What Factors Drive Board Gender Diversity Return?

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December 2023

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Abstract: Gender diversity has become a popular investment strategy mostly appealing to the ESG investors. In this paper, we examine if investing in firms with gender diversified boards can deliver excess return and if such return can be explained by common factors. By constructing an annually rebalanced portfolio of firms with female board directors, we find that the portfolio earns higher return than the market, especially during bad times. The portfolio of firms with women on board has higher exposure to the investment, profitability, and quality factors compared to the market. Regressing the portfolio against a battery of factor models, we find it to have significant Jensen's alpha in the CAPM and the Fama-French Three-Factor model, but not in the Fama-French Five-Factor model, the *q*-factor model, or the quality factor model. These results indicate that board gender diversity is associated with high quality, which is reflected in low investment and high profitability. Our finding is consistent with the notion that high quality firms are more likely to engage in gender diversity, and that the scarcity of highly qualified female professionals allows them to choose high quality firms to serve as board directors.

Keywords: Board gender diversity, stock returns, factor investing

1. Introduction

Several practitioner studies show that firms with female board directors are "better business" that have superior corporate financial performance and earn higher stock returns (McKinsey, 2007; MSCI, 2015, Credit Suisse, 2012, 2014; State Street Global Advisors, 2016). With a few exceptions, most of the academic literature focuses on the influence of board gender diversity on corporate governance, corporate decisions, financial performance, and stock market valuations.[1] However, these studies have not reached a consensus (Adams and Ferreira, 2009; Ferreira, 2010; Ghosh, Petrova, and Xiao 2015). In this study, we investigate the relation between board gender diversity and stock returns through the lens of asset pricing factors. To our knowledge, we are the first academic study to explore such relation from the factor investing perspective.

Absent of a consensus on the positive impact of board gender diversity on corporate financial performance or stock returns, investment managers have created index funds and ETFs using board gender diversity as one of a set of key criteria to identify companies that are superior in their corporate leadership gender diversity achievement. For example, the Pax Ellevate Global Women's Index fund would only consider companies that satisfy "multiple criteria of gender leadership, including: representation of women on the board of directors; representation of women in executive management; woman CEOs; woman CFOs; whether they are signatories to the United Nations Women's Empowerment Principles, a joint initiative of the UN Global Compact and UN Women".[2] State Street Global Advisors team up with California State Teachers' Retirement System and created SPDR® SSGA Gender Diversity Index ETF, SHE, which invests in companies

[1] Schmid and Urban (2015) study the stock returns around exogenous retirements of board members due to death or illness, and Chapple and Humphrey (2014) use a sample of Australian firms to study the association between corporate board gender diversity and stock performance.
[2] http://www.paxellevate.com/index/index-design

with female board directors, female C-level executives, and a high percentage of female executives.[3] Besides investment managers, U.S. Congress introduced the bill "Federal Employee Gender Diversity Investment Act" in the House on May 19, 2015 (H.R. 2432), which would establish a Gender Equality-Focused Stock Index Fund as an investment option for the Thrift Savings Plan. The bill states that the "…index comprised of stocks that have been analyzed and selected based on criteria that include, at a minimum: (1) gender diversity in corporate board and senior management composition…" Therefore, board gender diversity has already become an important investment strategy in the broader gender diversity and equality investment products that appeal not only to asset allocators such as pensions and endowments, but also to legislators.

Investment products built on the board gender diversity strategy are marketed to institution and retail investors. As these products gaining traction, it is imperative to understand the relation between board gender diversity and stock returns. We form an annually rebalanced value-weighted portfolio of firms with women on board to imitate the board gender diversity indexing strategy. This gender diversity strategy produces higher average stock returns and higher Sharpe ratio over the entire sample period from July 1998 to December 2015 than the total returns of S&P 500, S&P 1500, and Russell 1000 indices. A dollar invested in the gender diversity portfolio in June 1998 could grow into $3.41 by the end of 2015 (Sharpe ratio 0.56), which is 36% higher than the $2.50 earned by S&P 500 (Sharpe ratio 0.42), and 30% higher than the $2.63 for Russell 1000 (Sharpe ratio 0.43). Moreover, even though the board gender diversity strategy earns lower returns during the bull market following the Great Financial Crisis and on up-market days (defined as positive S&P 500 return days), it provides much better downside protection when the market condition

[3] Besides investment products with a corporate gender leadership focus, investing in companies excel at leadership gender diversity is also part of the broader environmental, social and governance (ESG) investing. Although ESG investing does not target at return generation, its return attribute is generally considered positive without proper academic research.

deteriorates during the Great Financial Crisis and on down-market days. Over a longer horizon, the board gender diversity strategy is superior to market index strategy in terms of both return and risk-return reward.

Although there is very little theory to directly predict the relation between board gender diversity and stock returns, the agency theory of financial economists and the resource dependence theory of management science researchers suggest that firms with gender diversified board have better governance and financial performance as Ferreira (2010) discusses in detail. Firms with better governance and financial performance may share characteristics that are common among firms earn high average stock returns. In addition, since there are less qualified female directors than male directors, the director labor market supply and demand dynamic also prescribes a certain set of firm characteristics that are typical for firms with women on board (Farrell and Hersch, 2005; Ferreira, 2010). We focus on a list of firm characteristics that intersect the board gender diversity literature and the asset pricing literature and analyze the exposure of the board gender diversity strategy to these firm characteristics.[4] Specifically, we examine the exposure of the board gender diversity strategy to predicted beta, dividend yield, investment-to-asset ratio, idiosyncratic volatility, leverage, book-to-market equity, market capitalization, return-on-asset, return-on-equity, and more heuristically, *quality*.[5] The exposures to these characteristics capture the return correlation between the strategy and asset pricing factors in several mainstream asset pricing models, including the CAPM, the Fama-French three-factor model (Fama and French, 1993), the Fama-French five-factor model (Fama and French, 2015), the *q*-factor model (Hou, Xue, and Zhang, 2015), and the quality-minus-junk factor model (Asness, Frazzini, and Pedersen, 2014).

[4] We use standardized firm characteristics in the cross-section as firm level exposures, and aggregate them with value-weight to the portfolio level.

[5] "Quality" is a summary firm characteristics that consists of many aspects of a firm. We adopt the definition of a widely cited practitioner's study, Asness, Frazzini, and Pedersen (2014).

We then regress the gender diversity strategy return on these factor models and examine the sign and significance of the model coefficients. These time-series factor regressions allow us to test if the board gender diversity strategy generates any abnormal return, and to dissect the source of the return.

Our empirical results show that board gender diversity strategy has low exposure to beta, investment-to-asset, idiosyncratic volatility, leverage, and high exposure to dividend yield, market capitalization, return-on-equity, and quality.[6] These results are consistent with Farrell and Hersch (2005) and Ghosh, Petrova, and Xiao (2015). The exposure of book-to-market equity is low and return-on-asset is high, compared with firms with no female directors, but the magnitude is statistically insignificant. Among these firm characteristics, low beta, low investment-to-asset, low idiosyncratic volatility, low leverage, high dividend yield, high return-on-asset, high return-on-equity and high quality are positively related to average stock returns, while as low book-to-market, and high market capitalization are negatively related with average stock returns.

Then we perform the time-series factor regressions and find the board gender diversity strategy loadings on these factors are largely consistent with the exposure analysis. Specifically, the gender diversity strategy negatively loads on SMB (small-minus-big), and positively loads on CMA (conservative-minus-aggressive investment), RMW (robust-minus-weak profitability), I_A (investment-to-asset), ROE (return-on-equity), and QMJ (quality-minus-junk, an equally-weighted composite factor of profitability, growth, safety, and payout).[7] The only discrepancy is the strategy's positive loading on the HML (high-minus-low) factor. We argue that returns from

[6] We compare firms in the board gender diversity portfolios with firms without female directors, and firms in our sample that we cannot determine if they have female directors or not. P-values from these comparisons are generally lower than the conventional 0.05 confidence level.

