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Share Buybacks and Gender Diversity

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Abstract

We find that board gender diversity increases the likelihood that firms announce a buyback but long-term excess returns are significantly smaller when there are females on the board. Hence, it appears that boards with women are less able to time the market by repurchasing undervalued stock. Our results are consistent with past research that finds that male executives make superior returns than females from insider trading. However, we find that timing ability increases significantly when women have better access to information networks, i.e. when they are CEOs or when they sit on other boards.

Keywords: Gender Diversity; Share Buybacks; Market Timing; Ethics

JEL Classifications: G3

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I. Introduction

The purpose of this paper is to examine the impact of gender diversity on corporate decision making and shareholder value in the context of share buybacks. As buybacks are corporate events that increase leverage and therefore financial risk and can be driven by the market timing ability of company insiders [e.g., Dittmar and Field (2015), Ikenberry et al. (1995), Peyer and Vermaelen (2009)], they provide a unique experimental setting to answer some of the most common questions in the diversity literature. For example, do women have less information e.g., because they are not part of the (larger) male information network? Are women more risk averse than men? Are men more overconfident than women? We examine these questions by testing whether board composition, in particular the presence or percentage of women on the board (hereafter also called "diversity"), influences the likelihood that a firm announces a buyback, as well as the consequences of the buyback for shareholder value.

In the United States the board of directors has to authorize buyback programs. In doing so it has to trade-off the costs and benefits of these programs. Costs could mean giving up profitable investment opportunities if the firm is financially constrained. Benefits include corporate tax savings especially if the repurchase is financed with debt, fighting takeover bids (Billiett and Hui, 2007), reducing dilution from stock options [e.g., Bens et al. (2003), Kahle (2002)], reducing excess cash that otherwise may be wasted in negative NPV projects, i.e. reducing agency costs of free cash flow [e.g., Dittmar (2000)], saving personal taxes or increasing flexibility by replacing dividend payments [e.g., Grullon and Michaely (2004)] or correcting mispricing of its shares by giving a "signal" that the company shares are undervalued [e.g., Vermaelen (1981)].

However, regardless of the motivation for the buyback, as a buyback is an investment decision, the board has to be convinced that the company is not buying back stock when its shares are overvalued. In a recent survey of 44 board members serving on 95 publicly traded companies with an aggregate market value of $2.7 trillion, Fields (2016) reports that

the majority of board members agree with Warren Buffet that an essential precondition for a company to repurchase shares is that "its stock is selling at a material discount to the company's intrinsic value, conservatively calculated".[1] That is why it is not surprising that CFOs consider "undervaluation" to be the most important factor when deciding to buy back shares (Brav et al., 2005).

The implicit assumption here is that the shares are undervalued and the market underreacts to the buyback announcement. As a result, the repurchase allows managers to time the market, generating benefits to long term shareholders at the expense of sellers. Past research [e.g., Dittmar and Field (2015), Ikenberry et al. (1995), Peyer and Vermaelen (2009), Evgeniou et al. (2016), Cziraki et al. (2016)] has shown that, on average, open market share repurchase authorization announcements are not only followed by positive short term but also positive long-term excess returns, which is consistent with the hypothesis that, at least on average, managers are able to time the market.

Building on past findings on share buybacks, our study adds to the growing literature on the impact of diversity on corporate decision making and shareholder value.[2] Huang and Kisgen (2013) examine three other corporate decisions: acquisitions, equity issuance and debt issuance. They find that acquisitions as well as debt issues made by female executives generate larger announcement returns. Levi et al. (2014) focus on acquisitions and reach similar conclusions, i.e. firms with female directors are less likely to make value destroying acquisi-

[1]Warren Buffet letter to the shareholders of Berkshire Hathaway, February 25, 2012.

[2]Other studies on the impact of diversity on shareholder value involve testing the impact of exogenous regulatory changes, such as mandatory gender quotas [e.g., Eckbo and Thorburn (2016), Ahern and Dittmar (2012), Farrell and Hersch (2005), Adams and Ferreira (2009), Matsa and Miller (2013)]. All these studies find no effect or a negative effect of mandatory quotas on shareholder value. Explanations for the negative stock market response include the perception that quotas will result in board members with inferior skills (Ahern and Dittmar, 2012), the perception that women care more about stakeholder value than shareholder value (Matsa and Miller, 2013), or that having boards with greater diversity leads to overmonitoring in firms with strong corporate governance (Adams and Ferreira, 2009).

tions. They interpret this result as evidence that markets believe that *men are overconfident* and are therefore more likely to overestimate the NPV of their decisions. In other words, men are over-optimistic, i.e. they overestimate cash flows or underestimate risk (Dittrich et al., 2005).[3] Market timing, i.e. buying back undervalued shares, also requires confidence, in the same way as buying another company does. Andreou et al. (2016) employ press-based measures of overconfidence proposed by Malmendier and Tate (2005, 2008) and find that long-term abnormal returns following share repurchases are substantially smaller when they are made by executives identified as overconfident. This leads to our first hypothesis:

H1: *According to the male overconfidence hypothesis, when an all-men board announces a share buyback program, the buyback will be followed by smaller long-term excess returns than when there are (more) women on the board.*

For example, although a severe stock price decline in the 6 months before a buyback, on average, signals that the stock is undervalued (Peyer and Vermaelen, 2009) it could also mean that the strategy of the firm is fundamentally flawed. Overconfident CEOs will consider the stock price decline as an investment opportunity while others will consider the decline as a message from an efficient market. According to the *male overconfidence hypothesis* women will be on average better able to judge whether this optimism is justified or not and influence the board decision accordingly.

What makes share buybacks different from other corporate decisions is that they can also be considered as a form of collective insider buying, to the extent that insiders are long-term investors and don't sell their shares to the company. Indeed, many firms apply the same blackout period (when all trades are forbidden) as they do for insider trading. Cziraki et al. (2016) find that insider trading and market timing through share buybacks and

[3]Their interpretation is consistent with findings by others in non-corporate settings. For example, Barber and Odean (2001) find that among online retail investors, males trade more frequently than females and earn larger negative excess returns. Svenson (1981) report male over-confidence for driving ability.

equity issues are complimentary: insiders tend to buy (sell) more shares prior to open market buybacks (seasoned equity offerings). Moreover, the larger the extent of insider buying prior to share buyback announcement, the larger the post-buyback excess returns. Huang and Kisgen (2013) report that women are less involved in buying shares of their own company and exercise options early. Malmendier and Tate (2005) interpret such behavior as (female) lack of confidence as it shows that they don't want to be exposed to the idiosyncratic risk of their firms. However, whether this result can be interpreted as a "lack of female confidence" or "male overconfidence" depends on the profitability of the trades. If men typically lose money when they buy shares in their own company and women don't, the interpretation of "male overconfidence" is supported.

However, Inci et al. (2016) report evidence inconsistent with the "male overconfidence" explanation: they find that both female and male executives make profits from insider trading but men earn superior returns and trade more than females. Instead, this is consistent with the "*male information advantage hypothesis*". Inci et al. (2016) argue that women have less access to information because they are not part of the predominantly male social network. On the other hand, the fact that they are not part of this network could be positive as it increases director independence (Eckbo and Thorburn, 2016). Indeed, Adams et al. (2010) report that CEO turnover is higher in companies with more independent directors. However, the lack of access to the network, means also that women have less access to information useful to judge whether the company's stock is undervalued. So, consistent with the evidence of low profitability of female insider trading, an alternative hypothesis about post-repurchase announcement returns is:

H2: *According to the male information advantage hypothesis, when an all-men board announces a share buyback program, the buyback will be followed by larger long-term excess returns than when there are (more) women on the board.*

We expect that possible information disadvantage will be smaller if women have better

knowledge about the firm's fundamentals, specifically if she is the CEO. We also expect this information disadvantage is smaller if she has a wider network as well as more experience. Hence we also predict that women who are serving on other boards are better positioned to judge whether the firm's shares are undervalued.

Share buybacks provide a unique experimental setting to test these two competing hypotheses in the literature regarding women on the board: women are less confident or women have less access to information. For example, a male CEO may be proposing a buyback to increase earnings per share and maximize his bonus (tied to earnings per share) but motivate the buyback by undervaluation. Because of the lack of inside information, women board members will not be in a position to challenge the CEO, making it easier to pursue buybacks that don't create long-term shareholder value. Of course it is also possible that the presence of any women on a board would not affect the ability of the rest of the board to recognize and act upon undervaluation hence also not affect the firm's market timing ability. So whether buybacks in firms with gender diverse boards will be followed by smaller long-term excess returns is an empirical question.

Note that the assumption for both hypotheses is that, although female directors may be in the minority (as is the case for most of the firms in our sample), or even alone (as is the case for most firms in our sample with some women on their board), they will be on average able to influence the majority of the board members. Assuming instead that women can't have any influence unless if they are many or a majority (or even more than one) defeats the whole purpose of the gender diversity efforts often promoted by politicians and regulators.

Although we find evidence consistent with the *"male information advantage hypothesis"*, i.e., on average long-term excess returns after buybacks are negatively related to gender diversity, our results may also indicate that women are less interested in market timing. After all, as share buybacks are an indirect way of insider buying, some people may find such behavior unethical (although not illegal). If women are on average more ethical then

men[4], they may be less interested in using company cash to buy undervalued stock from uninformed investors. Note that this "moral" argument could also explain the relatively smaller profits from female insider trading reported by Inci et al. (2016). Scarlat et al. (2015) also find that insider trading profits decline following switches from male-to-female CEOs. They argue that female executives change the corporate culture in the firm and encourage more ethical behavior. In their review of 30 years of research on the determinants of business ethics Kish-Gephart et al. (2010) conclude that although the relationship remains unclear, the weight of the empirical evidence and theory supports the hypothesis that women are less likely than men to make unethical decisions. So our results are also consistent with alternative hypothesis:

H2': *Women are more ethical than men and as they may consider repurchasing stock to take advantage of undervaluation as an unethical activity, buybacks by firms with (more) women on their board may be less driven by market timing hence followed by lower long-term excess returns on average.*

Finally, our analysis can shed some light on whether female executives are more risk averse than men. One argument for mandatory gender quotas on bank boards, made after the financial crisis, is that as women are more risk averse the crisis could have been avoided had there been more women on bank boards. For example, this argument was made by Michel Barnier, Europe's internal markets commissioner to justify gender quotas on bank boards (Treanor, 2011). A repurchase increases leverage and therefore risk. This leads us to our final hypothesis:

H3: *If women are more risk averse, the risk aversion hypothesis predicts that boards with female representation would be more reluctant to repurchase stock.*

[4]Evidence that women are more ethical in business across a wide range of practices, including being more critical of ethical issues and less loyal to the company in questionable situations, is provided by Ford and Richardson (1994) and Craft (2013).

Numerous studies in the Psychology literature [e.g., Byrnes et al. (1999)] document that women are typically more risk-averse. However, as pointed out by Adams and Ragunathan (2015), generalizing from the general population to the executive ranks may be misleading. Adams and Funk (2012) in a survey of the population of directors in Sweden find that female directors are less risk averse than male directors in their sample. Also, Adams and Ragunathan (2015) find that gender diversity is positively related to risk taking in the banking sector around the financial crisis. On the other hand Huang and Kisgen (2013) find evidence consistent with the risk aversion hypothesis: when females replace males on boards, the likelihood of acquisitions, leverage and debt issuance fall. Bernile et al. (2016) also show that greater board diversity leads to policies associated with lower financial risk, i.e. lower financial leverage and higher dividend yields.

Our key finding is that long-term post buyback announcement abnormal returns are significantly smaller for firms with (more) female representation on their board. We reach this conclusion using, for robustness, two different measures of diversity: the presence of women and the percentage of women on the board. This result is consistent with H2, but not consistent with H1. At the same time, we also find evidence contradicting H3: firms with more female board representation are more, not less likely, to announce buyback programs. We also test whether women directors are better at market timing when they have access to better information as predicted by the male information advantage hypothesis H2. Consistent with this hypothesis when the CEO is female, or when female directors have a larger network because they sit on more boards post-buyback long term excess returns improve. Note that this inconsistent with H2', i.e. that female executives are opposed to market timing because of ethical considerations.

Our key finding holds also after controlling for potential endogeneity issues. For example, it may well be that the decision to hire women directors is correlated with proxies for the likelihood of undervaluation. In other words, firms with women on the board are perhaps priced more correctly, on average. For example, large firms are more likely to hire women but

large firms are also priced more correctly than small firms. Firms with higher institutional holdings may also have more women on their boards. If institutional investors make markets more efficient you would also expect that gender diversity would be negatively correlated with market timing ability. In our analysis of long-term excess returns (following the approach of Brennan et al. (1998)) we control for various proxies for the likelihood of undervaluation. We also adopt the instrumental variable approach proposed by Adams and Ferreira (2009) who argue that the fraction of male directors with board connections to female directors can be a valid instrument for the fraction of female directors. The same results hold also when we use a different, but weaker in our case, instrument, namely that used by Chen et al. (2016) in their study on female board representation and acquisition intensity. That instrument is the female labor force participation rate at the location of the firm's headquarters.

Although the focus of our paper is on long-term excess returns, we also examine short-term announcement returns. It is possible that women executives are not good at market timing or they don't believe that market timing is an appropriate motivation for a buyback. But, perhaps, buyback decisions when gender diversity is high create more value for other reasons. For example, the stock was undervalued but the market reacted more efficiently, correcting a large part of the undervaluation at the time of the announcement. We find that announcement returns are significantly lower for firms with gender diverse boards. However, after introducing control variables for potential benefits from share buybacks this gender effect disappears. So the smaller long-term excess returns are not compensated by higher short-term excess returns.

The paper is organized as follows. We describe the repurchase data used for our study in Section II. In Section III we present differences of our sample firms depending on the firms' (board gender) diversity, and study the effects of diversity on the likelihood that a firm announces a repurchase program. In section IV we first examine the effect of buyback announcements on short term returns and test whether diversity makes a difference in the short run. We then turn in Section V to our main question whether the market timing of

share repurchases is related to diversity. After we find that high diversity firms and firms with female representation on their board are worse market timers, we test whether this finding is not simply the result of the fact that these firms are less likely to be undervalued, using various proxies of undervaluation proposed in the literature. In Section VI we study market timing of repurchases using cross-sectional regressions controlling for factors that may affect post repurchase announcement returns as well as using an instrumental variable approach to control for possible endogeneity. In this section we also document that connectivity of women, measured by the number of boards they are on, is positively related to long term excess returns. Finally, we conclude in Section VII.

II. Data

Our sample of buyback announcements spans the period from 1999 to 2015 as this is the period for which we also have data on firms' board composition. We use board composition data from Boardex. For each firm we obtain each year the number and percentage of females on the board. In order to also study the effects of having a female CEO, we do not include women CEOs in the number of women board members.[5] In order to proxy for the information network of directors, we also measure the number of other boards where they are present. We use the most recent information available before the repurchase announcement. We combined all open market repurchase authorization announcements from both the SDC Repurchases data base and the SDC US mergers and acquisitions (M&A) data base. We removed the following events: (1) no CRSP returns were available; (2) not all Compustat data were available; (3) the percentage of shares authorized was larger than 50%, (4) the one month pre-announcement closing price was less than \$3, (4) the primary stock exchange was not the NYSE, Nasdaq, or Amex; (5) the firm belonged to the Financial or Utilities sector, (6) board

[5]Including them does not affect our conclusions on gender diversity - results available upon request. Note that only 193 of our events are from firms with a female CEO.

composition data were missing. We obtained a final sample containing 4,875 buyback events made by 1,673 firms. We also collected company fundamentals data from Compustat/CRSP. All variables used throughout this paper are described in the Appendix.

Table 1 provides some summary statistics. The average (median) percent of shares authorized for our sample of firms is 7.50% (6.10%), the average (median) market capitalization at announcement is \$8,707 (\$1,762) Million, while the average (median) BE/ME ratio is 0.50 (0.40). As Boardex collects data mostly for relatively large firms, our sample has firms that are larger than the typical repurchasing firm (e.g., the average (median) market capitalization of the sample of Evgeniou et al. (2016) is close to \$6 billion (\$860 million)).

