women on board firm's equal-weighted return alpha is 0.12%. When testing the no women on board firm for value-weighted portfolio, the alpha is -0.26%, with women on board firm's equal-weighted return alpha is 0.04%. Adjusted R-squares are all above 90% and are illustrated in the table respectively. Based on the last approach, we conclude that firms with women on board outperform firms with no women on board.

6. Conclusion

According to our data analysis, one of our approaches concludes that the type 0 firms (the firms with no women on board) outperformed the type 1 firms (the firms with women on board). One of our approaches concludes that the type 1 firms outperformed the type 0 firms. Although the last approach is more convincing, we cannot get a consistent final conclusion based on our current findings and results.

One of our results is consistent with most prior research and debates on this topic that found there are good influences related to the diversity of the firms in term of firm performance. Isidro and Sobral (2015) found that a higher ratio of female directors on board indirectly increased a firm's value, which is demonstrated by the increased return on sales and return on assets. As investors increasingly pay attention to social responsibilities and ethical standards, their investment behaviours change at the same time. Moreover, businesswomen are playing increasingly important roles in a wide range of industries. However, a negative and significant relationship between their on-board presence and firm performance in our regression analysis approach can draw some connections with the study conducted by Sila et al. in 2016. They stated that gender diversity can affect equity risk, while equity risk will change the boardroom gender ratio. We did not prove whether a demand for conservative management styles caused the presence of women on board in our research. The significant and negative effect we examined in approach #3 can be potentially caused by a presence of women on board and an unrelated underperformance occurring at the same time. Nevertheless, further debates are needed to testify the relationship between women on board and firms' performance.

Figure 1: Women on Board Trend

Figure 1 below shows the increasing trend of women on board in firms from 2008 to 2018. The data is generated by month. The number increased from 53% in Jan 2018 to 78% in Dec 2018.