[7] The CMA and RMW factors are from Fama and French (2015?). The I_A and ROE factors are from Hou, Xue, and Zhang (2016?). The QMJ factor is from Cliff, Frazzini, and Pedersen (2014).

the HML factor are driven by the increasing (decreasing) valuation of cheap (expensive) stocks; therefore, the positive loading on the HML factor implies that, albeit slightly more expensive, firms with women on board can further extend their valuation.[8]

By combining the board gender diversity strategy factor loadings and average factor returns, we find the strategy's return in excess of the market comes mostly from low investment (CMA and I_A), high profitability (RMW and ROE), and more comprehensively, high-quality (QMJ). By adding the summary quality factor to the models with the investment and profitability factors, the returns from the profitability factors are weakened. These results indicate that returns from investing in a board gender diversity strategy come mostly from firms with low investment and high quality.[9] This evidence suggests that board gender diversity itself does not generate abnormal returns, but it helps to select firms with the characteristics that can produce high risk-adjusted returns.

Based on these findings, we further examine the robustness of the positive return relation with board gender diversity. Since the distribution of firms with gender diversified boards is uneven among industries (Ghosh, Petrova, Sun, and Xiao, 2016), our board gender diversity strategy portfolio construction may overweigh industries which have high level of board gender diversity. If industries with better board gender diversity perform better, our results can be biased upwards. To rule out this possibility, we first value-weigh firms with women on board within each industry, and then equal-weigh all industry board gender diversity portfolios. The resulting portfolio earns a slightly higher return and has a higher risk-return reward. The industry-adjusted board gender

[8] This is similar to Asness, Frazzini, and Pedersen's (2014) explanation of high-quality companies. The authors argue that high quality firms are not cheap, but they still earn high average returns.
[9] The profitability factor is embedded in the quality factor, which can partially explain why the explanatory power of the profitability factors can be subsumed by the quality factor. The quality factor also contains low-risk factors such as low predicted beta, which may offer additional explanatory power.

diversity portfolio also shares similar exposures to the set of firm characteristics with the non-adjusted portfolio, and factor regressions find qualitatively same results.

We further partition firms with women on board by the number of female directors and examine if the positive returns are driven by firms with two or more female directors, as some studies suggest that a critical mass of women is needed for firms to achieve better performance. We do not find evidence supports that hypothesis. First, we find the group of firms with one female director generally earn higher average stock returns than the groups of firms with two or more female directors. But the risk-return reward is similar over the entire sample period. By separating our sample period into four sub-periods, we find the one female director group performs better during the "tech bubble" and "easy credit" periods, but the two and more female directors groups perform better during the post-Great Financial Crisis period. On down- market days, the two and more female directors group is best at protecting the loss, with slightly higher volatility possibly caused by the small number of firms in this group. On up- market days, the one female director group has the best returns and risk-return rewards. These comparisons suggest that returns from firms with more female directors are lower but also have lower risk, offering better downside protection, while firms with one female director have higher returns but also higher risk, offering better up-market participation. The firm characteristics exposure and factor regression analysis show broadly stronger pattern observed between firms with women on board versus firms with no female directors.

The rest of the paper is organized as follows. Section 2 describes our data and sample construction. Section 3 presents the stock return performance of the board gender diversity index strategy. Section 4 relates the board gender diversity strategy return to pricing factors in commonly

used asset pricing multifactor models, and discuss our interpretation of what drives the gender diversity stock returns. Section 5 concludes.

2. Data

Our U.S. corporate board director data are from the Institutional Shareholder Services (ISS). ISS director data covers S&P 500, S&P MidCaps, and S&P SmallCap firms. We aggregate directorship data by firm, and obtain the board size, the number of female directors, and if a female director is also the CEO from 1997 to 2013.[10]. All financial statements variables are obtained from CompuSTAT, and security price, return and share outstanding data are from CRSP. Following standard convention, we align accounting data with fiscal year end anywhere in the calendar year t-1 with security data at the end of June in the calendar year t. Since ISS does not report the exact date of the directorship data, we use the common assumption that proxy statements are filed within 120 days of fiscal year end, and match the ISS data reported in year t-1 to security data at the end of June in the calendar year t. This matching scheme ensures sufficient gap between stock return data and firm accounting and board director data so that our return analysis does not suffer from the look-ahead bias.

To be included in our sample, we require a firm to have a common stock (shared code to be 10 or 11) that trades on NYSE/AMEX/NASDAQ, and also a valid industry classification SIC code that can be matched to one of Fama-French 12 industries by the end of June in any year between 1998 to 2015.[11] We also require the firm to have enough data to compute the quality factor.[12] The

[10] The gender data in 1996 identifies all firms with female directors, which is erroneous. Therefore, we only use the data from 1997.
[11] Since the firms covered in the ISS database are from the S&P 1500 index, most of them are investable. Therefore, we do not screen for firm size. However, if we restrict our sample by using the common firm size threshold (such as book equity to be larger than $250,000 and total asset greater than $500,000), our results do not change materially.
[12] Note that the calculation of the quality factor does not require to have data for all underlying variables.

second column in Table 1 reports the number of firms that we can identify the number of female board directors. This forms our main sample. The number of firms that in the intersection of CompuSTAT and CRSP that we cannot generate a match with ISS data is reported in the last column in Table 1. [13] When we compute standardized firm characteristics exposure, we include these firms to obtain mean and standard deviation estimates because the full cross-section of firms better represents the true population.

The percentage of firms with women on board increases from around 50% in late-1990s to around 80% towards the mid-2010s. By dissecting firms with female board directors by the number of female directors, the increases was actually driven by firms with two or more female directors. The percentage of firms with just one female director has not materially changed over our sample period.

Table 2 reports the summary statistics of the variables used in our study. Variable construction largely follows the literature popularizes these variables. In particular, BAB is the "betting against beta" factor, which equals minus the predicted market beta. BOARD_SIZE is the number of directors on the corporate board. DIV is total dividend divided by total asset. FEMALE DIR % is the number of female directors divided by BOARD_SIZE. FEMALE DIR # is the number of female directors. I_A is total asset minus lagged total asset divided by lagged total asset. IVOL is minus the stock's idiosyncratic volatility estimated from CAPM. LEV is minus firm total debt divided by total asset. LOGBM is the logarithm of book to market equity. LOGSIZE is the logarithm of market capitalization. QUALITY is the combination of various firm characteristics that measure the quality of a firm, as in Asness, Frazzini, and Pedersen (2014). ROA is net income

[13] Note that the number of female director unidentified firms shrinks over time. This is mainly driven by the number of firms with share code to be 10 or 11 decreases in the CRSP monthly stock return tape.

divided by total asset. ROE is net income divided by book equity. We report the summary statistics for all firms in the intersection of CompuSTAT and CRSP in panel A, to provide a description of the mean and standard deviation we use in the firm characteristics exposure standardization. In panel B, we present the summary statistics for firms that we cannot identify the number of female directors. Then we focus on the observations with matching ISS data, and report the statistics for firms with no women on board in panel C, with at least one female board directors in panel D, with exactly one female director in panel E, with two female directors in panel F, and three and more female directors in panel G. Figure 1A and 1B plot the visualization of the average and median firm characteristics by the number of women on board.

A couple of sample attributes are worth noting. First, only 29% of firms in Table 2 panel A have board size. This indicates that for all firms in the CompuSTAT and CRSP merge, less than one third are covered by ISS. Since ISS only collects data on firms in the S&P 1500 index, the average firm size in our main sample is much larger than the rest of firms. This precludes microcap stocks driving our results. Generally, institutional investors are more active in common stock indices such as S&P 500, Russell 1000 and Russell 2000, which have a large overlap with the universe of firms ISS covers. Second, Table 2 panels C, E, F and G and Figure 1A and 1B reveal a persistent pattern when comparing average and median firm characteristics in our main sample with a different number of female directors. Except for LOGBM, all the firm characteristics that are related to stock returns demonstrate monotonicity when the number of women on board increases from zero to more than two. The direction of the monotonicity is positively related to average stock returns. For example, the quality factor exposure increases from 0.280 for the all-male board firms, to 0.508 for firms with more than two women on board. Such pattern suggests

that firms with more female directors are likely to be associated with higher return contribution from these factors.