In our sample of 4,875 buyback events, the average number of females on the board is 1.07. In 1,689 cases there is no female member on the board, in 1,753 cases there is one, in 999 cases there are two, in 307 cases there are three, and in 127 cases more than three, with the maximum number of women being 6. Hence there is very little variability in the number of women. For 193 buyback events the CEO is female, while for only 17 events the CFO is female. For 70 events at least one female senior executive or director (non-CEO) is present on the board.[6] Since only few of the firms have a female CEO, CFO, or senior executive, we focus on female representation on corporate boards, which is both more common and more heterogeneous across firms, as well as typically used in the literature [e.g., Chen et al. (2016)]. Given the little variability in the number of women, we use the presence or percentage of women on a board as our main variables for gender diversity. As can be inferred from Table 1, on average 11.43% of the board members are women. For the firms for which there is at least one female on the board, we find that females represent on average 17.32% of board members, with the maximum being 80%. Table 1 also shows descriptive statistics for our proxy for connectivity: the average number of board positions in other companies, both for

[6]We considered these positions, reported in Boardex: "Presiding Independent Director","Independent Vice Chairman", "Executive VP","Lead Independent Chairman","Presiding Independent Chairman", "Executive VP/COO","COO","Presiding Lead Independent Director".

men and women. The median event with female board presence has females with no other board seats, while the median for male board members is 0.71 board seats.

Table 1 also shows some proxies for the likelihood of undervaluation, i.e. the U-index developed by Peyer and Vermaelen (2009) and the EU-index developed by Evgeniou et al. (2016). Controlling for these proxies allows us to test whether the gender diversity effect is simply the result of the fact that women are less present in undervalued firms. Following Peyer and Vermaelen (2009) we calculate the U-index as follows. Companies get a size score from 1 (large firms) to 5 (small firms) depending on the quintile of their market value of equity in the month prior to the buyback announcement. Then, we calculate the 6-months pre-announcement absolute returns by summing up daily returns until 2 days before announcement for all events and assign a score of 5 to the firms in the lowest return quintile and a score of 1 to firms in the highest return quintile. Finally, we assign a book value to market value (BE/ME) score to firms depending on the quintile of their BE/ME value of equity in the year prior to the buyback announcement, with a score of 1 to small BE/ME firms and 5 to large ones. Like Peyer and Vermaelen (2009) we use all CRSP companies to define the quintile thresholds each month. The U-index is the sum of all these scores so it ranges between 3 and 15. Table 1 shows the average (median) value of the U-index in our sample is 7.89 (8). The assumption behind the U-index is that small beaten up value stocks are more likely to buy back stock because they are undervalued than other stocks.

The EU index of Evgeniou et al. (2016) considers two additional indicators of the potential for misvaluation: volatility and standardized idiosyncratic volatility measured by $(1 - R^2)$. The reason for adding these two variables to the U-index is that managers are more likely to have inside information when stock prices are driven by company-specific events and when the potential for mispricing is large (such as in very risky firms). The volatility is measured as the daily standard deviation of returns during the previous 6 months and R^2 is measured using the Fama and French (2015) five factor model, also using daily returns over the previous 6 months. We define two types of events: "low (idiosyncratic) volatility"

and "high (idiosyncratic) volatility" events, depending on whether (idiosyncratic) volatility was in the top or bottom 20% of the (idiosyncratic) volatilities of all CRSP companies. The EU-index is then simply calculated as the the sum of three numbers: high U-index firms (top 20%) get a score of 2, low U-index firms (bottom 20%) get a score of 0; high idiosyncratic risk firms get a score of 2, low get a 0; and high volatility firms get a score of 2, low get a 0. Firms that get neither 0 nor 2 (hence are in the middle of the range) get a score of 1 for each of these 3 scores. So the maximum value of the EU index is 6 and the minimum is zero. Table 1 shows that the average (median) value of the EU index is 2.99 (3).

Figure 1 Panel A shows the number of buyback announcements for which the percentage of women on the board of the firm is available within the year before the buyback announcement. The number of buyback announcements increases steadily until 2007 to more than 500 per year. In 2009, immediately after the crisis, the number of buyback announcements drops by more than 60%, before recovering at the end of our sample period to reach a number of 326 buybacks in 2015. Figure 1 Panel B shows the average number of women on the board, only for the buyback announcements that had at least one female on the board. Ignoring 1999 when we have very few observations, the average number of women seems to increase over time from 1.48 in 2000 to 1.84 in 2015. Figure 1 Panel C shows the average percentage of women, also only for the buyback announcements that had at least one female on the board. Again a clear positive trend is observable: while in 2000 14.37% of board members were women, by 2015 this number increased to 19.80%. As mentioned supra, we consider the last board composition reported before the buyback announcement and within at most one year before the announcement.

Our two measures of diversity are the presence (dummy variable) or the percent of women on the board. Note that our sample mostly consists of events of firms which have up to three women on board (97.39% of our events), with most (70.61% of our events) having no or only one. When we use the percentage of women on the board as a measure of diversity, we also define *high diversity buybacks* as buybacks announced by companies in the top 20^{th} percentile

of our sample in terms of percent of women: in this subsample of 1,087 events, firms have at least 20% women on their board. Unlike the presence of women on the board this measure adjusts for board size.[7] Given that 34.65% of the firms in our sample have no women on their board we consider all these 1,689 events as our *low diversity buybacks* - and use the terms "no female" and "low diversity" interchangeably. Finally, for the double sorting analysis, for other firm characteristics (such as e.g., volatility) we define "low" and "high" events to be those in the top or bottom 50% of all CRSP firms the month before the repurchase according to that characteristic.[8]

III. Gender Diversity and Characteristics of Buyback Firms

In Table 2 we split the sample into low diversity and high diversity company-announcements using the percentage of women on the firm's board as discussed above.[9] Panel A shows the percentage of firms in each group that have a specific characteristic. Panel B measures the average value of each characteristic. For each characteristic we test whether its mean (percentage) is statistically different between the low and high diversity samples.

Low diversity firms are more likely to mention in the press release "undervalued" as a motivation for the buyback although it should be pointed out that very few firms state an explicit motivation for the repurchase. In the high diversity sample 14.08% of CEOs are

[7]Indeed, consider a company with a board with 8 men and 1 woman and another board with 3 men and 2 women. By simply defining low diversity firms as those with no women on the board, we assume that the influence of the female directors is independent of board size.

[8]We use this high percentage also in order to have enough events in each category in our double-sorts. Modifying this threshold does not affect the results qualitatively.

[9]We also made a comparison between firms with no women and firms with some women on board. The conclusions are identical to the ones of Table 2. Using the medians instead of the averages also leads to the same conclusions. Results available upon request.

female but there are basically no female CFOs. So CFOs which in theory should know more about company valuation than other directors are basically always male. High diversity firms tend to be relatively larger firms with higher returns in the 6 months prior to the buyback announcement, but with lower book-to-market value (BE/ME) ratios. Note that size, BE/ME and prior return are the major components of the Undervaluation-index (U-index) developed by Peyer and Vermaelen (2009). As argued in that paper, small beaten up value stocks are more likely to buy back stock because they are undervalued. So the fact that high diversity firms tend to be larger, have higher prior returns and lower BE/ME ratios means also that they have significantly smaller U-index ratios as indicated in the table. Table 2 shows that the EU-index and its components are also significantly higher in low diversity firms, again supporting the hypothesis that high diversity firms are less likely to be undervalued.

Figure 2 shows the histograms of the U- and EU-index for the low and high diversity samples: in agreement with Table 2, the histogram for the low diversity firms is slightly shifted to the right. Finally, low diversity firms tend to have lower leverage but they buy back larger fractions of shares. They are also less covered by analysts, which is not surprising as they are smaller firms. Using the E-index of Bebchuk et al. (2009)[10] as one measure of corporate governance it seems that low diversity firms have lower governance quality and fewer board members. The fact that their payout ratios and return on assets are lower suggests potentially higher governance concerns in companies with low female board participation.

So one general conclusion from Table 2 is that buybacks in high diversity firms seem to be less driven by undervaluation than buybacks in low diversity firms, at least if we use ex-ante measures of the likelihood of undervaluation. High diversity firms tend to be larger, well performing growth firms with relatively smaller (idiosyncratic) volatility and relatively larger

[10]The E-index is taken from the website of Lucian Bebchuk for events until 2006, and calculated following Bebchuk et al. (2009) for the more recent events as the sum of six binary variables indicating whether the firm has the following: Staggered board, Limitation on amending bylaws, Limitation on amending the charter, Supermajority, Golden parachute, Poison pill.

analyst coverage. Hence, based on the results of past research [e.g.,Peyer and Vermaelen (2009), Evgeniou et al. (2016)] we expect that these buybacks will be on average followed by smaller long-term excess returns. So controlling for these variables will be crucial in our subsequent empirical analysis.

Table 2 also shows that high diversity boards tend to be larger, with 9.70 seats on average versus the 7.40 seats of low diversity boards. This is also expected as high diversity firms are also on average larger ($15.24 billion vs $1.97 for the other firms). So the number of women on the board does not necessarily indicate more power for women directors. We also document the percent of men that sit on other boards with at least one woman, which will be our main instrumental variable to control for endogeneity in our analysis. In high diversity firms 40.10% of the men sit on other high diversity firms, significantly more than the 17.70% in low diversity firms.

Tables 3 and 4 test whether the probability of a buyback depends on gender diversity, using all CRSP firm-month decisions during the same period. Table 3 measures diversity with a presence of women dummy while Table 4 uses percent women on the board. To a large extent we use the model of Massa et al. (2007) to predict whether, ceteris paribus, diversity increases the likelihood of a share buyback. Both Logistic and Probit regressions show that a share repurchase is more likely if the firm has announced a repurchase during the previous 2 years, if it has low returns in the previous 6 months, has low leverage, large profitability, a low book-to-market ratio, or low capital expenditures. Ownership structure also matters: firms with more institutional investors and independent directors are more likely to buy back stock. The most relevant finding for this study is that the regression coefficient on the diversity variable in both Table 3 and Table 4 is statistically significantly positive at the 5% level. This result is inconsistent with H3, the *risk aversion hypothesis*, i.e. the hypothesis that boards with (more) female representation are less inclined to approve share buybacks because they increase leverage and therefore risk.

Note that our results on buybacks differ from Chen et al. (2016) who find that female

representation on boards reduces the likelihood that a firm will make acquisitions, especially large acquisitions. They explain their findings using social identity theory which predicts that compared to all-male boards, boards with one or more female directors will be associated with more thorough intra-board discussions and more active oversight in evaluating strategic decisions.

IV. Gender Diversity and short-term returns around buybacks

Share repurchases can have many objectives including (1) moving to an optimal (more leveraged) capital structure possibly to benefit from the tax deductibility of interest payments, (2) reducing agency costs of free cash flows to eliminate excess cash that otherwise would be wasted, or (3) signaling that the stock is undervalued. Note that none of these motivations predicts long-term excess returns, unlike the market timing hypothesis which assumes market under-reaction. It is also not obvious that gender should have a material impact on short term returns. The *"male overconfidence hypothesis"* as well as the *"male information advantage hypothesis"* apply to the investment aspect of a share buyback, i.e. the ability to buy undervalued stock, which should be reflected in long-term returns, not short-term returns. Even if one would adopt the thesis that female executives care more about stakeholder value (Matsa and Miller, 2013) than shareholder value, one would expect, ceteris paribus, fewer buybacks in firms with larger diversity, which is inconsistent with the results in Table 3. Indeed, while many arguments can be made that buybacks are good for shareholders, they may hurt other stakeholders such as workers and bondholders: a buyback increases leverage and pays out cash that could have been used to create more jobs and increase salaries.[11]

[11]For example, Lazonick Lazonick (2014), an advisor to Hilary Clinton, argues that "if the U.S. is to achieve growth that distributes income equitably and provide stable employment, government and business leaders must take steps to bring both stock buybacks and executive pay under control".

Table 5 shows the CAR for three subperiods around repurchase authorization announcement and tests for significant difference between low diversity (no female representation) and high diversity firms. Three subsamples are considered: the first "No Female" (also "Low Diversity") sample includes the 1,689 firms in which there are no females on the company board; the second "Some Female" sample includes all 3,186 firms with at least one female on the board; the third "High Diversity" sample includes all 1,087 firms for which the percentage of females on board was in the top 20^{th} percentile in our sample, as discussed above. For each event we calculated the Fama and French (2015) five-factor model β's using 60 days before day -10 from the repurchase announcement. We then used these β's to calculate cumulative average abnormal returns (CAR) for the indicated time periods.

In all three sub-samples, firms experience significant negative abnormal returns in the 10 days prior to the buyback announcement, a result consistent with past research on share buybacks [e.g., Vermaelen (1981), Dann (1981)]. Moreover, these pre-announcement returns are significantly higher in the "High Diversity" sample than in the no female sample. This is consistent with the results from Table 2 that when diversity is low it is more likely the buyback is driven by undervaluation. If we define the announcement return CAR (0,1) as the sum of the excess return on day 0 and day +1 (to allow for the fact that some announcements may be made after hours), we find that average abnormal announcement returns are 0.60% lower (t = 2.42) in the high diversity group than in the "No Female" group. This dominance of low diversity firms continues after day 1: from day +2 until day +10 the high diversity firms experience 0.96% lower (t = 3.71) excess returns than the "No Female" firms. So the finding that low diversity firms do better when the buyback is announced is not reversed in the near future.

To confirm whether diversity independently determines short term returns we run cross-sectional regressions of the announcement excess return CAR (0,1) against board gender diversity (Woman on board dummy)[12] controlling for variables that proxy for motivations

[12]When we use the percent of women on the board as our diversity variable, the results are identical

for the buyback proposed in the literature. As the signaling motivation for buybacks is more likely if firms are undervalued, we include the components of the U-index of Peyer and Vermaelen (2009) as well as other proxies proposed by Evgeniou et al. (2016) such as volatility, idiosyncratic volatility and analyst coverage as control variables for the signaling motive. To control for agency costs of free cash flow we include leverage, payout ratio and the E-index and in order to control for tax benefits we include the return on assets as well as the corporate tax rate as tax savings will only be relevant if a firm is profitable.

The results are shown in Table 6. Controlling for event/firm characteristics, we find that, in contrast to the findings of Huang and Kisgen (2013) who examine other corporate decisions such as mergers and acquisitions and debt issues, short-term announcement returns are not influenced by gender. The most significant explanatory variable is prior returns, a proxy for the likelihood of undervaluation. However, the more interesting question is whether *long-term* excess returns are driven by gender: are boards with (more) females better or worse than male- dominated boards in judging whether a buyback is justified because of undervaluation? We turn to this question next.

V. Gender Diversity and Market Timing

A. Unconditional Results

For all our analyses, in order to calculate excess returns we use the Fama and French (2015) five factor model as a benchmark. This model assumes that expected stock returns are driven by 5 factors: the market index, size, book-to-market, profitability and investment. We use the IRATS method (Ibbotson, 1975) where for a given sample of firms that announced an open market share repurchase we run the following regression each event month j:

$$(R_{i,t} - R_{f,t}) = a_j + b_j(R_{m,t} - R_{f,t}) + c_j SMB_t + d_j HML_t + e_t RMW_t + f_t CMA_t + \epsilon_{i,t},$$

(available upon request).

where $R_{i,t}$ is the monthly return on security i in the calendar month t that corresponds to the event month j, with $j = 0$ being the month of the repurchase announcement. $R_{f,t}$ and $R_{m,t}$ are the risk-free rate and the return on the equally weighted CRSP index, respectively. SMB_t, HML_t, RMW_t, CMA_t are the monthly returns on the size, book-to-market factor, profitability factor and investment factor in month t, respectively. We then report the sums of the intercepts of cross-sectional regressions over the relevant event-time-periods, expressed in percentage terms. The standard error (denominator of the t-statistic) for a window is the square root of the sum of the squares of the monthly standard errors. Note that the IRATS method adjusts for buyback induced risk changes after the announcement (Grullon and Michaely, 2004) and that events are equally weighted. Value-weighting events reduces the significance of long-term excess returns for the simple reason that small stocks are more likely to be mispriced [e.g., Peyer and Vermaelen (2009), Loughran and Ritter (2000)]. As Loughran and Ritter (2000) point out, when an event is controlled by managers, more observations will occur in periods when firms are misvalued. So alternative methods such as the calendar time approach which constructs equally weighted portfolios in calendar time are systematically biased against detecting market inefficiencies.