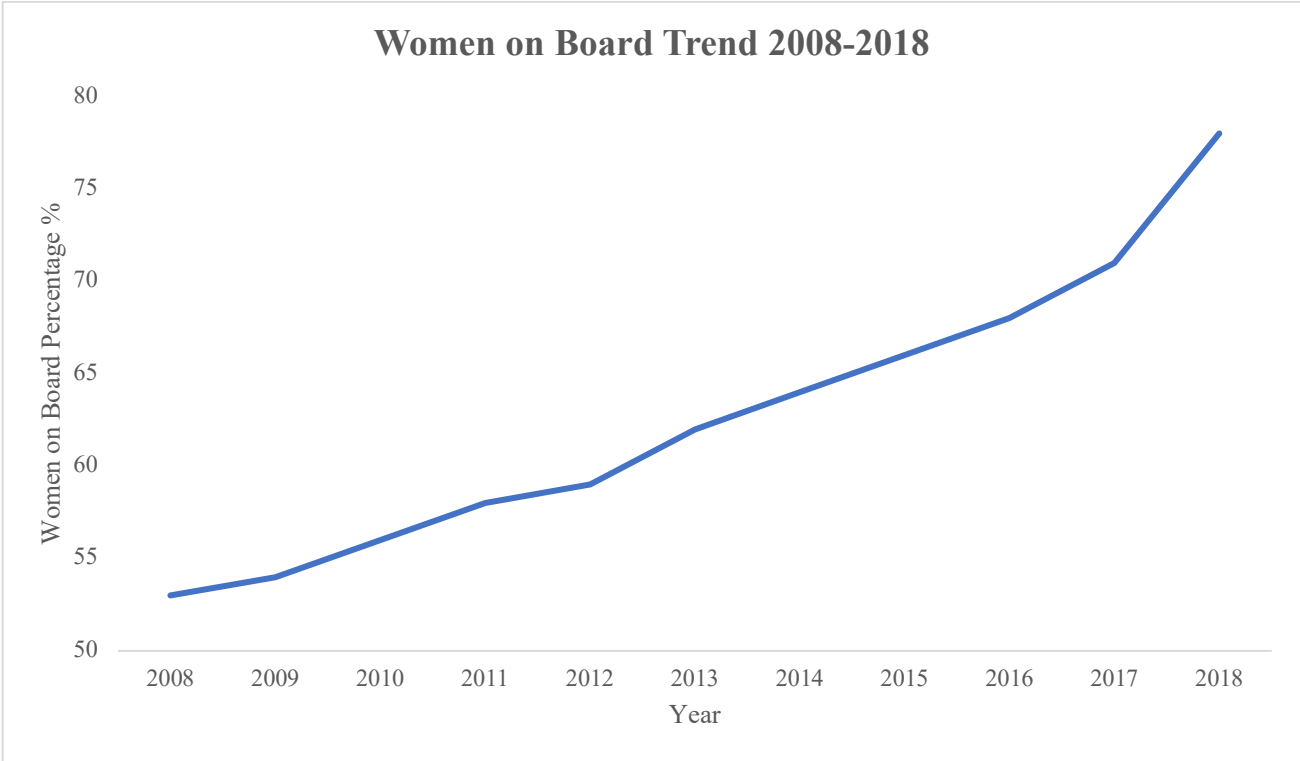


Figure 2: Women on Board Trend by Three Different Firm Sizes

Figure 2 below illustrates the increasing trend of women on board by three different firm sizes from 2008 to 2018 monthly. The small-sized firms fall between market capitalizations of \$0.3 million and \$239.5 million. The medium-sized firms fall between market capitalizations of \$239.5 million and \$1551.2 million. The large-sized firms fall between market capitalizations of \$1.55 billion and \$1099 billion.