3. Gender Diversity Strategy Return

3.1. Board gender diversity index strategy return performance

Our main board gender diversity index strategy portfolio is formed every June with firms with at least one female director. We require the firms to have common stocks traded on NYSE/AMEX/NASDAQ, positive market capitalization and Fama-French 12 industry classification. Since our main sample covers a relative broad firm size spectrum, we use the end of June market capitalization as the weight to reduce the impact of small cap firms. Market capitalization weighting scheme is also commonly used in actual investment products. We do not rebalance the portfolio until next June, but the weights of each stock will change based on price movement throughout the 12-month holding period. If a stock is delisted during the holding period, we replace its subsequent returns with the 1-month treasury. We plot the cumulative returns of the gender diversity strategy and the S&P 500, S&P 1500, and Russell 1000 index returns in Figure 2A. The gender diversity strategy outperforms the market indices over our sample period spanning over 17 years.

The performance summary statistics of the board gender diversity index strategy are reported in column "1+" under panel A, Table 3. We compute the monthly average returns, return volatility, and Sharpe ratios for different sample periods, which include the full sample period (from July 1998 to December 2015) and four sub-periods, representing the recession period surround the tech bubble (July 1998 to November 2001), the period of business expansion with easy credit (December 2001 to November 2007), the collapse of subprime mortgage recession period that included the Great Financial Crisis (December 2007 to June 2009), and the post-Great Financial

Crisis recovery of the U.S. stock market (July 2009 to December 2015). We also report performance for S&P 500 positive return (up-market) and negative return (down-market) days. In Table 4, we report the total return performance of S&P 500, S&P 1500, and the Russell 1000 market indices. For further reference, we also include the performance of all factors used in our factor regressions.

By comparing the board gender diversity strategy returns in Table 3 with the three market indices returns in Table 4, the gender diversity strategy produces average monthly returns of 0.68% over the full sample period, which is over 10 bps higher than the 0.54% produced by S&P 500, and 0.57% by both S&P 1500 and Russell 1000 indices. A 10 bps monthly difference can accumulate to over 1% higher return annually, which should be high enough to justify the slightly higher expense of the gender diversity investment products.[14]

By partition the full period to four subperiods, the better overall performance is mostly driven by the strategy's higher returns during the unfavorable market condition periods. During the tech bubble period, the gender diversity strategy earns 0.56% per month, compared with 0.27% by S&P 500, 0.32% by S&P 1500, and 0.29% by Russell 1000. During the Great Financial Crisis period, the gender diversity strategy suffered a loss of -1.76% per month, whereas S&P 500 lose 2.04%, S&P 1500 1.99%, and Russell 1000 2.02%. The performance gap widens to 20 - 30 bps per month during these tough times of our economy. When the market condition is more favorable, the gender diversity strategy does not always trail behind the market. During the credit expansion error under Greenspan, the gender diversity strategy made 0.73% per month, while S&P 500 made 0.57%, S&P 1500 made 0.62%, and Russell 0.62%. The only subperiod where the strategy underperformed is the post-Great Financial Crisis era. The gender diversity strategy rebounded

[14] For example, the SPDR SSGA Gender Diversity Index ETF has an expense ratio of 0.20%.

1.27% per month, but S&P 500 did 1.28%, S&P 1500 1.29%, and Russell 1000 1.29%, but the difference of 1 to 2 bps is very small compared to when the strategy outperforms.

By separating up-market and down-market days, the gender diversity strategy on average lose 3.34% on down-market days, which is a much smaller loss compared with S&P 500's 3.80%, S&P 1500's 3.82%, and Russell 1000's 3.85% losses. On up-market days, the strategy earns 3.25%, slightly less than the 3.32% gain by S&P 500, 3.39% by S&P 1500, and 3.39% by Russell 1000. Although there are more up-market months than down-market months, the strategy's underperformance during good times is offset by its outperformance during bad times, hence achieving overall better return performance.

3.2. Board gender diversity strategy return by number of female directors

We further investigate if the number of female directors on board matters to the strategy's superior performance. Some studies suggest that having one woman on board is mere tokenism, and a critical mass is necessary for the gender effect to matter (e.g., Torchia, Calabo and Huse, 2011). In this case, the better stock return performance of the gender diversity strategy could have been driven by firms with more female directors than just one. We form portfolios based on the number of female directors in the same way as our gender diversity strategy, that is, by June every year, we use firm end of June market capitalization as holding weights in one, two, and more than two female directors portfolios. The cumulative returns are plotted in Figure 2B. We compute the same performance summary statistics and report them in column "1" to "3+" under panel A of Table 3.

Interestingly, from Figure 2B and Table 3 we find that the portfolio of firms with only one female director has the best stock price performance over the full sample period, compared with portfolios with two or more female directors. But return volatilities of the two and more than two

female directors portfolios are markedly smaller, hence the differences between the Sharpe ratios among these three portfolios are negligible. Comparing these statistics in the four subperiods, we find the first two periods may drive the performance difference we observe in the full sample period. The tech bubble period produces the largest return and risk disparity between these portfolios. During the easy credit period, the higher number of women on board portfolios also have notably lower return volatility. In the GFC and post-GFC periods, the return differences become much muted, albeit the return volatility reduction in the more than one female director portfolios is still quote noticeable.

Referring back to the number and percentage of firms with two and more than two female directors, we see the largest differences in the early years in our sample period. The portfolio of two female directors has less than half the number of firms as the portfolio of one female director. The portfolio of more than two female directors has less than one-tenth the number of firms as the portfolio of one female director. The smaller number of firms could potentially introduce higher idiosyncratic risk related to these portfolios, hence resulting in lower returns and higher return volatility. The numbers of firms in the two and more than two female directors portfolios catch up in recent years, albeit still smaller than the one female director portfolio. The average returns for these two portfolios are more in line with the one female director portfolio.

From these results we do not find strong support for the hypothesis that a critical mass of female directors is necessary to generate better stock price performance, but there is some evidence in recent years that more female directors on the board is associated with lower stock return volatility, which helps to improve risk adjusted returns.

3.3. Industry adjusted board gender diversity strategy return

The industry adjusted portfolio is created by first value-weighing firms with female directors within an industry, and then equal-weighing all 12 industry gender diversity portfolios. To maintain equal weights among industries, this portfolio is rebalanced monthly. The cumulative performance of the industry-adjusted board gender diversity strategy is plotted in Figure 2A, and the summary statistics are reported in column "1+" under panel B of Table 3.

This strategy produces even better performance than the gender diversity strategy without industry adjustment. Over the entire sample period, the performance improvement comes from both higher returns and lower return volatility. In all subperiods, the industry-adjusted strategy earns higher returns and have lower risk (except the GFC period). However, since these two strategies have different rebalancing schedule and hence turnover, we do not interpret this evidence as the industry-adjusted gender diversity strategy has superior equity investor returns. We use this finding as a robustness check that a portfolio consists of firms with female directors can outperform the market without overweighing industries that tend to welcome female as their board of directors.

4. Explaining Board Gender Diversity Returns

In the previous section, we show that board gender diversity strategy earns higher risk-adjusted returns compared with typical market indices. But is board gender diversity a market anomaly? What drives the performance of the gender diversity strategy? In this section, we answer these questions. We first investigate the characteristics of the firms with women on board, and then we regress the gender diversity strategy time-series returns on a set of widely used asset pricing models to understand if the strategy has excess returns. Based on the evidence found, we provide our explanation for the relation between board gender diversity and stock returns.

4.1. Firm characteristics exposures of the board gender diversity strategy

At the time we construct the board gender diversity strategy portfolio, i.e., June of each year, we compute a set of firm characteristics based on the accounting data released in the prior calendar year. We compute predicted beta, dividend yield, investment-to-asset ratio, idiosyncratic volatility, leverage, book-to-market equity, market capitalization, return-on-asset, return-on-equity, and quality. Our calculation follows the relevant literature such as Asness et. al (2014). All variables are winsorized at 1% and 99%. Table 2 includes the raw value of these firm characteristics, and Figure 1 plots them by the number of female directors. In addition to the raw values, we also estimate the portfolio-level exposure to these characteristics by standardizing firm-level variable to have zero mean and unit variance across the entire cross-section of firms we have. For firms with missing characteristics, we set its exposure value to zero. The portfolio-level exposure aggregates the standardized variables with market capitalization weighting. We also compute the aggregated exposures for the group of firms with no female directors, and the group of firms that we cannot identify if they have female directors or not. To control for the effect of year, we use two-sample *t*-tests paired by year to compare the gender diversity strategy exposures to these characteristics with the other two groups of firms.