Table 7 shows the IRATS 5-factor abnormal returns for the same three types of buyback events as in Table 5: a) those for which there are no females on the company board, b) those for which there is at least one female, c) those for which the percentage of females on board is in the top 20^{th} percentile of our sample (noted as "High Diversity" in Table 2). On average, share buybacks by firms with some female board members or with high diversity boards generate economically and statistically significant lower long term excess returns than firms with no females on the board. This conclusion holds for all horizons. The results are also shown in Figure 3.

Table 8 Panel A shows again the 5 factor cumulative abnormal returns but now for 5 buyback subsamples: firms without female representation and firms with 1, 2, 3 or more women on the board. Table 8 Panel B tests whether excess returns in firms with no female

representation are different from excess returns in firms with 1 or more females on the board. The results show that for all investment horizons firms with no females on the board earn statistically significant (at the 5% or less) larger excess returns than firms with one, two, or three females on the board. However, the absolute number of women (one or more) does not matter. Note that there are only a few events (127 events) with more than three women on board, which may explain some of the non-significant returns.

One explanation for our findings is that firms with female representation happen to be less likely to be mispriced, as for example suggested by their relatively low scores for the U-index reported in Table 2. Hence we need to adjust for these factors before making any conclusions. First we compare high diversity and low diversity firms, conditional on 4 proxies for undervaluation. We then run cross-sectional regressions of long term excess returns, also controlling for possible endogeneity.

B. Conditional Results

Table 9 shows whether the lower excess returns after buyback announcements from firms with female representation are simply the result of the correlation of diversity with measures of the likelihood of undervaluation such as the U-index (Peyer and Vermaelen, 2009) and the EU-index (Evgeniou et al., 2016). Panel A compares long-term excess returns for no and some female representation firms, both for high and low U-index firms. Panel B is similar to Panel A but now we use the EU-index to classify firms. As noted above, there are few "High Diversity" events in our sample (1,087 events), hence in our double-sorting analysis we end up with small numbers of events in a number of cases. Therefore for this analysis we do the double-sorting using the "No Female" and "Some Female" cases for the diversity dimension. The results are qualitatively similar for the low vs high diversity split double-sorting analysis.[13]

Table 9 indicates that, given the level of undervaluation, buybacks by firms with female

[13]Results available upon request.

representation are followed by smaller long-term excess returns than the other ones. For example, for the low U-index firms, the no female representation group is followed by 48-month excess returns of 24.38% (t = 7.08), significantly larger than the 9.95% (t = 5.84) in the other sample. However, double-sorting only using these undervaluation proxies does not always lead to statistically significant differences in excess returns of the no female and some females on board samples. Note though that the U-index is generally not a good predictor of undervaluation in our sample, as high U-index firms do not have larger excess returns than low U-index firms in all cases. To some extent this is not surprising as our sample consists of relatively large firms and the predictive power of the U-index falls when firms become larger (Peyer and Vermaelen, 2009). However, Panel B of Table 9 shows that the EU index is a much better predictor as, for comparable samples, high EU index firms outperform low EU index firms in the long run. The better performance of the EU-index must be caused by the better predictive power of idiosyncratic and/or total risk. These proxies are added by Evgeniou et al. (2016) to the components of the U-index (market-to-book, firm size and prior return) to construct the EU-index, and we study them in Table 10.

In Panel A of Table 10, we control for idiosyncratic volatility measured by $1 - R^2$, where R^2 is of the regression of the pre-buyback announcement returns on the five factors using daily returns during the 6 months before the buyback announcement. If we assume that managers only have superior information about company-specific events, we expect that buybacks in firms with high idiosyncratic volatility are more likely driven by market timing. In short, the fact that gender diversity is negatively correlated with long-term excess returns could be the result of the fact that diversity is negatively correlated with (idiosyncratic) volatility. Table 10 rejects this hypothesis: firms with no female representation are always associated with larger excess returns than the other firms, both for the low and the high idiosyncratic volatility firms. In the case of low idiosyncratic volatility, in firms with no female representation, after 36 months cumulative excess returns are more than 2 times larger than in the gender diversity sample and the difference is statistically significant at the 1% level.

Table 10 Panel B, also tests whether the fact that gender diversity is correlated with lower long-term excess returns is related to another proxy for the probability that the buyback is motivated by undervaluation: volatility. Ikenberry and Vermaelen (1996) argue that, because open market repurchase programs are not firm commitments, they should be considered as options to take advantage of undervaluation. The larger the volatility the larger the value of this option. To the extent the market underreacts to the creation of this option, one would expect to see larger excess returns after repurchase authorization announcements of volatile companies. Both for the high and the low volatility subsample events, all-male board firms are always associated with larger excess returns than those with females on their board, the difference being statistically significant at the 1, 5 or 10% level for most of the horizons.

The conditional tests above indicate that, although Table 2 shows that women are more represented in firms that are less likely to be undervalued (using ex ante proxies for the likelihood of undervaluation), this cannot fully explain why, ex post, share repurchase programs approved by boards with female presence experience lower long-term excess returns. Indeed, it is striking that in all the comparisons in Tables 9 and 10 regardless of the ex- ante proxy used for the likelihood that the buyback is driven by undervaluation, no gender diversity firm buybacks are followed by larger long term excess returns than the other ones, for all horizons. This is consistent with the *male information advantage hypothesis*: when the management asks board approval for a buyback, claiming it is a good time to buy back shares because the shares are undervalued, the board has to assess whether the stock is undervalued or whether the buyback is driven by other motivations such as e.g., EPS management. In order to make this assessment the board can use publicly available information (such as the U-index) or private information. However, if male boards have access to more private information they can more easily judge whether indeed the company is really undervalued or whether the fact that the stock is beaten up (resulting in e.g., a high U-index) reflects poor strategic decisions. As a result buybacks in firms with no or low female representation will be followed by higher post announcement returns.

VI. Cross-Sectional Analysis of Long-Run Excess Returns

To test whether diversity has explanatory power for excess returns in addition to known factors, we also ran regressions of long-run monthly excess returns on diversity measures and a number of control variables. We start again by using the percentage of women on the board as a measure of diversity. Following Brennan et al. (1998), we first estimate factor loadings $\beta_{jk,\tau}$ for each event j, risk factor k, and event month τ using data from the 60 months prior to the event month τ (requiring that there are at least 24 return observations during those 60 months). The risk factors used in our study are the Fama and French (2015) five factors ($R_M - R_F$, SMB, HML, RMW, and CMA). Factor loadings $\beta_{jk,\tau}$ are obtained from the following time series regression:

$$R_{jt} - R_{Ft} = a_{j\tau} + b_{j\tau}(R_{Mt} - R_{Ft}) + s_{j\tau}SMB_t + h_{j\tau}HML_t + r_{j\tau}RMW_t + c_{j\tau}CMA_t + e_{jt} =$$

$$a_{j\tau} + \sum_{k=1}^{5} \beta_{jk,\tau} F_{kt} + e_{jt}, \tag{1}$$

where F_{kt} indicates the k^{th} risk factor in month t, and t ranges over the 60 months before the event month τ for which returns are available.

Next, for each stock j in event month τ, we calculate the estimated risk-adjusted return $\Delta R_{j\tau}$ using the estimated $\beta_{jk,\tau}$ factor loadings:

$$\Delta R_{j\tau} = (R_{j\tau} - R_{F\tau}) - [b_{j\tau}(R_{M\tau} - R_{F\tau}) + s_{j\tau}SMB_\tau + h_{j\tau}HML_\tau + r_{j\tau}RMW_\tau + c_{j\tau}CMA_\tau] =$$

$$(R_{j\tau} - R_{F\tau}) - \sum_{k=1}^{5} \beta_{jk,\tau} F_{k\tau} \tag{2}$$

Then for all event stocks in each post-event month τ (from the 1^{st} to the 48^{th} month

following the buyback announcement), we run the following cross-section regression:

$$\Delta R_{j\tau} = c_{0\tau} + \sum_{m=1}^{M} c_{m\tau} Z_{mj} + \mathrm{Y}earDummies + \epsilon_{j\tau}, \tag{3}$$

where Z_{mj} are the m^{th} characteristic of stock j in the month prior to the buyback announcement, such as centrality, total volatility, $(1 - R^2)$, analyst coverage, U-index, etc.

Finally, we compute the average of the monthly regression coefficient estimates $c_{m\tau}$ over the event months 3 through 48, C_m^n for n in 3 to 48. We calculate standard errors of the aggregated coefficients using the standard Fama-MacBeth approach (Fama and Macbeth, 1973): the t-statistics for testing the hypothesis that $C_m^n = 0$ are:

$$t(C_m^n) = (C_m^n)/(s(C_m^n)/\sqrt{n}) \tag{4}$$

where n is the number of post-event months to calculate C_m^n and $s(C_m^n)$ is the standard deviation of the monthly estimates, $c_{m\tau}$ for τ in 1 to n. We do this for four different time horizons n: 1 to 12 months, 1 to 24 months, 1 to 36 months, and 1 to 48 months.

In Tables 11 and 12 we run multivariate cross-sectional regressions of the long-run monthly excess returns on the firm's board gender diversity controlling for a number of firm characteristics, and including year and industry controls. For robustness we use the presence of women in Table 11 and the percentage in Table 12. In both tables, the significance of the characteristics depends on the investment horizon. For example, for the 48-month horizons, we find results that are largely consistent with past research: small firms, and firms with high $(1 - R^2)$ experience larger long-run excess returns. However, both the presence (dummy variable for Table 11) and the percentage (for Table 12) of women on the board is always negative and statistically significant for all cases (at the 1 or 5% level for the 36- and 48-months horizons).

Table 11 indicates that the presence of women on the board of a firm leads to a drop on the average monthly excess returns over the 48 months after the buyback announcement

of 0.19%, or 9.30% over the 48 months. Similarly, from Table 12 we see that on average a percentage increase of women on the board of a firm leads to a drop on the average monthly excess returns over the 48 months after the buyback announcement of 0.01%, or 0.48% over the 48 months. Note that the average percent of women in firms with at least one women on the board in our sample is 17%, so in these firms a share buyback is followed on average by 8.16% lower returns after 48 months. Interestingly the coefficient of the dummy variable indicating whether the CEO is female is positive and significant (at the 5 or 10% level) over the 36-month and 48-month horizons in both tables: when the CEO is female she may no longer have an information disadvantage. Note however that for only 35 of the events that have a woman CEO there are no other women board members, which may partly explain the lower significance of that variable when we measure gender diversity using the presence of women on board.

Finally, in Table 13 we control for gender diversity in a third way: we test the effect of the absolute number of women on the board, controlling for the size of the board. Using dummies for the absence of women or for the presence of 2, 3, or more than 3 women, we can see the effects of the number of women relative to having only one. The results are again consistent with those in Tables 11 and 12: the absence of women has a positive effect on the long term returns relative to having one woman on board. However, having more than one woman on board does not make a difference relative to having only one, consistent with the results in Table 8. Together with Tables 11 and 12 this also indicates that the presence of percent or women matter, but not their number - which may also be an artifact of the fact that most of our data have up to 3 women on the board.

A. Robustness Test: Endogeneity.

While all results so far support the hypothesis that long-term excess returns after buyback announcements are lower when there are more women on the board, one could argue that the interpretation of these results suffers from endogeneity concerns. Perhaps firms with women

on their board are different from other firms and this may explain the difference in long-term excess returns.

In order to adjust for endogeneity, we adopt a 2-stage Heckman model approach using an instrumental variable to explain the presence of women on a firm's board. In the first stage we use a probit model to predict the presence of women on the board, and we then use the Inverse Mills ratio from that stage in a second stage regression to explain the excess returns after a buyback announcement. For robustness, we use two instrumental variables used by others in related research. First, for our main instrumental variable we follow Adams and Ferreira (2009) and use the percentage of men on the board of the firm who are also on other boards that include women. Second, following Chen et al. (2016), we also use as our exogenous instrument the female labor force participation rate, calculated at the U.S. county level (data sourced from the U.S. Census Bureau), at the location of a firm's headquarters. This measure is not firm specific and should be related to the number or percentage of women on the board as firms are more likely to hire local directors (Knyazeva et al., 2013). So in a first stage we regress the presence of female directors against an instrumental variable and all other controls as also used in the second one. In the second stage we regress excess returns using also the Inverse Mills ratio from the probit regression, and the other controls.

The results for the first stage regression using both instrumental variables are shown in Table 14. Note that the control variables include proxies for the likelihood of undervaluation, the likelihood of a share buyback, board size, and measures of corporate governance. Both instrumental variables are statistically significant at the 1 and 5% level. The second instrument (female labor force participation rate) is, however, less significant that the first, as is also indicated by the basic comparison of high and low diversity samples in Table 2.

The results of the second stage using the main instrumental variable are shown in Tables 15 (for presence of women) and 16 (for percentage of women). The conclusion that gender diversity, ceteris paribus, is associated with smaller long-term excess returns after buybacks is confirmed. The effect is negative and statistically significant at the 1 or 5% level for the

36 and 48 months horizon. Moreover, when the CEO is a woman, long term excess returns improve significantly at the 5 or 10% level in both tables for the 48-month horizon, consistent with the hypothesis that excess returns reflect access to information.

For robustness, we show in Tables 17 and 18 the second stage regression using the second, weaker, instrumental variable. The regression confirms our results: over all horizons from 24 months and beyond, the presence of women on the board lowers long-term excess returns while having a female CEO is associated with long term positive excess returns. However the results are less statistically significant, possibly due to the use of a weaker instrument.

B. Are better connected women associated with larger excess returns?

One prediction of the male information advantage hypothesis is that women with better information networks should make better timing decisions. Our previous results already show support for this hypothesis, as the long-term excess returns associated with the presence of women basically disappears when the CEO is a woman. We now explore this hypothesis further by studying also the number of other boards women (and men) are on, assuming that more board positions improve the information network.

As an initial test of the importance of board connections for market timing, we return to our IRATS methodology and cumulative long-term excess returns for 2 subsamples of only the firms with women: the Low Connections sample which contains the firms with the bottom 50% women board connections, and the High Connections sample which contains the firms with the top 50% women board connections. Note that as the median of the average connection of women is 0 (see Table 2), the first sample consists of the firms for which women board members are not connected to any other boards. The results in Table 19 show that over every horizon, long-term excess returns are higher when women have more board connections. Of course it should be noted that, unlike the previous non-IRATS results we have not controlled for other factors that could explain the difference in returns, such as firm

size, the U-index, volatility and the EU index. However, Table 20 shows that, compared to the Low Connections sample, in the High Connections subsample the average market cap is significantly higher and the U-index and the volatility are significantly smaller. Specifically, the average firm size, U-index, volatility, and EU-index of the "Low Connections" ("High Connections") sample are 14474.20 Million (21,803 Million - t-test -4.10), 7.35 (7.12 - t-test 2.24), 2.02% (1.93% - t-test 2), and 2.57 (2.50 - t-test 1.24), respectively. Hence the fact that "High Connections" firms outperform "Low Connections" ones can clearly not be explained by the fact that the former are more likely to be undervalued. Indeed, interestingly all these characteristics indicate that the "High Connection" sample should have lower long-term excess returns, not higher as indicated in Table 19.

To control for possible differences between the two samples of firms, we also run cross-sectional regressions this time only for the sample of firms that have women on their board, including as an independent variable the average number of connections of both women and men. As before, we adjust for potential endogeneity (e.g. of sample selection of firms that do have women on their board) by including the Inverse Mills ratio from the probit regression of Table 14. The results using our main instrumental variable (percent of men on other boards with women) are shown in Table 21. The results show that when women have other board seats long-term excess returns improve and often the relation is statistically significant, especially over the 48 months horizon where the effect is significant at the 1% level. While the effect for men is also positive, it is less significant at the 48 month horizon. Possibly men have access to more alternative social networks, making board networks less relevant. These results are consistent with the interpretation that market timing with share buybacks is easier when board members have better information networks. Women (as well as men) can improve their information network if they are the CEO or if they sit on many other boards. As a robustness check, Table 22 shows the results when we use the second instrumental variable (county female labor force participation). The results are similar to the results reported in Table 21, although the regression coefficients on the Women on Board percent variable

are less significant (e.g. for the 48-month case the p-value is 0.12). Note again, however, from Table 14 that, when predicting presence of women, the second instrument is far less significant (t = 2.50) than the first one (t = 10.05).