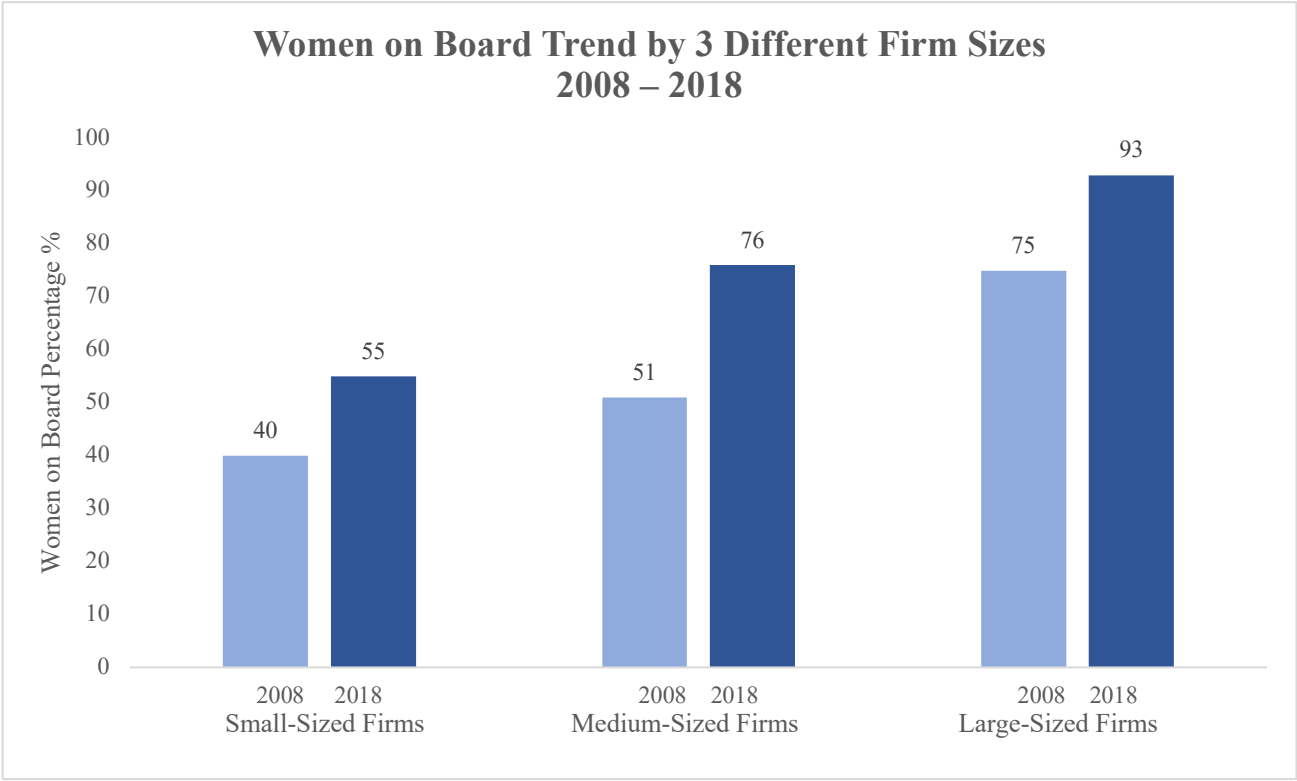


Table 1: Summary of Average Frequency of Women on Board

The total observations are 517,778, which includes all North American-listed companies' data from 2008 to 2018 monthly. 0 stands for there being no women on board in the firm, while 1 stands for there being 1 woman on board in the firm at the time.

Summary Table of Average Frequency of Women on Board Through 2008-2018			
Women on Board	Frequency	Percent	Cumulative Percent
0	193379	37	37
1	172090	33	71
2	97019	19	89
3	38803	7	97
4	12394	2	99
5	3334	1	100
6	576	0	100
7	140	0	100
8	14	0	100
Other Values	29	0	100
Total	517778	100	

*We treat missing values as Other Values in our table

Table 2: Difference of Means

This table provides descriptive statistics of the monthly raw returns of firms as well as the market during the sample period. Type 0 firms are firms with no women on the board, and type 1 firms are firms with women on the board. The difference of means test is provided in the bottom line.

Type=0 variable	N	Mean (%)	sd	p5	p25	p50	p75	p95
ret	1973379	0.81	18.36	-22.89	-6.95	0.12	7.03	25.3
mkt	1973379	1216.74	5064.33	13.78	71.49	247.28	856.3	4750.35
Type=1 variable	N	Mean (%)	sd	p5	p25	p50	p75	p95
ret	324399	0.83	13.34	-18.02	-4.9	0.67	5.98	19.27
mkt	324399	7634.65	27346.64	38.29	258.07	1121.89	4334.36	32151.7
Difference of means		0.02		t-stat	0.48			

* Difference of means = mean (Type 1)- mean (Type 0)

Table 3: Difference of Means Based on Four Factor Alpha

The table below shows the alphas of the first two approaches. Approach 1 is based on year-firm alphas, while approach 2 is based on two alphas per firm at most depending on the board type. There is a Type 1 firm (no women on board) and a Type 2 firm (with women on board) for each approach. The difference is the mean of women on board (Type 1 firm) minus the mean of no women on board (Type 0) firm. The difference of the t-tests is also shown in the table.

Approach		No women on board (%)	Women on board (%)	Difference (%)	Difference t-tests
Based on year-firm alphas		0.02	-0.23	-0.25	-0.69
Based on two alphas per firm at most depending on board type		-0.11	-0.14	-0.3	-0.20

* Difference = mean (Type 1)- mean (Type 0)

Table 4: Result of one sample t-test

The table shows the result of one sample t-test for the coefficient on the women variable in the four-factor regressions, including the women factor for each firm. The hypothesis is the mean of the coefficient on the women variable is equal to zero. The t stats are shown below.

One Sample t-test		
Variable	Mean	t-test
women	-0.15%	-3.28

* Ho: mean (coefficient on women) = 0; Ha: mean (coefficient on women) \neq 0

Table 5: Equal- and Value-Weighted Portfolio Results

The table below shows the four-factor regression results with the value of equal- and value-weighted long no women and long women respectively, as well as the long no women and short women with equal- and value-weighted portfolio respectively. Alpha and adjusted R-squared are shown in percentage form, and the t statistics are illustrated.

Value of equal- and value-weighted the firm with or with no women				
Portfolio		Alpha (%)	t	Adj R-squared (%)
Equal-weighted	Long no women	-0.02	-0.11	93.25
	Long women	0.12	1.95	98.26
Value-weighted	Long no women	-0.26	-1.93	91.73
	Long women	0.04	0.74	98.29
Equal-weighted	Long no women and short women	-0.14	-1.34	17.38
Value-weighted	Long no women and short women	-0.3	-2.48	36.8

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