We report these summary statistics and the *t*-test p-values in Table 5. In panel A, we report the exposure differences between firms we have no ISS data, firms with no female directors, and firms with at least one female directors. In panel B, we further divide the group of firms with female directors by the number of female directors. Panels C and D repeats panels A and B respectively, but adjust the exposures by industry. As we briefly discussed in section 2, these comparisons show that firms with female directors are in general safer (low in predicted beta, IVOL, and leverage), invest less (low asset growth), more profitable (high in return-in-asset and equity), pay more

dividends, larger in size, and valued slightly higher. These characteristics match the description of the high quality definition of Asness, Frazzini, and Pedersen (2014). These patterns becomes stronger with the number of female directors. The p-values for the *t*-tests indicate that the differences in these firm characteristic exposures are often significantly large. Since the gender diversity strategy is associated with these firm characteristics that are positively related to average stock returns, we investigate next if pricing factors constructed on these firm characteristics can explain the board gender diversity strategy returns.

4.2. Time-series factor regressions of board gender diversity strategy

We regress the board gender diversity portfolio with CAPM, the Fama-French three-factor model (FF3M), Fama-French five-factor model (FF5M), Hou, Xue, and Zhang investment-based factor model (HXZ), and the Asness, Frazzini, and Pedersen's QMJ factor, as in the following equation form.

$$r_G - r_f = \alpha + \mathrm{B}F + \varepsilon$$

The regression coefficients are reported in column "1+" under panel A of Table 6. With CAPM and FF3M, the board gender diversity portfolio earns significant 0.17% and 0.12% of Jensen's alpha respectively per month. With an annually rebalanced portfolio which does not sort by financial performance, this is quite impressive. However, once factors related to investment and profitability are introduced in the model, such as FF5M and HXZ, the alpha disappears. This suggests that these two factors have explanatory power for the "abnormal" returns earned by the board gender diversity portfolio. With the QMJ factor, the board gender diversity strategy also earns no excess returns. By including the QMJ factor in FF5M and HXZ, the QMJ absorbs the explanatory power of the profitability factors (RMW and ROE), but not the investment factors (CMA and I_A). The strategy return coefficients on the factors CMA, RMW, I_A, ROE, and QMJ

are all positive and statistically significant. These results suggest that the outperformance generated by firms with board gender diversity is mostly related to the strategy loading on these alpha pricing factors, low asset growth and high quality in particular.

We run these regressions also on portfolios constructed with just one female director, two female directors, and more than two directors. And we repeat these regressions with industry-adjusted portfolio returns. All previous results hold. These battery of results confirm that the returns generated by the board gender diversity strategy can be explained by popular pricing factors.

4.3. What drives the board gender diversity returns?

Based on the results from the time-series regressions, we argue that the stock return relation with board gender diversity is driven by the characteristics of firms with women on board, and these characteristics load on pricing factors that earn positive returns over time. In untabulated Fama-MacBeth regressions, we do not find board gender diversity earns any premiums. Therefore, board gender diversity is not an anomaly.

The literature offers several explanation as why firms with gender diversified boards tend to share such characteristics (Hermalin and Weisbach, 1988, Farrell and Hersche, 2005, Ferreira, 2010). We argue that the type of firms end up making the decision to hire female directors and are able to attract female directors are generally high quality firms and less aggressive in asset expansion. This reflects in the evidence we have provided in this study.

5. Conclusion

In this paper, we provide the first academic investigation of the relation between board gender diversity and stock returns. We create an annually rebalanced board gender diversity portfolio, and compare its return performance with three market indices. The evidence shows that the gender

diversity strategy beats the market, especially during bad times. The strategy provides meaningful benefit for investors with higher risk-adjusted return than investing in a traditional market index fund.

We further analyze the exposure of the strategy to a set of firm characteristics that are typical of firms with women on board documented in the corporate finance literature, and positive stock returns in the asset pricing literature. We find that these firm characteristic exposures shared by firms with female directors are higher than firms with no female directors in the direction positively related to cross-section stock returns. Then we regress the strategy time-series returns on well-established asset pricing factors, and find the board gender diversity strategy does not offer any abnormal returns beyond these factors. We conclude that board gender diversity as a firm attribute helps to identify firms that can generate better risk-return rewards for the investors.

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Table 1: Number and percent of firms by number of women on board

Table 1 reports the number of firms in the intersection of CompuSTAT and CRSP that can be matched with the ISS corporate board data. Among the firms that we can identify the gender composition of the board, we count the number and percentage of firms with no female director, with one female director, two female directors, and more than two female directors.

	Sample	Number of firms by number of women on board					Percent of firms by number of women on board					Unidentified
Year	firms	0	1+	1	2	3+	0	1+	1	2	3+	firms
1997	1225	525	700	481	186	33	43%	57%	39%	15%	3%	4613
1998	1331	719	612	443	142	27	54%	46%	33%	11%	2%	4143
1999	1315	648	667	459	169	39	49%	51%	35%	13%	3%	4033
2000	1298	634	664	458	168	38	49%	51%	35%	13%	3%	3746
2001	1351	659	692	480	167	45	49%	51%	36%	12%	3%	3285
2002	1114	494	620	406	172	42	44%	56%	36%	15%	4%	3157
2003	1119	462	657	426	179	52	41%	59%	38%	16%	5%	2946
2004	1107	419	688	442	185	61	38%	62%	40%	17%	6%	2898
2005	1072	383	689	427	204	58	36%	64%	40%	19%	5%	2846
2006	1027	320	707	402	237	68	31%	69%	39%	23%	7%	2814
2007	910	309	601	333	209	59	34%	66%	37%	23%	6%	2850
2008	1077	327	750	394	271	85	30%	70%	37%	25%	8%	2431
2009	1096	344	752	383	278	91	31%	69%	35%	25%	8%	2199
2010	1102	332	770	391	280	99	30%	70%	35%	25%	9%	2027
2011	1121	311	810	396	303	111	28%	72%	35%	27%	10%	1860
2012	1127	282	845	404	305	136	25%	75%	36%	27%	12%	1694
2013	1132	258	874	396	322	156	23%	77%	35%	28%	14%	1583
2014	1127	214	913	399	344	170	19%	81%	35%	31%	15%	1582

Table 2: Firm characteristics by number of women on board

Table 2 provides descriptive statistics of the sample for each group of firms in Table 1, including all firms in the intersection of CompuSTAT and CRSP (Panel A), firms we cannot match with ISS director data (Panel B), firms with no female director (Panel C), firms with at least one female director (Panel D), firms with one female director (Panel E), firms with two female directors (Panel F), and firms with more than two female directors (Panel G). *BAB* is the "betting against beta" factor, which equals minus the predicted market beta. *BOARD_SIZE* is the number of directors on the corporate board. *DIV* is total dividend divided by total asset. *FEMALE DIR %* is the number of female directors divided by *BOARD_SIZE*. *FEMALE DIR #* is the number of female directors. *I_A* is total asset minus lagged total asset divided by lagged total asset. *IVOL* is minus the stock's idiosyncratic volatility estimated from CAPM. *LEV* is minus firm total debt divided by total asset. *LOGBM* is the logarithm of book to market equity. *LOGSIZE* is the logarithm of market capitalization. *QUALITY* is the combination of various firm characteristics that measure the quality of a firm, as in Asness, Frazzini, and Pedersen (2014). *ROA* is net income divided by total asset. *ROE* is net income divided by book equity.