Overall, the combined results of Tables 7 through 22 are consistent with the male information advantage hypothesis that argues that men have a better information network which allows them to value firms better, i.e. to judge whether shares are undervalued when the management requests a buyback authorization. This is consistent with the interpretation of Inci et al. (2016) who find that female directors earn smaller profits from insider trading. It could of course be also consistent with an "ethical" interpretation: women may be more ethical than men and don't believe that market timing, i.e. buying undervalued shares from uninformed investors, is a proper thing to do. Regardless, all the results in this paper are inconsistent with the "male overconfidence" hypothesis supported by the past findings that mergers and acquisitions made by female executives generate larger excess returns (Huang and Kisgen, 2013).

VII. Conclusion

We find that buyback authorizations approved by boards with (more) female representation are followed by significantly smaller short term and long-term excess returns. While this gender effect disappears for short-term returns once we control for proxies for undervaluation, agency costs, and other potential motivations for share buybacks, it persists for long-term excess returns. Diverse boards are more prevalent in firms that are less likely to be mispriced, i.e. large firms with high market-to-book ratios and firms with low measures for undervaluation such as the U-index of Peyer and Vermaelen (2009) and the EU-index of Evgeniou et al. (2016). However, after controlling for these as well as other indicators of the likelihood that the buyback is motivated by undervaluation, as well after controlling for endogeneity with two instrumental variables, we still find that long-term excess return are

smaller for gender diverse boards. This conclusion holds whether we define gender diversity based on the presence of women on the board or on the basis of the percentage of women on the board. Note, that although women almost never have a majority of board seats, this implies that they have an impact on firm decision making - an assumption also made in the gender diversity literature.

The post-repurchase announcement long-term excess returns are typically interpreted as evidence of market timing: managers buy back stock because their shares are undervalued. So our results are consistent with the hypothesis that high diversity boards are less successful at market timing. This conclusion is reinforced by the finding that high diversity firms on average issue equity when their shares are undervalued.

These results are inconsistent with the "*the male overconfidence hypothesis*" considered by Huang and Kisgen (2013) who find that female executives create more shareholder value in acquisitions and debt issues. However, our results are consistent with the findings of Inci et al. (2016) that female insiders earn smaller profits from insider trading. Indeed, a share buyback can be considered as an indirect form of insider buying, not with the insiders' own personal funds but with the cash flows of the corporation, which may be partially owned by insiders. In summary, we can interpret our results in the same way as Inci et al. (2016): because women have a smaller network than men they tend to have an information disadvantage. Alternatively, they may be less interested in buying back stock from uninformed investors, in the same way as they may feel it is inappropriate to engage in insider trading as suggested by Scarlat et al. (2015). In other words, the results of this paper could be given an ethical interpretation: women tend to be more ethical than men and consider market timing to take advantage of the uninformed as unethical. Or, more ethical firms hire more women.

Two additional findings, however, are more consistent with the information advantage hypothesis than the ethics hypothesis. First, in the 4% of the cases when the CEO is female, and therefore should have better access to information than the average board member, long-term excess returns clearly improve. Second, long-term excess returns improve when the

women directors sit on more boards, which we interpret as having access to better information networks. Hence, another interesting result of this paper is that board connections matter for valuation assessment. Yet, women tend to be on fewer boards, but those that are on other boards or are the CEO seem to have the same information network as men. Future research should examine how exactly networks improve valuation and market timing skills. A potential policy implication of our results is that for women directors to be more effective it is important that they have access to a solid information network e.g., by taking more leadership positions and being part of more boards.

Appendix: Variable Definitions

Analyst coverage: Number of analysts following the firm before the repurchase announcement. Variable NUMREC, I/B/E/S Database.

BE/ME: Ratio of the book value of equity to the market value of equity. We follow Fama and French (2001) to calculate the book value of equity. This is calculated using the following CCM variables: SEQ, CEQ, PSTK, PSTKRV, TXDITC, PRBA, DLC, DLTT, AT, LT. Market value of equity is calculated as the price per share multiplied by the number of shares outstanding: CCM and CRSP Monthly Stocks.

Capital Expenditures: Ratio of capital expenditure to the total assets of the firm: CCM data 128/CCM data 6 (CAPX/AT). Equal-weighted moving average over the past three years.

County Female Labor Force Participation: Percent of female labor force participation at the county of the firm's headquarters.

E-index: The E-index of Bebchuk et al. (2009). We use the data from until 2006 and we construct it after 2006 as described in Bebchuk et al. (2009) using the ISS (formerly RiskMetrics) database variables CBOARD, LABYLW, LACHTR, SUPERMAJOR PCNT, GPARACHUTE, and PPILL.

EU-index: Based on Evgeniou et al. (2016), the EU-Index of a repurchase firm is the sum of 3 indicators measured using firms characteristics scores the month before the repurchase announcement: the U-index, plus a score of 0, 1, 2 for low, middle, and high firms in terms of their volatility and standardized idiosyncratic volatility $(1 - R^2)$ the month before the announcement.

Board Size: The total number of directors on the board.

Female CEO: A dummy that is 1 when there is a female CEO reported during the year before the repurchase announcement

Female Percentage on the Board: Percentage of reported board members during the year before the repurchase announcement that are female

Institutional Holdings: Ratio of firm's shares held by the institutional investors relative to the total shares outstanding: CDA/Spectrum Database.

Leverage: The ratio $debt/(debt + equity)$. Debt is the sum of the Compustat variables DLC+ DLTT. Equity is the Compustat variable SEQ. We make the winsorization and other data adjustments as in `http://www.ivo-welch.info/professional/leverage.placebo/`.

Liquid Assets: Current assets minus current liabilities, divided by the total assets: (CCM data 4 - CCM data 5)/CCM data 6 (ACT-LCT)/AT. Equal-weighted moving average over the past three years.

Market Cap.: Market value of equity, calculated as the price per share multiplied by the number of shares outstanding: CRSP Monthly Stocks.

Non-Operating Income: Ratio of non-operating income to total assets: CCM data 61/CCM data 6 (NOPI/AT). Equal-weighted moving average over the past three years.

Number of Institutions: Number of Institutions holding shares of the firm: CDA/Spectrum Database

Numb. of Other Boards for Women: The average number of other boards women have also been members of until the event date.

Numb. of Other Boards for Men: The average number of other boards men have also been members of until the event date.

Operating Income: Ratio of operating income to total assets: CCM data 13/CCM data 6 (OIBDP/AT). Equal-weighted moving average over the past three years.

Percent of Men on Other Boards with Women: The percentage of men who are also on other boards that have female representation.

Percent Shares: The percentage of shares authorized for repurchase in the case of buybacks, or issued for the case of issuers: SDC Database.

Price/Earnings Ratio: Share price divided by the basic earnings per share: CCM data 24/CCM data 58 (PRCC/EPSPX). Equally-weighted moving average over the past three years.

Prior Returns: Cumulative return for the previous 6 months: CRSP Daily Stocks.

Profitability (ROA): Return on Assets: CCM data 18/CCM data 6 (IB/AT)

Standardized Idiosyncratic Vol. $(1 - R^2)$**:** The R^2 of the Fama and French (2015) five factor model using returns over the previous 6 months: CRSP Daily Stocks and Kenneth French's Website.

Std. Dev. Of Op. Income: Standard deviation of Operating Income over 5 years

Total Payout: Sum of repurchases and dividends: CCM data 115 + CCM data 21 (DVC + PRSTKC)

U-index: Based on Peyer and Vermaelen (2009), the U-Index of a repurchase firm is the sum of 3 indicators measured using firms characteristics scores the month before the repurchase announcement: 0, 1, 2 for low, middle, and high firms in terms of their size (2 is for large firms, 0 for small, and 1 for others), BE/ME (2 is for large BE/ME), and returns over the 6 months before the announcement (2 is for low returns).

Volatility: Standard deviation of daily returns over the previous 6 months: CRSP Daily Stocks.

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Table 1: Descriptive Statistics: Buybacks 1999-2015

Firm characteristics of sample used. See the Appendix for detailed definitions of the variables.

Panel A: Buybacks

	Min.	1st Qu.	Median	Mean	3rd Qu.	Max.
Market Cap. (Mil.)	11.66	559.2	1762	8707	6184	367400
Prior Returns	-136.8	-14.57	1.66	-0.73	15.27	296.2
BE/ME	2.6e-04	0.27	0.43	0.53	0.69	6.89
U-index	3	6	8	7.89	9	15
EU-index	0	2	3	2.99	4	6
Volatility (Percent)	0.62	1.6	2.12	2.37	2.84	10.83
One minus Rsq	0.1	0.55	0.68	0.67	0.79	0.99
Percent Shares	3e-03	3.94	6.12	7.5	9.63	49.1
Female Percent on Board	0	0	11.11	11.43	18.18	80
Female Number on Board	0	0	1	1.06	2	6
Board Size	4	7	9	8.96	11	21
Numb. of Other Boards for Women	0	0	0	1.19	1.5	24
Numb. of Other Boards for Men	0	0.33	0.71	0.98	1.36	11.09

Table 2: Firm Characteristics and Board Gender Diversity

Firm characteristics for low and high diversity buyback firms. Diversity is measured using the percentage of women on the board of the firm. Panel A shows percentages of repurchase events in the indicated column, while Panel B shows averages across the events in that column. ** indicates statistically significant difference between the two columns at the 1% level, * at the 5% level, and + as the 10% level. The χ^2-test for proportions is used in Panel A, and the t-test in Panel B. See the Appendix for detailed definitions of the variables.

Panel A: Percentages	Low Div.	High Div.	Low-High Div. (chi2-stat)
SDC Sources of Funds: Cash	8.34	9.48	-1.13 (0.91)
SDC Purpose: Undervalued	2.36	1.01	1.35* (5.9)
SDC Purpose: Stock Option Plan	0.91	0.74	0.17 (0.07)
CEO is Female	0	14.08	-14.08** (243.91)
CFO is Female	0	0.55	-0.55** (6.8)
Announced Repurchace in Previous 2 Years (0/1)	0.4	0.56	-0.17** (-8.57)

Panel B: Averages	Low Div.	High Div.	Low-High Div. (t-stat)
Market Cap. (Mil.)	1973.73	15244.5	-13270.77** (-12.81)
Prior Returns	-4.31	3.03	-7.35** (-7.01)
BE/ME	0.58	0.49	0.09** (5.31)
U-index	8.7	7.31	1.38** (14.88)
EU-index	3.48	2.68	0.8** (16.66)
Volatility (Percent)	2.79	2.07	0.72** (16.5)
(1-R^2)	0.69	0.65	0.05** (7.13)
Percent Shares	6.88	6.13	0.75** (3.31)
Analyst Coverage	8.69	14.17	-5.48** (-17.97)
Female Percent on Board	0	26.34	-26.34** (-129.55)
Female Number on Board	0	2.4	-2.4** (-90.59)
Numb. of Other Boards for Women	-	1.01	-
Numb. of Other Boards for Men	1.22	0.9	0.32** (5.08)
Board Size	7.43	9.71	-2.28** (-28.18)
Percent Independent Directors	0.72	0.79	-0.07** (-13.05)
Percent of Men on Other Boards with Women	17.65	40.07	-22.42** (-25.35)
County Female Labor Force Participation	58.77	59.92	-1.15** (-4.66)
Total Payout in Year before Event (million)	66.58	818.28	-751.7** (-10.39)
Lag Dividend Payout Ratio	0.13	0.3	-0.17* (-2.27)
Leverage	0.19	0.3	-0.1** (-10.59)
Profitability (ROA)	0.06	0.07	-0.01** (-3.66)
Net Debt	-0.1	0.02	-0.12** (-10.48)
Tax Rate	29.77	30.41	-0.64 (-1.42)
Operating Income (Percent assets)	0.13	0.16	-0.03** (-7.35)
std Operating Income	0.01	1.7e-03	3.4e-03** (6.56)
Non-Operating Income (Percent assets)	0.01	5e-03	2e-03** (4.5)
Liquid Assets (Percent assets)	0.33	0.21	0.12** (15.24)
Price/Earnings Ratio	21.53	16.43	5.1^{+} (1.79)
Capital Expenditures (Percent assets)	0.05	0.05	-3.3e-04 (-0.18)
Institutional Holdings	67.88	72.29	-4.41** (-5.47)
Number of Institutions	135.99	359.81	-223.82** (-22.04)
E-index	2.44	2.57	-0.13* (-2.42)
Observations	1654	1087	-

Table 3: The decision to repurchase: Logistic and Probit Regressions for Presence of Women on Board (Dummy)

This table presents the results for the firm's decision to repurchase using logistic and probit regressions on firm-month observations. The dependent variable is a binary variable indicating whether there was a repurchase announcement in a given month by a given firm. **, * and + denote significance levels at 1%, 5%, and 10%, respectively. Year and industry controls are used. See the Appendix for detailed definitions of the variables.

	Logistic		Probit	
	Coeff.	t-stat	Coeff.	t-stat
Intercept	-6.06**	-15.25	-2.88**	-19.06
Announced Repurchace in Previous 2 Years (0/1)	0.51**	14.71	0.21**	15.02
Market Cap.	-8.9e-04^{+}	-1.72	-3.8e-04^{+}	-1.74
BE/ME	-78.66^{+}	-1.91	-30.33^{+}	-1.95
Prior Returns	-85.51**	-9.63	-33.54**	-9.8
Percent Independent Directors	0.48**	3.24	0.17**	2.98
Total Payout in Event Year	-4.8e-05	-0.61	-1.7e-05	-0.49
Total Payout in Year before Event	-4.3e-05	-0.51	-2.2e-05	-0.62
Leverage	-0.46**	-5.21	-0.19**	-5.54
Profitability (ROA)	2.15**	8.47	0.73**	7.93
Operating Income (Percent assets)	0.88**	3.4	0.42**	4.28
Non-Operating Income (Percent assets)	0.56	0.32	0.25	0.35
Std. Dev. Of Op. Income	-0.62	-0.44	-0.03	-0.06
Lag Dividend Payout Ratio	-0.31**	-4.57	-0.12**	-4.71
Liquid Assets (Percent assets)	-0.15	-1.29	-0.05	-1.07
Price/Earnings Ratio	2.9e-04	0.53	1.2e-04	0.55
Capital Expenditures (Percent assets)	-2.53**	-4.69	-0.98**	-4.72
Institutional Holdings	0.01**	7.77	2.7e-03**	7.47
Number of Institutions	1.6e-03**	5.74	6.9e-04**	6.03
E-index	-9.3e-04	-0.04	-1.6e-04	-0.02
Board Size	0.01	1.03	3.3e-03	0.86
CEO Female	-1.05	-1.53	-0.43	-1.6
Women on Board (Dummy)	0.08*	2.06	0.03*	1.99
Observations	298759		298759	

Table 4: The decision to repurchase: Logistic and Probit Regressions for percent of Women on Board

This table presents the results for the firm's decision to repurchase using logistic and probit regressions on firm-month observations. The dependent variable is a binary variable indicating whether there was a repurchase announcement in a given month by a given firm. **, * and + denote significance levels at 1%, 5%, and 10%, respectively. Year and industry controls are used. See the Appendix for detailed definitions of the variables.