Variable	Firm-year #	% of all	Mean	Std	Min	Median	Max
Panel A: All observations							
BAB	62505	88%	-0.913	0.599	-3.613	-0.817	0.124
BOARD_SIZE	20651	29%	9.531	2.777	1.000	9.000	34.000
DIV	71148	100%	0.009	0.024	0.000	0.000	0.243
FEMALE DIR %	20651	29%	0.096	0.093	0.000	0.100	0.667
FEMALE DIR #	20651	29%	0.981	0.968	0.000	1.000	7.000
I_A	70928	99%	0.244	1.024	-0.701	0.064	19.539
IVOL	71287	100%	-0.035	0.024	-0.182	-0.028	-0.006
LEV	66041	93%	-0.215	0.227	-1.353	-0.154	0.000
LOGBM	68726	96%	-0.680	0.894	-4.144	-0.616	2.392
LOGSIZE	71358	100%	5.657	2.128	0.601	5.542	11.833
QUALITY	71358	100%	0.000	1.000	-7.259	0.186	6.541
ROA	71238	100%	-0.048	0.260	-2.538	0.015	0.290
ROE	68737	96%	-0.096	0.665	-6.239	0.076	0.965
Panel B: Women=?							
BAB	42185	83%	-0.839	0.610	-3.613	-0.713	0.124
DIV	50530	100%	0.008	0.025	0.000	0.000	0.243
I_A	50280	99%	0.293	1.189	-0.701	0.065	19.539
IVOL	50636	100%	-0.040	0.026	-0.182	-0.033	-0.006
LEV	48435	96%	-0.213	0.240	-1.353	-0.135	0.000
LOGBM	48380	95%	-0.619	0.939	-4.144	-0.530	2.392
LOGSIZE	50707	100%	4.845	1.749	0.601	4.737	11.833
QUALITY	50707	100%	-0.160	1.027	-7.259	0.085	6.541
ROA	50587	100%	-0.083	0.290	-2.538	0.009	0.290
ROE	48391	95%	-0.170	0.742	-6.239	0.052	0.965
Panel C: Women=0							
BAB	7497	98%	-1.132	0.592	-3.613	-1.054	0.001
BOARD_SIZE	7640	100%	8.028	2.263	1.000	8.000	26.000
DIV	7631	100%	0.009	0.020	0.000	0.000	0.243
FEMALE DIR %	7640	100%	0.000	0.000	0.000	0.000	0.000
FEMALE DIR #	7640	100%	0.000	0.000	0.000	0.000	0.000
I_A	7640	100%	0.166	0.509	-0.701	0.083	12.895
IVOL	7640	100%	-0.027	0.015	-0.173	-0.024	-0.007
LEV	6709	88%	-0.197	0.200	-1.353	-0.158	0.000
LOGBM	7512	98%	-0.804	0.760	-4.144	-0.771	1.891
LOGSIZE	7640	100%	6.935	1.365	1.210	6.865	11.302
QUALITY	7640	100%	0.280	0.845	-7.180	0.308	6.361
ROA	7640	100%	0.023	0.175	-2.538	0.044	0.290
ROE	7512	98%	0.036	0.452	-6.239	0.105	0.965

Table 2 continue

Variable	Firm-year #	% of all	Mean	Std	Min	Median	Max
Panel D: Women>0							
BAB	12823	99%	-1.031	0.506	-3.613	-0.975	0.001
BOARD_SIZE	13011	100%	10.413	2.670	4.000	10.000	34.000
DIV	12987	100%	0.014	0.021	0.000	0.008	0.243
FEMALE DIR %	13011	100%	0.153	0.070	0.033	0.125	0.667
FEMALE DIR #	13011	100%	1.558	0.768	1.000	1.000	7.000
I_A	13008	100%	0.100	0.264	-0.701	0.056	5.252
IVOL	13011	100%	-0.020	0.012	-0.137	-0.017	-0.006
LEV	10897	84%	-0.235	0.178	-1.353	-0.220	0.000
LOGBM	12834	99%	-0.840	0.755	-4.144	-0.788	2.392
LOGSIZE	13011	100%	8.074	1.568	1.725	7.990	11.833
QUALITY	13011	100%	0.458	0.773	-4.968	0.409	6.299
ROA	13011	100%	0.044	0.093	-2.538	0.043	0.290
ROE	12834	99%	0.106	0.314	-6.239	0.123	0.965
Panel E: Women=1							
BAB	7395	98%	-1.040	0.528	-3.613	-0.978	-0.005
BOARD_SIZE	7520	100%	9.783	2.464	4.000	9.000	30.000
DIV	7499	100%	0.013	0.021	0.000	0.006	0.243
FEMALE DIR %	7520	100%	0.108	0.027	0.033	0.111	0.250
FEMALE DIR #	7520	100%	1.000	0.000	1.000	1.000	1.000
I_A	7518	100%	0.109	0.266	-0.701	0.063	4.385
IVOL	7520	100%	-0.021	0.012	-0.133	-0.018	-0.006
LEV	6327	84%	-0.225	0.180	-1.326	-0.207	0.000
LOGBM	7429	99%	-0.818	0.731	-4.144	-0.779	2.074
LOGSIZE	7520	100%	7.744	1.484	1.725	7.685	11.833
QUALITY	7520	100%	0.434	0.774	-4.968	0.399	6.299
ROA	7520	100%	0.041	0.104	-2.538	0.044	0.289
ROE	7429	99%	0.088	0.335	-6.239	0.119	0.965
Panel F: Women=2							
BAB	4076	99%	-1.024	0.474	-3.569	-0.977	-0.002
BOARD_SIZE	4121	100%	11.042	2.664	4.000	11.000	34.000
DIV	4119	100%	0.016	0.021	0.000	0.010	0.218
FEMALE DIR %	4121	100%	0.191	0.044	0.059	0.182	0.500
FEMALE DIR #	4121	100%	2.000	0.000	2.000	2.000	2.000
I_A	4120	100%	0.092	0.270	-0.679	0.050	5.252
IVOL	4121	100%	-0.018	0.011	-0.137	-0.015	-0.006
LEV	3408	83%	-0.245	0.173	-1.353	-0.234	0.000
LOGBM	4059	98%	-0.874	0.791	-4.144	-0.813	2.083
LOGSIZE	4121	100%	8.434	1.561	2.867	8.407	11.833
QUALITY	4121	100%	0.486	0.790	-4.664	0.426	5.969
ROA	4121	100%	0.047	0.080	-1.657	0.042	0.290
ROE	4059	98%	0.125	0.298	-5.758	0.127	0.965
Panel G: Women>2							
BAB	1352	99%	-0.998	0.470	-3.322	-0.947	0.001
BOARD_SIZE	1370	100%	11.984	2.683	5.000	12.000	28.000
DIV	1369	100%	0.019	0.021	0.000	0.013	0.218
FEMALE DIR %	1370	100%	0.286	0.069	0.111	0.273	0.667
FEMALE DIR #	1370	100%	3.289	0.559	3.000	3.000	7.000
I_A	1370	100%	0.076	0.229	-0.476	0.047	2.794
IVOL	1370	100%	-0.016	0.009	-0.104	-0.013	-0.006
LEV	1162	85%	-0.254	0.175	-0.990	-0.245	0.000
LOGBM	1346	98%	-0.861	0.771	-4.144	-0.773	2.392
LOGSIZE	1370	100%	8.803	1.559	3.074	8.834	11.833
QUALITY	1370	100%	0.508	0.711	-2.885	0.421	5.610
ROA	1370	100%	0.048	0.060	-0.428	0.037	0.290
ROE	1346	98%	0.147	0.227	-3.539	0.130	0.965

Table 3: Gender diversity strategy return performance statistics

Table 3 reports the gender diversity strategy return performance during different time periods for the group of firms with at least one female directors in "1+" column, exactly one female director in "1" column, two female directors in "2" column, and more than two female directors in "3+" column. Under Panel A, the returns are value-weighted by market capitalization in June each year, and held through next June without rebalance. Under Panel B, returns are first value-weighted within each industry, and then equal-weigh all industry each month. The Avg Ret is average monthly return. Ret Vol is the volatility of monthly stock returns. Sharpe is the Sharpe ratio of annualized stock returns.

			Panel A: Returns by # of female directors				Panel B: Ind-adjusted returns by # of female directors			
	Mth	Statistics	1+	1	2	3+	1+	1	2	3+
All months	210	Avg Ret	0.68%	0.71%	0.62%	0.63%	0.72%	0.73%	0.71%	0.68%
7/1998-12/2015		Ret Vol	4.21%	4.58%	4.09%	4.17%	4.14%	4.41%	4.11%	4.56%
		Sharpe	0.56	0.54	0.53	0.53	0.60	0.58	0.60	0.52
Tech bubble	41	Avg Ret	0.56%	0.74%	0.30%	0.43%	0.61%	0.82%	0.35%	0.50%
7/1998-11/2001		Ret Vol	4.71%	5.31%	4.34%	5.10%	4.38%	4.85%	4.09%	5.64%
		Sharpe	0.41	0.48	0.24	0.29	0.48	0.59	0.30	0.31
Easy credit	72	Avg Ret	0.73%	0.76%	0.72%	0.68%	0.79%	0.81%	0.80%	0.73%
12/2001-11/2007		Ret Vol	3.29%	3.66%	3.00%	3.09%	3.27%	3.38%	3.22%	3.50%
		Sharpe	0.77	0.72	0.83	0.76	0.83	0.83	0.86	0.72
GFC	19	Avg Ret	-1.76%	-1.77%	-1.75%	-1.74%	-1.59%	-1.79%	-1.32%	-1.57%
12/2007-6/2009		Ret Vol	6.56%	6.56%	6.64%	6.90%	6.79%	6.67%	6.93%	7.09%
		Sharpe	-0.93	-0.93	-0.91	-0.87	-0.81	-0.93	-0.66	-0.77
Post-GFC	78	Avg Ret	1.27%	1.25%	1.27%	1.27%	1.28%	1.23%	1.30%	1.29%
7/2009-12/2015		Ret Vol	3.83%	4.26%	3.87%	3.45%	3.80%	4.21%	3.87%	3.91%
		Sharpe	1.15	1.02	1.14	1.28	1.16	1.02	1.17	1.14
SP500 down	82	Avg Ret	-3.34%	-3.69%	-3.17%	-2.74%	-3.15%	-3.36%	-3.10%	-2.91%
		Ret Vol	3.17%	3.25%	3.27%	3.69%	3.17%	3.35%	3.16%	4.00%
		Sharpe	-3.64	-3.93	-3.35	-2.57	-3.45	-3.47	-3.41	-2.52
SP500 up	128	Avg Ret	3.25%	3.53%	3.05%	2.79%	3.20%	3.36%	3.15%	2.98%
		Ret Vol	2.39%	2.71%	2.33%	2.82%	2.44%	2.66%	2.46%	3.23%
		Sharpe	4.71	4.51	4.54	3.44	4.53	4.36	4.43	3.20

Table 4: Market index and factor return performance statistics

Table 4 reports the return performance of the commonly used market indices S&P 500, S&P 1500, and Russell 1000, along with the performance of the factors in the CAPM, Fama-French three-factor model, Fama-French five-factor model, Hou, Xue, and Zhang's investment-based factor model, and the QMJ factor model.

	Mth	Statistics	SP500	SP1500	R1000	MKTRF	SMB	HML	RMW	CMA	ROE	I_A	QMJ
All months	210	Avg Ret	0.54%	0.57%	0.57%	0.41%	0.29%	0.14%	0.30%	0.31%	0.26%	0.33%	0.42%
7/1998-12/2015		Ret Vol	4.48%	4.52%	4.55%	4.66%	3.56%	3.40%	2.99%	2.25%	3.18%	2.20%	3.27%
		Sharpe	0.42	0.44	0.43	0.31	0.28	0.14	0.34	0.48	0.29	0.52	0.45
Tech bubble	41	Avg Ret	0.27%	0.32%	0.29%	-0.14%	0.38%	0.23%	0.44%	0.89%	0.49%	0.63%	1.05%
7/1998-11/2001		Ret Vol	5.53%	5.54%	5.65%	5.96%	6.42%	6.11%	5.44%	4.02%	4.81%	3.81%	4.66%
		Sharpe	0.17	0.20	0.18	-0.08	0.21	0.13	0.28	0.76	0.35	0.57	0.78
Easy credit	72	Avg Ret	0.57%	0.62%	0.62%	0.44%	0.37%	0.47%	0.23%	0.28%	0.36%	0.26%	0.03%
12/2001-11/2007		Ret Vol	3.44%	3.44%	3.43%	3.48%	2.55%	2.01%	2.47%	1.71%	2.77%	1.64%	2.63%
		Sharpe	0.58	0.62	0.63	0.44	0.50	0.81	0.32	0.57	0.45	0.55	0.05
GFC	19	Avg Ret	-2.04%	-1.99%	-2.02%	-2.03%	0.62%	-0.44%	0.92%	-0.12%	0.20%	-0.02%	1.51%
12/2007-6/2009		Ret Vol	6.93%	7.09%	7.10%	7.07%	2.50%	3.79%	1.85%	1.56%	4.28%	1.74%	4.28%
		Sharpe	-1.02	-0.97	-0.98	-0.99	0.86	-0.40	1.73	-0.27	0.16	-0.03	1.22
Post-GFC	78	Avg Ret	1.28%	1.29%	1.29%	1.27%	0.09%	-0.07%	0.13%	0.14%	0.03%	0.31%	0.18%
7/2009-12/2015		Ret Vol	3.78%	3.83%	3.84%	3.91%	2.35%	2.15%	1.50%	1.33%	1.70%	1.34%	2.51%
		Sharpe	1.17	1.16	1.16	1.13	0.13	-0.11	0.30	0.36	0.07	0.81	0.25
SP500 down	82	Avg Ret	-3.80%	-3.82%	-3.85%	-4.14%	-0.63%	0.62%	1.66%	0.94%	1.87%	0.83%	2.70%
		Ret Vol	3.29%	3.33%	3.36%	3.44%	3.82%	4.06%	3.52%	2.59%	2.92%	2.51%	3.22%
		Sharpe	-4.00	-3.97	-3.97	-4.16	-0.57	0.53	1.63	1.25	2.22	1.15	2.91
SP500 up	128	Avg Ret	3.32%	3.39%	3.39%	3.33%	0.88%	-0.17%	-0.58%	-0.09%	-0.74%	0.01%	-1.04%
		Ret Vol	2.49%	2.47%	2.49%	2.49%	3.27%	2.87%	2.19%	1.90%	2.93%	1.92%	2.33%
		Sharpe	4.62	4.74	4.72	4.63	0.93	-0.20	-0.91	-0.17	-0.87	0.02	-1.55

Table 5: Firm characteristic z-scores comparison by number of women on board

Table 5 reports the z-scores of firm characteristics and *t*-tests between subsamples with different number of female directors on board. The standardization uses all firms in the CompuSTAT and CRSP intersection. The variable definitions are in the note of Table 2. Panel A reports the value-weighted average z-scores of firms we cannot identify if there is female director on board, firms we can identify to have no female director on board, and firms with female director on board. Panel B compares the subgroups of firms with female directors on board. Panel C repeats Panel A but computes the value-weighted average z-scores by industry first, and then equal-weighs across industries. Panel D repeats that of Panel B, but uses the same industry adjustment as in Panel C.

	BAB	DIV	I_A	IVOL	LEV	LOGBM	LOGSIZE	QUALITY	ROA	ROE
Panel A: Firm characteristics of firms with unidentified (women=?), all male (women=0), and with women (women>0) on board										
Women=?	-0.152	0.078	0.218	0.488	-0.219	-0.460	1.301	0.308	0.267	0.232
Women=0	-0.516	0.061	0.097	0.614	0.085	-0.578	1.497	0.508	0.441	0.342
Women>0	-0.038	0.515	-0.079	0.870	-0.132	-0.601	2.046	0.731	0.451	0.449
Women=0 vs. Women=?	-0.364	-0.018	-0.121	0.126	0.304	-0.118	0.196	0.200	0.174	0.111
P-value	(0.000)	(0.723)	(0.038)	(0.000)	(0.000)	(0.008)	(0.000)	(0.000)	(0.000)	(0.000)
Women>0 vs. Women=?	0.114	0.437	-0.297	0.383	0.087	-0.141	0.745	0.423	0.184	0.217
P-value	(0.033)	(0.000)	(0.000)	(0.000)	(0.006)	(0.003)	(0.000)	(0.000)	(0.000)	(0.000)
Women>0 vs. Women=0	0.478	0.455	-0.176	0.257	-0.216	-0.023	0.550	0.223	0.010	0.106
P-value	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.531)	(0.000)	(0.005)	(0.365)	(0.000)
Panel B: Firm characteristics of firms with all male (women=0), one (women=1), two (women=2), and more than two (women>2) women on board										
Women=0	-0.516	0.061	0.097	0.614	0.085	-0.578	1.497	0.508	0.441	0.342
Women=1	-0.166	0.335	-0.041	0.811	-0.067	-0.568	1.887	0.667	0.451	0.419
Women=2	-0.010	0.676	-0.092	0.887	-0.161	-0.689	2.114	0.806	0.464	0.475
Women>2	0.172	0.668	-0.106	0.958	-0.272	-0.545	2.211	0.811	0.434	0.470
Women=1 vs. Women=0	0.350	0.275	-0.138	0.198	-0.151	0.010	0.390	0.159	0.011	0.077
P-value	(0.000)	(0.000)	(0.001)	(0.000)	(0.000)	(0.819)	(0.000)	(0.006)	(0.366)	(0.000)
Women=2 vs. Women=0	0.507	0.615	-0.189	0.273	-0.246	-0.111	0.617	0.299	0.023	0.132
P-value	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.013)	(0.000)	(0.006)	(0.136)	(0.000)
Women>2 vs. Women=0	0.689	0.608	-0.203	0.345	-0.356	0.033	0.714	0.303	-0.007	0.128
P-value	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.495)	(0.000)	(0.019)	(0.572)	(0.000)