	Logistic		Probit	
	Coeff.	t-stat	Coeff.	t-stat
Intercept	-6.08**	-15.3	-2.89**	-19.11
Announced Repurchace in Previous 2 Years (0/1)	0.51**	14.71	0.21**	15.02
Market Cap.	-8.9e-04^{+}	-1.72	-3.8e-04^{+}	-1.73
BE/ME	-78.65^{+}	-1.9	-30.35^{+}	-1.95
Prior Returns	-85.49**	-9.63	-33.56**	-9.8
Percent Independent Directors	0.48**	3.23	0.17**	2.96
Total Payout in Event Year	-5.2e-05	-0.65	-1.8e-05	-0.53
Total Payout in Year before Event	-4.7e-05	-0.56	-2.3e-05	-0.66
Leverage	-0.46**	-5.21	-0.19**	-5.55
Profitability (ROA)	2.15**	8.47	0.73**	7.93
Operating Income (Percent assets)	0.89**	3.43	0.42**	4.3
Non-Operating Income (Percent assets)	0.59	0.33	0.25	0.36
Std. Dev. Of Op. Income	-0.62	-0.44	-0.03	-0.06
Lag Dividend Payout Ratio	-0.31**	-4.6	-0.12**	-4.74
Liquid Assets (Percent assets)	-0.15	-1.31	-0.05	-1.09
Price/Earnings Ratio	2.8e-04	0.52	1.1e-04	0.54
Capital Expenditures (Percent assets)	-2.55**	-4.72	-0.99**	-4.74
Institutional Holdings	0.01**	7.81	2.7e-03**	7.51
Number of Institutions	1.6e-03**	5.76	6.9e-04**	6.04
E-index	7e-05	2.9e-03	1.7e-04	0.02
Board Size	0.01	1.39	4.4e-03	1.19
CEO Female	-1.43*	-1.99	-0.58*	-2.06
Women on Board (Percent)	0.38*	2.02	0.15*	1.98
Observations	298759		298759	

Table 5: Short Term Excess Returns over Various Time Windows

This table presents the short-term average cumulative abnormal returns around open market repurchase announcements for different day windows before and after the announcement date and for different types of companies depending on board gender diversity. For each event we calculate the Fama and French (2015) five-factor model β's using 60 days before day -10 from the repurchase announcement, and then the cumulative abnormal returns are estimated using these β's and the daily returns for the window of days around the announcement indicated in the rows. For example rows 'Days 0:+1' indicates the cumulative excess returns of days 0, and 1, where 0 is the date of the announcement. The significance levels are indicated by +, *, and ** and correspond to a significance level of 10%, 5%, and 1% respectively. t-stats are shown in parentheses.

	No Female	Some Female	High Diversity	Low (No)-High Div.
Days -10:-1	-2.18**	-0.77**	-0.82**	-1.36**
	(-8.85)	(-5.85)	(-3.72)	(-4.09)
Days 0:+1	1.77**	1.27**	1.2**	0.6*
	(10.26)	(13.2)	(6.94)	(2.42)
Days +2:+10	1.4**	0.43**	0.48**	0.96**
	(7.31)	(4.18)	(2.77)	(3.71)

Table 6: Cross-Section Regressions: Short Term Excess Returns and Presence of Women on Board.

Average coefficients of each firm characteristic explaining cumulative excess returns between days 0 and +1 of the repurchase announcement. The five-factor Fama-French model is used to estimate the factor loadings for each stock using 60 daily returns until 10 days before the announcement. Excess returns using this model are then calculated for days 0 to +1. We are then regressing these excess returns on the firm characteristic. Year and industry controls are used. The significance levels are indicated by +, *, and ** and correspond to a significance level of 10%, 5%, and 1% respectively, using a two-tailed test. See the Appendix for detailed definitions of the variables.

	Estimate	t-stat	p-value
Intercept	-0.235	-0.038	0.97
Market Cap.	2.57e-06	0.569	0.569
BE/ME	0.231	0.713	0.476
Prior Returns	-0.028**	-6.915	0
Volatility	0.257*	2.116	0.034
(1-R^2)	-0.537	-0.833	0.405
Analyst Coverage	-0.026$^+$	-1.67	0.095
Board Size	-0.013	-0.233	0.816
Percent Independent Directors	1.258	1.48	0.139
Percent Shares	0.026	1.524	0.128
Profitability (ROA)	-1.738	-1.234	0.217
Net Debt	-0.303	-0.472	0.637
Tax Rate	0.002	0.174	0.862
Lag Dividend Payout Ratio	-0.081	-0.399	0.69
Leverage	1.048	1.388	0.165
Institutional Holdings	-0.001	-0.196	0.845
E-index	0.002	0.013	0.99
CEO Female	0.231	0.435	0.664
Women on Board (Dummy)	0.018	0.073	0.942
Observations	3760	3760	3760

Table 7: Buyback announcements and Board Gender Diversity, during 1999-2015

This table presents the long-term abnormal return after open market repurchase announcements from the announcement date until t months after, for different types of companies depending on board gender diversity. Tables report monthly average cumulative abnormal returns (CAR) in percent using Ibbotson (1975) returns across time and security (IRATS) method combined with the Fama and French (2015) five-factor model for the sample of firms that announced an open market share repurchase plus various subsamples. The following regression is run each event month j:

$$(R_{i,t} - R_{f,t}) \quad = \quad a_j + b_j(R_{m,t} - R_{f,t}) + c_j SMB_t + d_j HML_t + e_t RMW_t + f_t CMA_t + \epsilon_{i,t},$$

where $R_{i,t}$ is the monthly return on security i in the calendar month t that corresponds to the event month j, with $j = 0$ being the month of the repurchase announcement. $R_{f,t}$ and $R_{m,t}$ are the risk-free rate and the return on the equally weighted CRSP index, respectively. SMB_t, HML_t, RMW_t, CMA_t are the monthly returns on the size, book-to-market factor, profitability factor and investment factor in month t, respectively. The numbers reported are sums of the intercepts of cross-sectional regressions over the relevant event-time-periods expressed in percentage terms. The standard error (denominator of the t-statistic) for a window is the square root of the sum of the squares of the monthly standard errors. The significance levels are indicated by +, *, and ** and correspond to a significance level of 10%, 5%, and 1% respectively, using a two-tailed test.

	No Female		Some Female		[No-Some Female]		High Diversity		[Low (No)-High Div.]	
	CAR	t-stat	CAR	t-stat	CAR	t-stat	CAR	t-stat	CAR	t-stat
-6	-1.83*	-2.28	-1.7**	-4.35	-0.13	-0.14	-0.43	-0.65	-1.4^{+}	-1.36
+12	7.38**	6.86	3.09**	5.06	4.3**	3.47	2.62*	2.5	4.76**	3.16
+24	12.29**	7.82	6.91**	7.36	5.37**	2.93	5.45**	3.28	6.84**	2.99
+36	16.49**	8.28	10.01**	8.34	6.48**	2.79	6.96**	3.27	9.53**	3.27
+48	20.94**	8.66	13.3**	8.9	7.64**	2.69	12.98**	4.73	7.96*	2.18
Observations	1689		3186		-		1087		-	

Table 8: Buyback announcements and Number of Women on Board, during 1999-2015

This table presents the long-term abnormal return after open market repurchase announcements and SEO announcements from the announcement date until t months after, for different types of companies depending on the number of women board members. Tables report monthly average cumulative abnormal returns (CAR) in percent using Ibbotson (1975) returns across time and security (IRATS) method combined with the Fama and French (2015) five-factor model for the sample of firms that announced an open market share repurchase plus various subsamples. The following regression is run each event month j:

$$(R_{i,t} - R_{f,t}) \quad = \quad a_j + b_j(R_{m,t} - R_{f,t}) + c_j SMB_t + d_j HML_t + e_t RMW_t + f_t CMA_t + \epsilon_{i,t},$$

where $R_{i,t}$ is the monthly return on security i in the calendar month t that corresponds to the event month j, with $j = 0$ being the month of the repurchase announcement. $R_{f,t}$ and $R_{m,t}$ are the risk-free rate and the return on the equally weighted CRSP index, respectively. SMB_t, HML_t, RMW_t, CMA_t are the monthly returns on the size, book-to-market factor, profitability factor and investment factor in month t, respectively. The numbers reported are sums of the intercepts of cross-sectional regressions over the relevant event-time-periods expressed in percentage terms. The standard error (denominator of the t-statistic) for a window is the square root of the sum of the squares of the monthly standard errors. Panel A shows the results for repurchase and Panel B for SEO announcement events. The significance levels are indicated by +, *, and ** and correspond to a significance level of 10%, 5%, and 1% respectively, using a two-tailed test.

Panel A: IRATs Cumulative Abnormal Returns for Buyback announcements

	No Female		One Female		Two Female		Three Female		More than Three Female	
	CAR	t-stat	CAR	t-stat	CAR	t-stat	CAR	t-stat	CAR	t-stat
-6	-1.83*	-2.28	-2.82**	-4.91	-0.02	-0.03	-1.49	-1.45	1.68	1.03
+12	7.38**	6.86	3.53**	4.05	2.81**	2.73	1.06	0.6	2.59	1
+24	12.29**	7.82	8.11**	6.15	5.29**	3.37	4.59	1.61	8.03	1.59
+36	16.49**	8.28	11.88**	7.14	8.07**	3.89	6.11^{+}	1.68	7.04	1.13
+48	20.94**	8.66	14.84**	7.28	11.68**	4.47	10.02*	2.34	10.02	1.07
Observations	1689		1753		999		307		127	

Panel B: Comparisons of IRATs Cumulative Abnormal Returns for Different Numbers of Women

	No-One		No-Two		No-Three		No-(More than Three)		One-(More than Three)	
	CAR	t-stat	CAR	t-stat	CAR	t-stat	CAR	t-stat	CAR	t-stat
-6	1	1.01	-1.8*	-1.77	-0.34	-0.26	-3.5*	-1.94	-4.5**	-2.62
+12	3.85**	2.79	4.57**	3.07	6.33**	3.06	4.79*	1.72	0.94	0.35
+24	4.17*	2.03	6.99**	3.15	7.69**	2.36	4.26	0.8	0.08	0.02
+36	4.61*	1.78	8.42**	2.93	10.38**	2.51	9.45^{+}	1.44	4.84	0.75
+48	6.1*	1.93	9.26**	2.6	10.92*	2.22	10.92	1.13	4.82	0.5
Observations	-		-		-		-		-	

Table 9: Buyback announcements, Presence of Women on Board and U-Index or EU-Index during 1999-2015

The tables present the long-run IRATS Cumulative Abnormal Returns (CAR) for subsets of firms repurchase announcements using the five factor Fama-French model. The tables report monthly average cumulative abnormal returns (CAR) in percent using Ibbotson (1975) returns across time and security (IRATS) method for the sample of firms that announced an open market share repurchase plus various subsamples. The following regression is run each event month j for the five-factor model:

$$(R_{i,t} - R_{f,t}) \quad = \quad a_j + b_j(R_{m,t} - R_{f,t}) + c_j SMB_t + d_j HMl_t + e_t RMW_t + f_t CMA_t + \epsilon_{i,t},$$

where $R_{i,t}$ is the monthly return on security i in the calendar month t that corresponds to the event month j, with $j = 0$ being the month of the repurchase announcement. $R_{f,t}$ and $R_{m,t}$ are the risk-free rate and the return on the equally weighted CRSP index, respectively. SMB_t, HMl_t, RMW_t, CMA_t are the monthly returns on the size, book-to-market factor, profitability factor and investment factor in month t, respectively. The standard error (denominator of the t-statistic) for a window is the square root of the sum of the squares of the monthly standard errors. Panel A reports the results for the repurchase announcements for low and high U-index firms. Panel B reports the results for the repurchase announcements for low and high EU-index firms. The significance levels are indicated by +, *, and ** and correspond to a significance level of 10%, 5%, and 1% respectively, using a two-tailed test.

Panel A: IRATs Cumulative Abnormal Returns and U-Index

	Low U: No Fem.		Some Fem.		No-Some Fem.		High U: No Fem.		Some Fem.		No-Some Fem.	
	CAR	t-stat	CAR	t-stat	CAR	t-stat	CAR	t-stat	CAR	t-stat	CAR	t-stat
-6	17.36**	11.11	7.13**	14.47	10.23**	6.24	-14.1**	-14.4	-14.72**	-19.65	0.62	0.51
+12	6.98**	4.08	2.51**	3.42	4.47**	2.4	7.62**	4.83	2.87*	2.15	4.75*	2.3
+24	12.73**	5.32	5.59**	5.17	7.15**	2.72	13.04**	5.52	6.87**	3.21	6.17*	1.93
+36	20.57**	6.96	8.61**	6.17	11.97**	3.66	15.42**	5.02	9.96**	3.65	5.46^{+}	1.33
+48	24.38**	7.08	9.95**	5.84	14.43**	3.76	19.31**	5.02	16.54**	4.74	2.77	0.53
Observations	600		1740		-		864		969		-	

Panel B: IRATs Cumulative Abnormal Returns and EU-Index

	Low EU: No Fem.		Some Fem.		No-Some Fem.		High EU: No Fem.		Some Fem.		No-Some Fem.	
	CAR	t-stat	CAR	t-stat	CAR	t-stat	CAR	t-stat	CAR	t-stat	CAR	t-stat
-6	7.91**	6.29	4.08**	9.34	3.83**	2.88	-8.34**	-6.12	-10.69**	-9.66	2.35^{+}	1.34
+12	5.44**	3.05	2.67**	3.7	2.77^{+}	1.44	7.55**	4.33	2.74^{+}	1.68	4.8*	2.01
+24	8.86**	3.45	5.08**	4.51	3.78^{+}	1.35	14.11**	5.44	9.69**	3.66	4.43	1.19
+36	12.92**	3.99	7.76**	5.3	5.16^{+}	1.45	17.32**	5.18	15.91**	4.65	1.41	0.29
+48	16.57**	4.19	10.78**	5.95	5.79^{+}	1.33	23.83**	5.79	18.97**	4.38	4.85	0.81
Observations	354		1401		-		783		738		-	

Table 10: Buyback announcements, Presence of Women on Board and (Idiosyncratic) Volatility during 1999-2015

The tables present the long-run IRATS Cumulative Abnormal Returns (CAR) for subsets of firms repurchase announcements using the five factor Fama-French model. The tables report monthly average cumulative abnormal returns (CAR) in percent using Ibbotson (1975) returns across time and security (IRATS) method for the sample of firms that announced an open market share repurchase plus various subsamples. The following regression is run each event month j for the five-factor model:

$$(R_{i,t} - R_{f,t}) \quad = \quad a_j + b_j(R_{m,t} - R_{f,t}) + c_j SMB_t + d_j HMl_t + e_t RMW_t + f_t CMA_t + \epsilon_{i,t},$$

where $R_{i,t}$ is the monthly return on security i in the calendar month t that corresponds to the event month j, with $j = 0$ being the month of the repurchase announcement. $R_{f,t}$ and $R_{m,t}$ are the risk-free rate and the return on the equally weighted CRSP index, respectively. SMB_t, HMl_t, RMW_t, CMA_t are the monthly returns on the size, book-to-market factor, profitability factor and investment factor in month t, respectively. The standard error (denominator of the t-statistic) for a window is the square root of the sum of the squares of the monthly standard errors. Panel A reports the results for the repurchase announcements for low and high (1-R^2) firms. Panel B reports the results for the repurchase announcements for low and high Volatility firms. The significance levels are indicated by +, *, and ** and correspond to a significance level of 10%, 5%, and 1% respectively, using a two-tailed test.

Panel A: IRATs Cumulative Abnormal Returns and Idiosyncratic (1-R^2) Volatility

	Low Idio.: No Fem.		Some Fem.		No-Some Fem.		High Idio.: No Fem.		Some Fem.		No-Some Fem.	
	CAR	t-stat	CAR	t-stat	CAR	t-stat	CAR	t-stat	CAR	t-stat	CAR	t-stat
-6	0.05	0.04	-0.74	-1.64	0.79	0.67	-3.46**	-3.07	-2.57**	-3.88	-0.89	-0.68
+12	7.68**	4.8	3.35**	4.43	4.34**	2.45	6.75**	4.65	3.11**	3.14	3.64*	2.07
+24	12.72**	5.64	7.16**	6.09	5.56*	2.19	11.23**	5.17	6.96**	4.59	4.26$^+$	1.61
+36	18.41**	6.57	7.35**	5	11.05**	3.5	14.14**	5.05	13.91**	7.01	0.23	0.07
+48	19.14**	5.79	9.29**	5.14	9.85**	2.62	21.95**	6.31	18.88**	7.52	3.07	0.72
Observations	708		1729		-		980		1457		-	

Panel B: IRATs Cumulative Abnormal Returns and Raw Volatility

	Low Vol.: No Fem.		Some Fem.		No-Some Fem.		High Vol.: No Fem.		Some Fem.		No-Some Fem.	
	CAR	t-stat	CAR	t-stat	CAR	t-stat	CAR	t-stat	CAR	t-stat	CAR	t-stat
-6	0.16	0.19	0.42	1.14	-0.27	-0.29	-2.88**	-2.65	-4.46**	-5.63	1.58	1.18
+12	5.89**	4.1	2.77**	4.28	3.12*	1.98	8.08**	5.69	3.72**	3.17	4.35**	2.36
+24	9.01**	4.23	5.43**	5.45	3.58$^+$	1.52	13.92**	6.74	9.19**	5.04	4.73*	1.72
+36	12.37**	4.54	8.55**	6.57	3.82	1.26	18.22**	6.97	12.1**	5.26	6.12*	1.76
+48	19.43**	5.76	11.5**	6.9	7.93*	2.11	21.86**	6.92	16.25**	5.79	5.62$^+$	1.33
Observations	525		1912		-		1163		1274		-	

Table 11: Cross-Section Regressions: Presence of Women on Board and Average Monthly Excess Returns

Monthly average coefficients of each firm characteristic estimated with the cross-section analysis following Brennan, Chordia and Subrahmanyam (1998). The five-factor Fama-French model is used to estimate the factor loadings for each stock in every month and, thus, monthly excess returns. Regressing monthly excess returns on all firm characteristics in every post-buyback-announcement month gives the monthly coefficients. The firm characteristics are U-index, volatility, $(1 - R^2)$, analyst coverage, institutional Holdings, and percentage of females at the firm's board. Coefficients reported in this table are the average of monthly coefficient estimates over the corresponding post-event window. The standard error (denominator of the t-statistic) for a window is the standard deviation of the monthly estimated coefficients divided by the square root of the number of months in the window. Year and industry controls are used. The significance levels are indicated by +, *, and ** and correspond to a significance level of 10%, 5%, and 1% respectively, using a two-tailed test. See the Appendix for detailed definitions of the variables.

	month 12		month 24		month 36		month 48	
	Month	*t*-stat	Month	*t*-stat	Month	*t*-stat	Month	*t*-stat
Intercept	-1.07	-0.21	-3.42	-1.12	-2.45	-1.09	-2.92	-1.62
Market Cap.	-2e-06	-0.98	-2.9e-06*	-2.16	-3.7e-06**	-3.38	-4e-06**	-4.29
BE/ME	-0.28	-1.04	-0.21	-1.22	4.5e-04	3.1e-03	0.04	0.33
Prior Returns	1.5e-04	0.04	2.5e-04	0.1	1.3e-03	0.7	6.6e-04	0.42
Volatility	0.11	1.26	0.13*	2.32	0.06	1.18	0.04	0.91
(1-R^2)	0.14	0.28	0.36	0.92	0.4	1.49	0.47*	2.14
Analyst Coverage	0.01^+	1.92	0.02**	3.2	0.02**	4.44	0.01**	3.59
Board Size	0.01	0.34	0.01	0.44	4.4e-03	0.29	0.01	0.61
Percent Independent Directors	0.1	0.26	0.52	1.66	0.28	0.8	0.3	1.05
Percent Shares	0.01	1.73	0.01	1	0.01	1.17	0.01	1.24
Profitability (ROA)	-0.62	-0.61	-0.74	-1.25	-0.55	-1.16	-0.19	-0.4
Net Debt	-0.44	-1.06	-0.44^+	-1.85	-0.56**	-2.96	-0.5**	-2.94
Tax Rate	3.3e-03	0.42	0.01^+	1.91	4.9e-03	1.25	4.6e-03	1.32
Lag Dividend Payout Ratio	-0.14	-1.13	-0.13	-0.9	-0.09	-0.66	-0.01	-0.09
Leverage	0.56	1.28	0.6^+	2.05	0.67*	2.59	0.63*	2.59
Institutional Holdings	-1.3e-04	-0.03	-1.7e-03	-0.59	-3.2e-03	-1.19	-1.9e-03	-0.81
E-index	0.03	0.41	-0.01	-0.32	-0.02	-0.57	-0.02	-0.57
CEO Female	0.46	1.46	0.27	1.3	0.26^+	1.72	0.24^+	1.77
Women on Board (Dummy)	-0.24^+	-1.94	-0.18^+	-1.79	-0.21*	-2.55	-0.19*	-2.56
Observations	4030		4030		4030		4030	

Table 12: Cross-Section Regressions: Percent of Women on Board and Average Monthly Excess Returns

Monthly average coefficients of each firm characteristic estimated with the cross-section analysis following Brennan, Chordia and Subrahmanyam (1998). The five-factor Fama-French model is used to estimate the factor loadings for each stock in every month and, thus, monthly excess returns. Regressing monthly excess returns on all firm characteristics in every post-buyback-announcement month gives the monthly coefficients. The firm characteristics are U-index, volatility, $(1 - R^2)$, analyst coverage, institutional Holdings, and percentage of females at the firm's board. Coefficients reported in this table are the average of monthly coefficient estimates over the corresponding post-event window. The standard error (denominator of the t-statistic) for a window is the standard deviation of the monthly estimated coefficients divided by the square root of the number of months in the window. Year and industry controls are used. The significance levels are indicated by +, *, and ** and correspond to a significance level of 10%, 5%, and 1% respectively, using a two-tailed test. See the Appendix for detailed definitions of the variables.

	month 12		month 24		month 36		month 48	
	Month	*t*-stat	Month	*t*-stat	Month	*t*-stat	Month	*t*-stat
Intercept	-1.11	-0.21	-3.45	-1.13	-2.49	-1.11	-2.95	-1.63
Market Cap.	-1.8e-06	-0.87	-2.8e-06^{+}	-2.04	-3.5e-06**	-3.22	-3.9e-06**	-4.12
BE/ME	-0.28	-1.06	-0.21	-1.23	-7.2e-04	-5e-03	0.04	0.33
Prior Returns	1.9e-04	0.05	2.9e-04	0.12	1.4e-03	0.72	7e-04	0.44
Volatility	0.11	1.28	0.13*	2.35	0.06	1.23	0.05	0.97
(1-R^2)	0.15	0.31	0.37	0.95	0.41	1.55	0.49*	2.2
Analyst Coverage	0.02^{+}	1.95	0.02**	3.28	0.02**	4.63	0.01**	3.69
Board Size	3.4e-03	0.11	3e-03	0.15	-2.7e-03	-0.17	6e-04	0.04
Percent Independent Directors	0.12	0.29	0.54	1.68	0.29	0.82	0.3	1.04
Percent Shares	0.01	1.73	0.01	0.99	0.01	1.16	0.01	1.23
Profitability (ROA)	-0.61	-0.6	-0.73	-1.23	-0.55	-1.15	-0.19	-0.4
Net Debt	-0.44	-1.07	-0.45^{+}	-1.86	-0.57**	-2.98	-0.51**	-2.96
Tax Rate	3.3e-03	0.41	0.01^{+}	1.9	4.9e-03	1.25	4.7e-03	1.34
Lag Dividend Payout Ratio	-0.13	-1.06	-0.13	-0.85	-0.08	-0.61	-4.9e-03	-0.04
Leverage	0.57	1.28	0.6^{+}	2.06	0.68*	2.62	0.64*	2.61
Institutional Holdings	-4.3e-04	-0.1	-1.9e-03	-0.67	-3.5e-03	-1.28	-2.1e-03	-0.9
E-index	0.03	0.4	-0.01	-0.32	-0.02	-0.59	-0.02	-0.61
CEO Female	0.6^{+}	2.03	0.38^{+}	1.87	0.38*	2.55	0.34*	2.44
Women on Board (Percent)	-0.01*	-2.45	-0.01^{+}	-2.01	-0.01**	-2.88	-0.01*	-2.51
Observations	4030		4030		4030		4030	

Table 13: Cross-Section Regressions: Number of Women on Board and Average Monthly Excess Returns

Monthly average coefficients of each firm characteristic estimated with the cross-section analysis following Brennan, Chordia and Subrahmanyam (1998). The five-factor Fama-French model is used to estimate the factor loadings for each stock in every month and, thus, monthly excess returns. Regressing monthly excess returns on all firm characteristics in every post-buyback-announcement month gives the monthly coefficients. Dummies are used for the absence of women from the board, and the presence of two, three, or more than three women, to compare relative to the presence of one woman. The firm characteristics are U-index, volatility, $(1-R^2)$, analyst coverage, institutional Holdings, and percentage of females at the firm's board. Coefficients reported in this table are the average of monthly coefficient estimates over the corresponding post-event window. The standard error (denominator of the t-statistic) for a window is the standard deviation of the monthly estimated coefficients divided by the square root of the number of months in the window. Year and industry controls are used. The significance levels are indicated by +, *, and ** and correspond to a significance level of 10%, 5%, and 1% respectively, using a two-tailed test. See the Appendix for detailed definitions of the variables.

	month 12		month 24		month 36		month 48	
	Month	t-stat	Month	t-stat	Month	t-stat	Month	t-stat
Intercept	-1.36	-0.26	-3.67	-1.2	-2.76	-1.23	-3.13^{+}	-1.74
Market Cap.	-1.6e-06	-0.78	-2.6e-06^{+}	-1.9	-3.5e-06**	-3.17	-3.8e-06**	-4.08
BE/ME	-0.28	-1.07	-0.21	-1.25	-4e-03	-0.03	0.04	0.31
Prior Returns	1.1e-04	0.03	2.3e-04	0.1	1.4e-03	0.72	6.8e-04	0.43
Volatility	0.11	1.22	0.13*	2.31	0.06	1.2	0.04	0.85
(1-R^2)	0.15	0.31	0.37	0.96	0.41	1.54	0.47*	2.13
Analyst Coverage	0.01^{+}	1.93	0.02**	3.32	0.02**	4.71	0.01**	3.76
Board Size	0.02	0.52	0.02	0.76	0.01	0.76	0.01	0.94
Percent Independent Directors	0.13	0.33	0.55^{+}	1.74	0.31	0.88	0.31	1.11
Percent Shares	0.01	1.78	0.01	1.04	0.01	1.17	0.01	1.22
Profitability (ROA)	-0.62	-0.61	-0.74	-1.24	-0.55	-1.15	-0.17	-0.36
Net Debt	-0.43	-1.06	-0.44^{+}	-1.83	-0.56**	-2.96	-0.51**	-2.96
Tax Rate	3.3e-03	0.41	0.01^{+}	1.9	4.8e-03	1.24	4.5e-03	1.27
Lag Dividend Payout Ratio	-0.13	-1.05	-0.12	-0.83	-0.09	-0.61	-0.01	-0.04
Leverage	0.57	1.28	0.6^{+}	2.04	0.68*	2.61	0.65**	2.7
Institutional Holdings	-2.5e-04	-0.06	-1.8e-03	-0.63	-3.3e-03	-1.24	-2e-03	-0.87
E-index	0.03	0.44	-0.01	-0.29	-0.02	-0.57	-0.02	-0.52
CEO Female	0.46	1.46	0.27	1.29	0.26^{+}	1.71	0.25^{+}	1.79
No Women (Dummy)	0.23^{+}	1.93	0.17^{+}	1.76	0.2*	2.36	0.17*	2.11
Two Women (Dummy)	-0.03	-0.27	-0.03	-0.37	-0.06	-0.85	-0.1	-1.31
Three Women (Dummy)	-0.34	-1.41	-0.32*	-2.36	-0.2	-1.65	-0.16	-1.34
More than three Women (Dummy)	6.9e-04	3.9e-03	-0.1	-0.63	-0.22	-1.29	-0.02	-0.09
Observations	4030		4030		4030		4030	

Table 14: Heckman Model first stage Probit Regressions: Presence of Women on Board

Probit regression for first stage of a Heckman Model. The dependent variable is a binary variable indicating whether there was a woman on the board of the firm. Two different instrumental variables are used: left regression (Instrument 1) uses as instrumental variable the percent of men on other boards with women; right regression (Instrument 2) uses as instrumental variables the firm's headquarters county female labor force participation. All control variables from the second stage (main) regression are included. **, * and + denote significance levels at 1%, 5%, and 10%, respectively. Year and industry controls are used. See the Appendix for detailed definitions of the variables.

	Instrument 1		Instrument 2	
	Coeff.	t-stat	Coeff.	t-stat
Intercept	1.3	3.5e-03	-0.25	-6.6e-04
Market Cap.	1.7e-05**	3.46	2.2e-05**	4.18
BE/ME	-0.07	-0.81	-0.06	-0.67
Prior Returns	4.5e-04	0.41	9.3e-04	0.83
Volatility	-0.05	-1.48	-0.08*	-2.44
One minus Rsq	-0.07	-0.4	-0.11	-0.61
Analyst Coverage	3.9e-03	0.81	0.01*	2.57
Board Size	0.28**	15.92	0.28**	15.79
Percent Independent Directors	0.64**	2.72	0.94**	3.98
Percent Shares	-0.01^{+}	-1.93	-0.01^{+}	-1.92
Profitability (ROA)	0.7^{+}	1.93	0.57	1.51
Net Debt	-0.31^{+}	-1.8	-0.26	-1.46
Tax Rate	-0.01*	-2.57	-0.01*	-2.01
Lag Dividend Payout Ratio	-0.01	-0.23	-0.04	-0.69
Leverage	0.53*	2.48	0.63**	2.96
Institutional Holdings	-1.2e-03	-0.72	-8.5e-04	-0.49
E-index	0.07^{+}	1.94	0.09*	2.46
Instumental Var.	0.01**	10.05	0.01*	2.5
Observations	3772		3477	

Table 15: Heckman Model second stage regressions: Presence of Women on Board (Inv. Mills Ratio from first stage probit using percent of men on other boards with women as instrument)

Monthly average coefficients of each firm characteristic estimated with the cross-section analysis following Brennan, Chordia and Subrahmanyam (1998) using Instrumental Variable analysis. The Inv. Mills Ratio used is from the first stage probit regression using as instrument the percent of men on other boards with women. The five-factor Fama-French model is used to estimate the factor loadings for each stock in every month and, thus, monthly excess returns. Regressing monthly excess returns on all firm characteristics in every post-buyback-announcement month gives the monthly coefficients. The firm characteristics are U-index, volatility, $(1 - R^2)$, analyst coverage, institutional Holdings, and presence of females at the firm's board. Coefficients reported in this table are the average of monthly coefficient estimates over the corresponding post-event window. The standard error (denominator of the t-statistic) for a window is the standard deviation of the monthly estimated coefficients divided by the square root of the number of months in the window. Year and industry controls are used. The significance levels are indicated by +, *, and ** and correspond to a significance level of 10%, 5%, and 1% respectively, using a two-tailed test. See the Appendix for detailed definitions of the variables.

	month 12		month 24		month 36		month 48	
	Month	*t*-stat	Month	*t*-stat	Month	*t*-stat	Month	*t*-stat
Intercept	-1.38	-0.27	-3.46	-1.15	-2.19	-0.98	-2.8	-1.55
Market Cap.	-2.1e-06	-0.97	-2.9e-06*	-2.11	-3.6e-06**	-3.21	-4e-06**	-4.16
BE/ME	-0.29	-1.06	-0.21	-1.22	0.01	0.04	0.05	0.35
Prior Returns	2.4e-04	0.07	2.6e-04	0.11	1.3e-03	0.66	6.3e-04	0.4
Volatility	0.1	1.19	0.13*	2.28	0.07	1.31	0.05	0.98
(1-R^2)	0.11	0.22	0.35	0.93	0.43	1.64	0.49*	2.28
Analyst Coverage	0.02	1.79	0.02**	2.84	0.02**	3.65	0.01**	3.04
Board Size	0.03	0.68	0.01	0.41	-0.01	-0.57	-7e-04	-0.03
Percent Independent Directors	0.19	0.5	0.54	1.63	0.21	0.55	0.26	0.85
Percent Shares	0.01	1.65	0.01	1	0.01	1.3	0.01	1.32
Profitability (ROA)	-0.57	-0.55	-0.73	-1.21	-0.59	-1.22	-0.21	-0.44
Net Debt	-0.45	-1.14	-0.44$^+$	-1.92	-0.55**	-2.98	-0.5**	-2.96
Tax Rate	2.8e-03	0.34	0.01$^+$	1.84	0.01	1.33	4.8e-03	1.36
Lag Dividend Payout Ratio	-0.15	-1.16	-0.13	-0.9	-0.09	-0.64	-0.01	-0.08
Leverage	0.61	1.47	0.6*	2.11	0.63*	2.55	0.62*	2.56
Institutional Holdings	-6.1e-05	-0.01	-1.7e-03	-0.59	-3.3e-03	-1.2	-1.9e-03	-0.82
E-index	0.03	0.44	-0.01	-0.28	-0.02	-0.66	-0.02	-0.62
CEO Female	0.47	1.47	0.27	1.3	0.25	1.68	0.24$^+$	1.74
Women on Board (Dummy)	-0.21	-1.45	-0.18	-1.63	-0.24*	-2.66	-0.21*	-2.55
Inv. Mills Ratio	0.18	0.56	0.03	0.14	-0.16	-0.9	-0.08	-0.47
Observations	3772		3772		3772		3772	