Table 5 continue

	BAB	DIV	I_A	-IVOL	LEV	BM	SIZE	QLTY	ROA	ROE
Panel C: Industry-adjusted firm characteristics of firms with unidentified (women=?), all male (women=0), and with women (women>0) on board										
Women=?	-0.129	0.127	0.124	0.503	-0.344	-0.396	1.234	0.322	0.289	0.261
Women=0	-0.229	0.212	0.038	0.654	-0.062	-0.450	1.322	0.481	0.433	0.349
Women>0	0.041	0.635	-0.099	0.877	-0.244	-0.618	2.025	0.747	0.460	0.455
Women=0 vs. Women=?	-0.100	0.084	-0.086	0.151	0.282	-0.054	0.088	0.159	0.144	0.089
P-value	(0.002)	(0.096)	(0.016)	(0.000)	(0.000)	(0.142)	(0.058)	(0.000)	(0.000)	(0.000)
Women>0 vs. Women=?	0.170	0.508	-0.222	0.374	0.100	-0.222	0.791	0.425	0.170	0.195
P-value	(0.006)	(0.000)	(0.000)	(0.000)	(0.001)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Women>0 vs. Women=0	0.271	0.424	-0.136	0.223	-0.182	-0.169	0.703	0.266	0.027	0.106
P-value	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.005)	(0.012)	(0.000)
Panel D: Industry-adjusted firm characteristics of firms with all male (women=0), one (women=1), two (women=2), and more than two (women>2) women on board										
Women=0	-0.229	0.212	0.038	0.654	-0.062	-0.450	1.322	0.481	0.433	0.349
Women=1	-0.032	0.478	-0.075	0.827	-0.204	-0.514	1.822	0.664	0.447	0.416
Women=2	0.034	0.692	-0.121	0.874	-0.277	-0.682	2.062	0.804	0.464	0.474
Women>2	0.190	0.854	-0.150	0.899	-0.319	-0.584	2.013	0.768	0.459	0.473
Women=1 vs. Women=0	0.197	0.266	-0.113	0.173	-0.142	-0.065	0.500	0.183	0.014	0.066
P-value	0.000	0.000	0.001	0.000	0.002	0.007	0.000	0.011	0.221	0.000
Women=2 vs. Women=0	(0.263)	(0.480)	-(0.159)	(0.220)	-(0.215)	-(0.232)	(0.740)	(0.323)	(0.031)	(0.125)
P-value	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.007	0.006	0.000
Women>2 vs. Women=0	(0.419)	(0.642)	-(0.187)	(0.245)	-(0.257)	-(0.135)	(0.691)	(0.287)	(0.025)	(0.124)
P-value	0.000	0.000	0.000	0.000	0.000	0.006	0.000	0.004	0.114	0.000

Table 6: Time-series factor regressions

Table 6 reports the coefficients of regressing board gender diversity strategy returns with CAPM, Fama-French three-factor model, Fama-French five-factor model, HXZ investment-based factor model, and the QMJ factor model. The p-value of the coefficients are reported below the coefficients. Panel A computes the strategy returns with value-weighting, whereas Panel B first value-weighs within industry and then equal-weighs across industries. The column "1+" is the main board gender diversity strategy. Column "1" to "3+" group firms with one, two, and more than two female directors.

	Panel A: Returns by # of female directors				Panel B: Industry-adjusted returns by # of female directors			
	1+	1	2	3+	1+	1	2	3+
CAPM								
ALPHA	0.17%	0.20%	0.12%	0.21%	0.23%	0.28%	0.22%	0.17%
	(0.053)	(0.037)	(0.218)	(0.101)	(0.021)	(0.019)	(0.032)	(0.297)
MKTRF	0.87	0.94	0.84	0.78	0.84	0.87	0.84	0.82
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
ADJRSQ	0.92	0.92	0.87	0.77	0.89	0.86	0.87	0.70
Fama-French three-factor model								
ALPHA	0.12%	0.14%	0.08%	0.16%	0.17%	0.21%	0.18%	0.14%
	(0.028)	(0.050)	(0.291)	(0.128)	(0.006)	(0.013)	(0.037)	(0.331)
MKTRF	0.93	0.99	0.89	0.84	0.90	0.95	0.89	0.86
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
HML	0.25	0.23	0.25	0.34	0.28	0.32	0.24	0.35
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
SMB	-0.10	-0.04	-0.13	-0.20	-0.11	-0.08	-0.10	-0.16
	(0.000)	(0.143)	(0.000)	(0.000)	(0.000)	(0.010)	(0.003)	(0.016)
ADJRSQ	0.97	0.95	0.93	0.86	0.95	0.94	0.92	0.77
Avg Stock #	714	416	225	73	650	378	205	74

Table 6 continue

	Panel A: Returns by # of female directors				Panel B: Industry-adjusted returns by # of female directors			
	1+	1	2	3+	1+	1	2	3+
Fama-French five-factor model								
ALPHA	-0.01%	0.03%	-0.07%	0.02%	0.04%	0.10%	0.01%	-0.07%
	(0.797)	(0.620)	(0.299)	(0.863)	(0.471)	(0.187)	(0.921)	(0.597)
MKTRF	0.98	1.04	0.95	0.90	0.96	0.99	0.96	0.95
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
HML	0.12	0.12	0.10	0.21	0.14	0.21	0.08	0.17
	(0.000)	(0.002)	(0.012)	(0.000)	(0.000)	(0.000)	(0.046)	(0.048)
SMB	-0.06	-0.01	-0.08	-0.15	-0.07	-0.04	-0.04	-0.08
	(0.000)	(0.651)	(0.010)	(0.001)	(0.004)	(0.222)	(0.198)	(0.223)
CMA	0.19	0.16	0.23	0.22	0.19	0.13	0.24	0.28
	(0.000)	(0.002)	(0.000)	(0.004)	(0.000)	(0.019)	(0.000)	(0.012)
RMW	0.16	0.14	0.21	0.20	0.18	0.16	0.24	0.32
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.001)	(0.000)	(0.000)
ADJRSQ	0.98	0.96	0.94	0.88	0.96	0.94	0.93	0.79
HXZ investment-based factor model								
ALPHA	-0.04%	0.02%	-0.10%	-0.03%	0.02%	0.07%	0.02%	-0.07%
	(0.528)	(0.740)	(0.245)	(0.829)	(0.783)	(0.492)	(0.776)	(0.656)
MKTRF	0.97	1.04	0.94	0.87	0.94	0.98	0.93	0.90
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
I_A	0.35	0.28	0.37	0.53	0.37	0.36	0.35	0.62
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
ROE	0.16	0.14	0.19	0.15	0.14	0.16	0.15	0.12
	(0.000)	(0.001)	(0.000)	(0.013)	(0.001)	(0.003)	(0.000)	(0.133)
ADJRSQ	0.96	0.95	0.92	0.84	0.93	0.91	0.91	0.77
QMJ factor								
ALPHA	0.02%	0.07%	-0.03%	0.03%	0.07%	0.12%	0.07%	-0.02%
	(0.837)	(0.418)	(0.748)	(0.837)	(0.488)	(0.278)	(0.463)	(0.901)
MKTRF	0.99	1.05	0.96	0.91	0.97	1.00	0.96	0.96
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
QMJ	0.24	0.21	0.24	0.27	0.26	0.27	0.23	0.29
	(0.000)	(0.001)	(0.000)	(0.000)	(0.000)	(0.001)	(0.000)	(0.006)
ADJRSQ	0.93	0.93	0.89	0.79	0.91	0.88	0.89	0.72

Table 6 continue

	Panel A: Returns by # of female directors				Panel B: Industry-adjusted returns by # of female directors			
	1+	1	2	3+	1+	1	2	3+
Fama-French three-factor, QMJ, and investment-based factors								
ALPHA	-0.03%	0.01%	-0.08%	-0.04%	0.02%	0.08%	0.02%	-0.12%
	(0.465)	(0.923)	(0.267)	(0.713)	(0.692)	(0.288)	(0.850)	(0.397)
MKTRF	1.01	1.07	0.97	0.94	0.99	1.02	0.97	0.99
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
HML	0.19	0.19	0.18	0.27	0.23	0.30	0.19	0.23
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.001)
SMB	-0.04	0.01	-0.07	-0.16	-0.06	-0.03	-0.04	-0.11
	(0.007)	(0.717)	(0.026)	(0.000)	(0.011)	(0.393)	(0.201)	(0.033)
QMJ	0.16	0.15	0.13	0.26	0.21	0.19	0.17	0.33
	(0.000)	(0.001)	(0.010)	(0.000)	(0.000)	(0.002)	(0.004)	(0.000)
I_A	0.14	0.09	0.18	0.25	0.12	0.04	0.15	0.37
	(0.000)	(0.078)	(0.000)	(0.001)	(0.001)	(0.390)	(0.004)	(0.001)
ROE	0.01	0.02	0.06	-0.10	-0.05	-0.03	0.01	-0.14
	(0.769)	(0.608)	(0.190)	(0.090)	(0.211)	(0.507)	(0.853)	(0.041)
ADJRSQ	0.98	0.96	0.94	0.88	0.96	0.94	0.93	0.80
Fama-French five-factor and QMJ factor								
ALPHA	-0.04%	0.00%	-0.09%	-0.03%	0.02%	0.07%	0.00%	-0.09%
	(0.402)	(0.950)	(0.229)	(0.799)	(0.796)	(0.370)	(0.951)	(0.535)
MKTRF	1.01	1.08	0.97	0.94	0.98	1.02	0.96	0.97
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
HML	0.15	0.17	0.12	0.27	0.18	0.25	0.08	0.19
	(0.000)	(0.000)	(0.010)	(0.000)	(0.000)	(0.000)	(0.058)	(0.028)
SMB	-0.05	0.00	-0.08	-0.15	-0.06	-0.03	-0.04	-0.07
	(0.001)	(0.946)	(0.014)	(0.001)	(0.010)	(0.352)	(0.208)	(0.224)
CMA	0.17	0.12	0.22	0.18	0.17	0.10	0.24	0.26
	(0.000)	(0.018)	(0.000)	(0.019)	(0.000)	(0.081)	(0.000)	(0.022)
RMW	0.08	0.02	0.16	0.06	0.10	0.06	0.23	0.27
	(0.059)	(0.752)	(0.011)	(0.456)	(0.049)	(0.373)	(0.001)	(0.064)
QMJ	0.11	0.15	0.06	0.16	0.10	0.12	0.01	0.07
	(0.006)	(0.013)	(0.370)	(0.016)	(0.043)	(0.063)	(0.867)	(0.608)
ADJRSQ	0.98	0.96	0.94	0.88	0.96	0.94	0.93	0.79

Figure 1A: Average firm characteristics by number of women on board from 1997 to 2014

Figure 1A plots the average firm characteristics by the number of female director on board. The variable definitions are in the note of Table 2, except LOGSIZE is divided by 100.

Figure 1B: Median firm characteristics by number of women on board from 1997 to 2014

Figure 1B plots the median firm characteristics by the number of female director on board. The variable definitions are in the note of Table 2, except LOGSIZE is divided by 100.

Figure 2A: Board gender diversity strategy and market index cumulative returns from July 1998 to December 2015

Figure 2A plots the cumulative returns of the gender diversity strategy, industry-adjusted gender diversity strategy, S&P 500, S&P 1500, and Russell 1000.

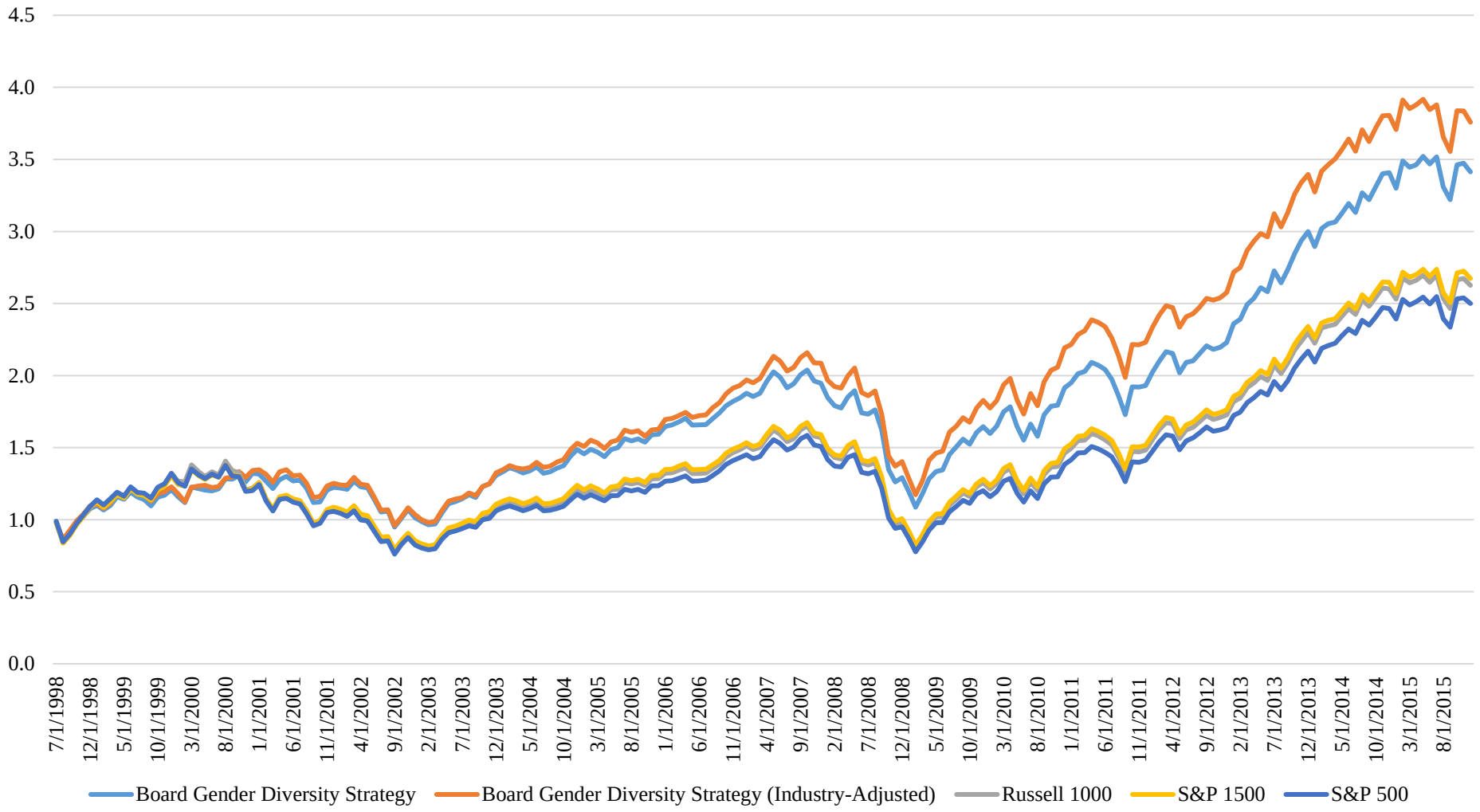

Figure 2B: Board gender diversity strategy cumulative returns by number of female directors from July 1998 to December 2015

Figure 2B plots the cumulative returns of the gender diversity strategy, and subsample of firms with one, two, and more than two female directors.