Table 16: Heckman Model second stage regressions: Percent of Women on Board (Inv. Mills Ratio from first stage probit using percent of men on other boards with women as instrument)

Monthly average coefficients of each firm characteristic estimated with the cross-section analysis following Brennan, Chordia and Subrahmanyam (1998) using Instrumental Variable analysis. The Inv. Mills Ratio used is from the first stage probit regression using as instrument the percent of men on other boards with women. The five-factor Fama-French model is used to estimate the factor loadings for each stock in every month and, thus, monthly excess returns. Regressing monthly excess returns on all firm characteristics in every post-buyback-announcement month gives the monthly coefficients. The firm characteristics are U-index, volatility, $(1 - R^2)$, analyst coverage, institutional Holdings, and percentage of females at the firm's board. Coefficients reported in this table are the average of monthly coefficient estimates over the corresponding post-event window. The standard error (denominator of the t-statistic) for a window is the standard deviation of the monthly estimated coefficients divided by the square root of the number of months in the window. Year and industry controls are used. The significance levels are indicated by +, *, and ** and correspond to a significance level of 10%, 5%, and 1% respectively, using a two-tailed test. See the Appendix for detailed definitions of the variables.

	month 12		month 24		month 36		month 48	
	Month	t-stat	Month	t-stat	Month	t-stat	Month	t-stat
Intercept	-1.48	-0.28	-3.54	-1.17	-2.31	-1.03	-2.91	-1.6
Market Cap.	-1.9e-06	-0.89	-2.8e-06^{+}	-2.01	-3.5e-06**	-3.07	-3.9e-06**	-4.02
BE/ME	-0.29	-1.08	-0.21	-1.23	3.3e-03	0.02	0.04	0.34
Prior Returns	3e-04	0.08	3.2e-04	0.13	1.3e-03	0.7	6.8e-04	0.43
Volatility	0.1	1.19	0.13*	2.28	0.07	1.31	0.05	0.98
(1-R^2)	0.12	0.23	0.36	0.94	0.43	1.67	0.49*	2.31
Analyst Coverage	0.02^{+}	1.92	0.02**	2.98	0.02**	3.91	0.01**	3.26
Board Size	0.03	0.62	0.01	0.34	-0.02	-0.65	-2.5e-03	-0.12
Percent Independent Directors	0.22	0.59	0.56	1.7	0.24	0.64	0.29	0.93
Percent Shares	0.01	1.61	0.01	0.97	0.01	1.25	0.01	1.26
Profitability (ROA)	-0.55	-0.54	-0.72	-1.19	-0.58	-1.18	-0.2	-0.41
Net Debt	-0.46	-1.15	-0.45^{+}	-1.93	-0.56**	-3.03	-0.51**	-3.01
Tax Rate	2.7e-03	0.33	0.01^{+}	1.82	0.01	1.31	4.8e-03	1.34
Lag Dividend Payout Ratio	-0.14	-1.1	-0.13	-0.86	-0.08	-0.6	-4.7e-03	-0.04
Leverage	0.62	1.5	0.62*	2.15	0.65*	2.62	0.63*	2.61
Institutional Holdings	-3.2e-04	-0.08	-1.9e-03	-0.67	-3.5e-03	-1.3	-2.1e-03	-0.9
E-index	0.03	0.46	-0.01	-0.27	-0.02	-0.65	-0.02	-0.61
CEO Female	0.61^{+}	2.04	0.38^{+}	1.86	0.38*	2.55	0.34*	2.45
Women Percent	-0.01^{+}	-2	-0.01^{+}	-1.85	-0.01**	-2.82	-0.01*	-2.38
Inv. Mills Ratio	0.22	0.7	0.06	0.28	-0.11	-0.63	-0.03	-0.15
Observations	3772		3772		3772		3772	

Table 17: Heckman Model second stage regressions: Presence of Women on Board (Inv. Mills Ratio from first stage probit using county female labor force participation as instrument)

Monthly average coefficients of each firm characteristic estimated with the cross-section analysis following Brennan, Chordia and Subrahmanyam (1998) using Instrumental Variable analysis. The Inv. Mills Ratio used is from the first stage probit regression using as instrument the firm's headquarters county female labor force participation. The five-factor Fama-French model is used to estimate the factor loadings for each stock in every month and, thus, monthly excess returns. Regressing monthly excess returns on all firm characteristics in every post-buyback-announcement month gives the monthly coefficients. The firm characteristics are U-index, volatility, $(1 - R^2)$, analyst coverage, institutional Holdings, and presence of females at the firm's board. Coefficients reported in this table are the average of monthly coefficient estimates over the corresponding post-event window. The standard error (denominator of the t-statistic) for a window is the standard deviation of the monthly estimated coefficients divided by the square root of the number of months in the window. Year and industry controls are used. The significance levels are indicated by +, *, and ** and correspond to a significance level of 10%, 5%, and 1% respectively, using a two-tailed test. See the Appendix for detailed definitions of the variables.

	month 12		month 24		month 36		month 48	
	Month	*t*-stat	Month	*t*-stat	Month	*t*-stat	Month	*t*-stat
Intercept	-3.15	-0.51	-5.09	-1.46	-3.54	-1.35	-4.01^{+}	-1.78
Market Cap.	-1.9e-06	-0.81	-3e-06^{+}	-1.97	-3.3e-06**	-2.79	-3.6e-06**	-3.51
BE/ME	-0.24	-0.85	-0.16	-0.95	0.03	0.22	0.05	0.37
Prior Returns	3.3e-03	1.09	1.9e-03	0.89	1.8e-03	1.01	7.9e-04	0.53
Volatility	0.12	1.16	0.13*	2.07	0.06	1.06	0.05	1.04
(1-R^2)	0.21	0.4	0.3	0.76	0.38	1.4	0.48*	2.22
Analyst Coverage	0.02^{+}	2.03	0.02**	3.1	0.02**	3.7	0.01*	2.63
Board Size	0.04	0.68	0.02	0.41	-0.01	-0.21	-0.01	-0.29
Percent Independent Directors	0.46	0.96	0.78*	2.24	0.4	1.04	0.37	1.12
Percent Shares	0.01	0.9	2.9e-03	0.41	0.01	1	0.01	1.2
Profitability (ROA)	0.01	0.01	-0.62	-0.88	-0.65	-1.13	-0.37	-0.7
Net Debt	-0.48	-1.33	-0.5*	-2.25	-0.6**	-3.45	-0.52**	-3.15
Tax Rate	3.7e-04	0.05	0.01	1.54	4e-03	0.97	4.3e-03	1.2
Lag Dividend Payout Ratio	-0.16	-1.25	-0.16	-1.07	-0.1	-0.71	-0.03	-0.24
Leverage	0.63	1.55	0.62*	2.24	0.6*	2.49	0.57*	2.37
Institutional Holdings	-1.9e-03	-0.44	-3.7e-03	-1.29	-4.3e-03	-1.56	-2.7e-03	-1.12
E-index	0.03	0.42	-0.01	-0.25	-0.03	-0.71	-0.03	-0.77
CEO Female	0.37	1.36	0.19	1.04	0.21	1.58	0.2	1.47
Women on Board (Dummy)	-0.24	-1.54	-0.18	-1.69	-0.23*	-2.57	-0.21*	-2.64
Inv. Mills Ratio	0.29	0.68	0.13	0.47	-0.06	-0.25	-0.12	-0.52
Observations	3477		3477		3477		3477	

Table 18: Heckman Model second stage regressions: Percent of Women on Board (Inv. Mills Ratio from first stage probit using county female labor force participation as instrument)

Monthly average coefficients of each firm characteristic estimated with the cross-section analysis following Brennan, Chordia and Subrahmanyam (1998) using Instrumental Variable analysis. The Inv. Mills Ratio used is from the first stage probit regression using as instrument the firm's headquarters county female labor force participation. The five-factor Fama-French model is used to estimate the factor loadings for each stock in every month and, thus, monthly excess returns. Regressing monthly excess returns on all firm characteristics in every post-buyback-announcement month gives the monthly coefficients. The firm characteristics are U-index, volatility, $(1 - R^2)$, analyst coverage, institutional Holdings, and percentage of females at the firm's board. Coefficients reported in this table are the average of monthly coefficient estimates over the corresponding post-event window. The standard error (denominator of the t-statistic) for a window is the standard deviation of the monthly estimated coefficients divided by the square root of the number of months in the window. Year and industry controls are used. The significance levels are indicated by +, *, and ** and correspond to a significance level of 10%, 5%, and 1% respectively, using a two-tailed test. See the Appendix for detailed definitions of the variables.

	month 12		month 24		month 36		month 48	
	Month	*t*-stat	Month	*t*-stat	Month	*t*-stat	Month	*t*-stat
Intercept	-3.31	-0.54	-5.21	-1.49	-3.68	-1.39	-4.14^{+}	-1.83
Market Cap.	-1.7e-06	-0.72	-2.9e-06^{+}	-1.87	-3.2e-06*	-2.66	-3.5e-06**	-3.37
BE/ME	-0.24	-0.88	-0.17	-0.98	0.03	0.18	0.04	0.34
Prior Returns	3.4e-03	1.1	2e-03	0.91	1.9e-03	1.05	8.5e-04	0.57
Volatility	0.12	1.16	0.13*	2.08	0.07	1.07	0.05	1.04
(1-R^2)	0.22	0.41	0.3	0.78	0.38	1.43	0.49*	2.24
Analyst Coverage	0.02^{+}	2.17	0.02**	3.26	0.02**	3.95	0.01**	2.84
Board Size	0.04	0.63	0.01	0.36	-0.01	-0.28	-0.01	-0.35
Percent Independent Directors	0.49	1.05	0.81*	2.31	0.43	1.11	0.39	1.19
Percent Shares	0.01	0.86	2.6e-03	0.38	0.01	0.95	0.01	1.15
Profitability (ROA)	0.03	0.03	-0.61	-0.86	-0.64	-1.11	-0.36	-0.67
Net Debt	-0.49	-1.35	-0.5*	-2.27	-0.61**	-3.5	-0.53**	-3.19
Tax Rate	2.9e-04	0.04	0.01	1.53	3.9e-03	0.97	4.3e-03	1.19
Lag Dividend Payout Ratio	-0.15	-1.19	-0.15	-1.03	-0.1	-0.68	-0.02	-0.21
Leverage	0.65	1.59	0.63*	2.29	0.62*	2.57	0.59*	2.42
Institutional Holdings	-2.3e-03	-0.53	-4e-03	-1.37	-4.6e-03	-1.66	-2.9e-03	-1.21
E-index	0.03	0.43	-0.01	-0.24	-0.03	-0.71	-0.03	-0.77
CEO Female	0.52*	2.21	0.3^{+}	1.73	0.32*	2.51	0.28*	2.22
Women Percent	-0.01^{+}	-1.96	-0.01	-1.7	-0.01*	-2.45	-0.01*	-2.22
Inv. Mills Ratio	0.34	0.83	0.17	0.62	4.6e-04	2e-03	-0.05	-0.25
Observations	3477		3477		3477		3477	

Table 19: Buyback announcements IRATs Cumulative Abnormal Returns and Women Board Connections

This table presents the long-term abnormal return after open market repurchase announcements from the announcement date until t months after only for companies with women on their board, depending on the average number of other boards of the women in the focal firm. Tables report monthly average cumulative abnormal returns (CAR) in percent using Ibbotson (1975) returns across time and security (IRATS) method combined with the Fama and French (2015) five-factor model for the sample of firms that announced an open market share repurchase plus various subsamples. The following regression is run each event month j:

$$(R_{i,t} - R_{f,t}) \quad = \quad a_j + b_j(R_{m,t} - R_{f,t}) + c_j SMB_t + d_j HML_t + e_t RMW_t + f_t CMA_t + \epsilon_{i,t},$$

where $R_{i,t}$ is the monthly return on security i in the calendar month t that corresponds to the event month j, with $j = 0$ being the month of the repurchase announcement. $R_{f,t}$ and $R_{m,t}$ are the risk-free rate and the return on the equally weighted CRSP index, respectively. SMB_t, HML_t, RMW_t, CMA_t are the monthly returns on the size, book-to-market factor, profitability factor and investment factor in month t, respectively. The numbers reported are sums of the intercepts of cross-sectional regressions over the relevant event-time-periods expressed in percentage terms. The standard error (denominator of the t-statistic) for a window is the square root of the sum of the squares of the monthly standard errors. The significance levels are indicated by +, *, and ** and correspond to a significance level of 10%, 5%, and 1% respectively, using a two-tailed test.

	Low Connections	t-stat	High Connections	t-stat	High-Low Connections	t-stat
-6	-1.14	-1.98*	-0.64	-0.82	0.49	0.51
+12	1.35	1.48	5.49	4.54**	4.13	2.73**
+24	3.98	2.81**	10.97	6.04**	6.99	3.03**
+36	6.76	3.67**	15.87	6.79**	9.11	3.06**
+48	8.75	3.8**	23.27	7.66**	14.53	3.81**
Observations	1298	1298	657	657	-	-

Table 20: Women Board Connections and Firm Characteristics

Firm characteristics for Low and High women Connection firms. Low Connection firms are those in the bottom 50% women board connections, and High Connections in the top 50% women board connections. Note that as the median of the average connection of women is 0, the first sample consists of the firms for which women board members are not connected to any other boards. Only firms with female presence on their board are considered. ** indicates statistically significant difference between the two columns at the 1% level, * at the 5% level, and + as the 10% level. See the Appendix for detailed definitions of the variables.

	Low Conn.	High Conn.	Low-High Conn. (t-stat)
Market Cap. (Mil.)	14474.25	21803.02	-7328.77** (-4.13)
Prior Returns	2.08	3.47	-1.39 (-1.32)
BE/ME	0.5	0.5	4.2e-03 (0.21)
U-index	7.35	7.12	0.23* (2.24)
EU-index	2.57	2.5	0.07 (1.24)
Volatility (Percent)	2.02	1.93	0.09* (2)
One minus Rsq	0.63	0.64	-0.01 (-0.9)
Female Percent on Board	16.75	19.76	-3.01** (-7.53)
Numb. of Other Boards for Women	0	3.54	-3.54** (-27.89)
Board Size	10.27	10.48	-0.21^{+} (-1.93)
Percent of Men on Other Boards with Women	40.26	45.26	-5** (-4.38)
County Female Labor Force Participation	59.11	59.85	-0.75* (-2.5)
Institutional Holdings	73.65	74.22	-0.57 (-0.75)
Number of Institutions	355.23	444.03	-88.81** (-5.79)
E-index	2.64	2.6	0.04 (0.7)

Table 21: Heckman Model second stage regressions: Percent and Connections of Women on Board and Women Connections (Inv. Mills Ratio from first stage probit using percent of men on other boards with women as instrument)

Monthly average coefficients of each firm characteristic estimated with the cross-section analysis following Brennan, Chordia and Subrahmanyam (1998) using Instrumental Variable analysis. The Inv. Mills Ratio used is from the first stage probit regression using as instrument the percent of men on other boards with women. The average number of other boards of men and women are included as control variables. The five-factor Fama-French model is used to estimate the factor loadings for each stock in every month and, thus, monthly excess returns. Regressing monthly excess returns on all firm characteristics in every post-buyback-announcement month gives the monthly coefficients. The firm characteristics are U-index, volatility, $(1 - R^2)$, analyst coverage, institutional Holdings, and percentage of females at the firm's board. Coefficients reported in this table are the average of monthly coefficient estimates over the corresponding post-event window. The standard error (denominator of the t-statistic) for a window is the standard deviation of the monthly estimated coefficients divided by the square root of the number of months in the window. Year and industry controls are used. The significance levels are indicated by +, *, and ** and correspond to a significance level of 10%, 5%, and 1% respectively, using a two-tailed test. See the Appendix for detailed definitions of the variables.

	month 12		month 24		month 36		month 48	
	Month	*t*-stat	Month	*t*-stat	Month	*t*-stat	Month	*t*-stat
Intercept	-0.64	-0.58	-2.87**	-3.15	-2.37**	-3.35	-2.87**	-3.25
Market Cap.	0	-0.19	-2.5e-06	-1.64	-4.5e-06**	-3.26	-4.7e-06**	-4.04
BE/ME	0.07	0.17	-0.11	-0.38	-0.1	-0.44	-0.02	-0.09
Prior Returns	-0.01	-0.93	4.2e-04	0.11	1.1e-03	0.36	2.1e-03	0.84
Volatility	0.04	0.32	3.5e-03	0.04	-0.06	-0.91	-0.04	-0.52
(1-R^2)	0.16	0.31	0.54	1.46	0.54$^+$	1.89	0.52*	2.26
Analyst Coverage	0.01	0.57	0.01	0.8	0.01	1.29	4.1e-03	0.71
Board Size	-0.04	-0.73	-0.02	-0.58	3.4e-03	0.12	0.02	0.56
Percent Independent Directors	-0.29	-0.65	0.85$^+$	1.73	1.18*	2.71	1.03*	2.53
Percent Shares	0.02	1.42	0.02	1.46	0.01	1.44	0.01	1.29
Profitability (ROA)	-0.86	-0.66	0.22	0.19	-0.15	-0.18	0.57	0.69
Net Debt	-1.45*	-2.21	-1.04*	-2.6	-0.93**	-2.74	-0.86*	-2.55
Tax Rate	6.7e-05	0.01	3.4e-03	0.57	3.1e-04	0.06	-3.5e-03	-0.73
Lag Dividend Payout Ratio	-0.11	-0.45	0.04	0.14	-0.03	-0.09	0.06	0.24
Leverage	0.94	1.55	0.87*	2.29	0.56	1.4	0.64	1.57
Institutional Holdings	0.01	1.55	1.8e-03	0.4	-3.9e-03	-0.97	-1.5e-03	-0.42
E-index	0.03	0.28	1e-03	0.02	-0.03	-0.52	-0.03	-0.7
CEO Female	0.54	1.16	0.51$^+$	1.9	0.52*	2.53	0.52**	2.8
Women on Board (Percent)	-0.02*	-2.23	-0.01	-1.51	-0.01*	-2.3	-0.01*	-2.16
Inv. Mills Ratio	-0.62	-1.18	-0.38	-1.11	-0.15	-0.57	0.12	0.46
Numb. of Other Boards for Women	0.07*	2.44	0.04	1.57	0.04$^+$	2.03	0.05**	3.24
Numb. of Other Boards for Men	0.01	0.26	0.09$^+$	2	0.07*	2.08	0.06$^+$	1.73
Observations	1578		1578		1578		1578	

Table 22: Heckman Model second stage regressions: Percent and Connections of Women on Board
(Inv. Mills Ratio from first stage probit using county female labor force participation as instrument)

Monthly average coefficients of each firm characteristic estimated with the cross-section analysis following Brennan, Chordia and Subrahmanyam (1998) using Instrumental Variable analysis. The Inv. Mills Ratio used is from the first stage probit regression using as instrument the firm's headquarters county female labor force participation. The average number of other boards of men and women are included as control variables. The five-factor Fama-French model is used to estimate the factor loadings for each stock in every month and, thus, monthly excess returns. Regressing monthly excess returns on all firm characteristics in every post-buyback-announcement month gives the monthly coefficients. The firm characteristics are U-index, volatility, $(1 - R^2)$, analyst coverage, institutional Holdings, and percentage of females at the firm's board. Coefficients reported in this table are the average of monthly coefficient estimates over the corresponding post-event window. The standard error (denominator of the t-statistic) for a window is the standard deviation of the monthly estimated coefficients divided by the square root of the number of months in the window. Year and industry controls are used. The significance levels are indicated by +, *, and ** and correspond to a significance level of 10%, 5%, and 1% respectively, using a two-tailed test. See the Appendix for detailed definitions of the variables.

	month 12		month 24		month 36		month 48	
	Month	*t*-stat	Month	*t*-stat	Month	*t*-stat	Month	*t*-stat
Intercept	-4.18^{+}	-1.93	-7.4**	-3.13	-7.45**	-3.71	-7.7**	-3.24
Market Cap.	0	-0.01	-2.4e-06	-1.48	-4.5e-06**	-3.07	-4.4e-06**	-3.62
BE/ME	0.27	0.7	-0.04	-0.13	-3.7e-03	-0.02	0.06	0.31
Prior Returns	-2.6e-03	-0.48	1.9e-03	0.48	2.3e-03	0.73	2.6e-03	1.03
Volatility	0.04	0.33	-0.02	-0.19	-0.1	-1.31	-0.06	-0.78
(1-R^2)	0.46	0.96	0.61	1.67	0.58^{+}	1.97	0.51*	2.19
Analyst Coverage	0.01	0.75	0.01	0.78	0.01	1.48	4.9e-03	0.73
Board Size	-0.03	-0.56	-0.03	-0.7	0.01	0.22	0.01	0.27
Percent Independent Directors	-0.03	-0.07	0.97*	2.11	1.1*	2.54	0.9*	2.22
Percent Shares	0.02	1.22	0.01	1.24	0.01	1.53	0.01	1.42
Profitability (ROA)	0.06	0.04	0.55	0.46	-0.01	-0.01	0.55	0.68
Net Debt	-1.57*	-2.67	-1.15**	-2.9	-0.98**	-3.04	-0.88*	-2.64
Tax Rate	-1e-03	-0.13	1.8e-03	0.33	-9.9e-04	-0.2	-4.4e-03	-0.96
Lag Dividend Payout Ratio	-0.13	-0.56	-3.7e-03	-0.01	-0.09	-0.29	-0.01	-0.04
Leverage	0.96	1.59	0.86*	2.31	0.53	1.49	0.62	1.49
Institutional Holdings	0.01	1.62	1.4e-03	0.29	-3.8e-03	-0.9	-9.7e-04	-0.26
E-index	0.02	0.22	-0.01	-0.23	-0.05	-0.92	-0.05	-1.15
CEO Female	0.29	0.72	0.3	1.2	0.42*	2.11	0.46*	2.44
Women on Board (Percent)	-0.01	-1.57	-0.01	-0.85	-0.01	-1.53	-0.01	-1.59
Inv. Mills Ratio	-0.4	-0.71	-0.38	-0.88	-0.02	-0.07	0.11	0.35
Numb. of Other Boards for Women	0.08*	2.63	0.04	1.66	0.04^{+}	1.94	0.05**	2.89
Numb. of Other Boards for Men	0.03	0.59	0.1*	2.14	0.07^{+}	1.95	0.05	1.48
Observations	1445		1445		1445		1445	

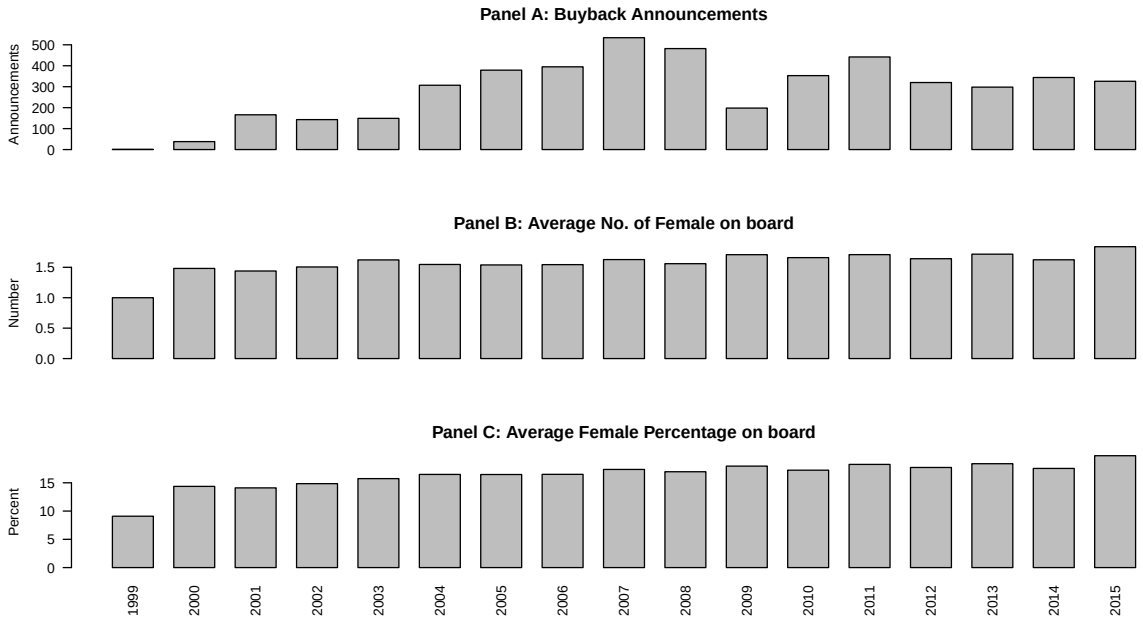

Figure 1: Panel A: Buybacks events per year for which we have available board gender composition data. Panel B: Average number of women on board of directors last reported before the announcement and within at most one year, across all buybacks announced the year indicated with at least one woman on the board of the firm. Panel C: Average percentage of women on board of directors last reported before the announcement and within at most one year, across all buybacks announced the year indicated with at least one woman on the board of the firm.

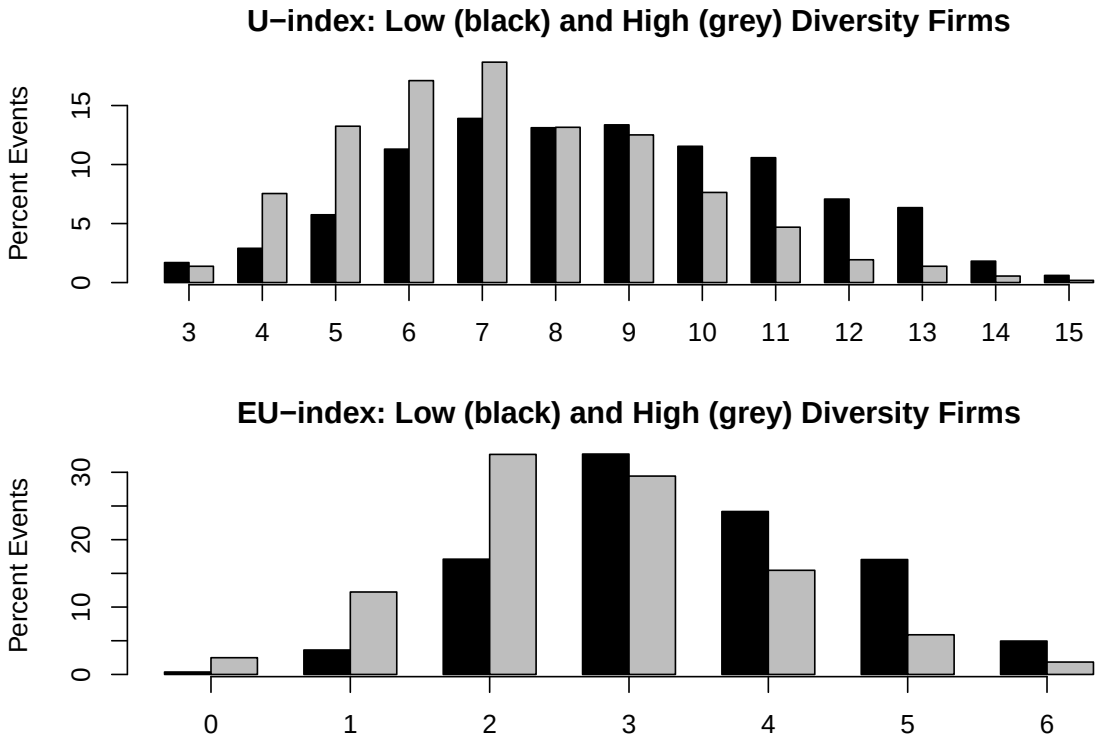

Figure 2: Panel A: Histogram of the U-index of Peyer and Vermaelen (2009) for the low diversity (black) and high diversity (grey) samples. Based on Peyer and Vermaelen (2009), the U-Index of a repurchase firm is the sum of 3 indicators measured using firms characteristics scores the month before the repurchase announcement. Companies get a size score from 1 (large firms) to 5 (small firms) depending on the quintile of their market value of equity in the month prior to the buyback announcement. Then, we calculate the 6-months pre-announcement absolute returns using daily returns until 2 days before announcement for all events and assign a score of 5 to the firms in the lowest return quintile and a score of 1 to firms in the highest return quintile. Finally, we assign a book value to market value (BE/ME) score to firms depending on the quintile of their BE/ME value of equity in the year prior to the buyback announcement, with a score of 1 to small BE/ME firms and 5 to large ones. Panel B: Histogram of the EU-index of Evgeniou et al. (2016) for the low diversity (light black) and high diversity (grey) samples. Based on Evgeniou et al. (2016), the EU-Index of a repurchase firm is the sum of 3 indicators measured using firms characteristics scores the month before the repurchase announcement: the U-index, plus a score of 0, 1, 2 for low, middle, and high firms in terms of their volatility and standardized idiosyncratic volatility $(1 - R^2)$ the month before the announcement.

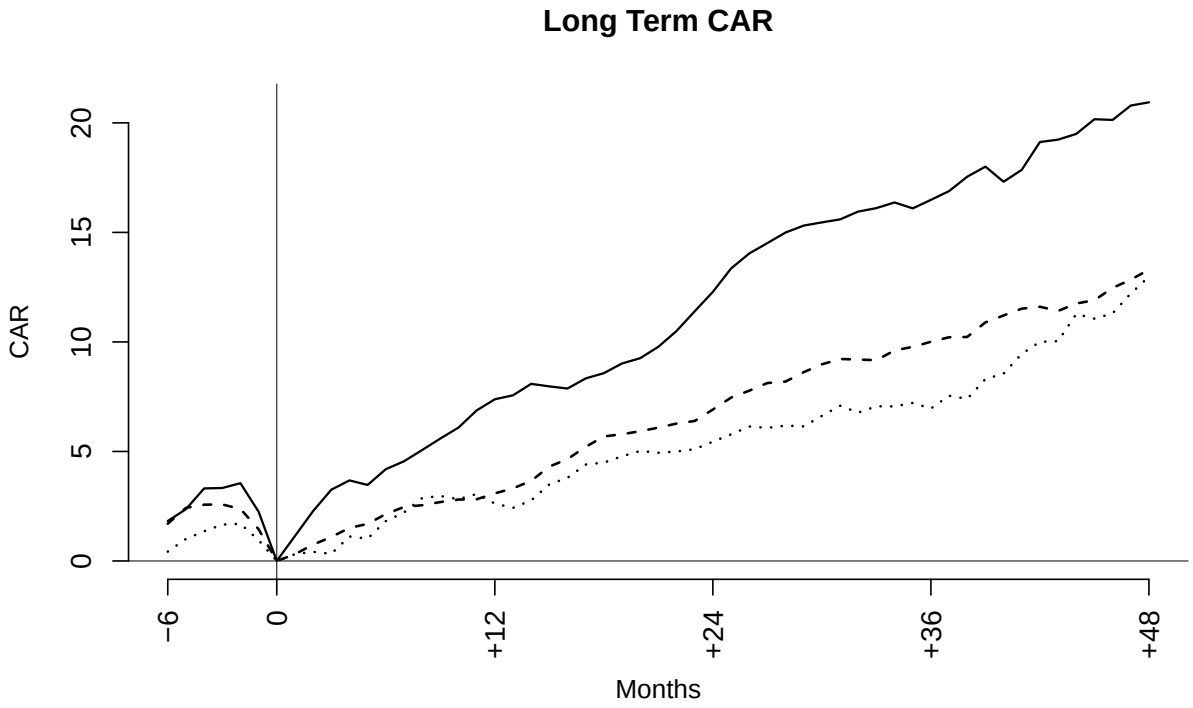

Figure 3: Long run average cumulative abnormal returns for three types of firms: a) firms without females on the board (solid lines), b) firms with at least one female on the board (dashed lines), c) firms where the percentage of females on the board was more than the 20^{th} percentile of all events in our sample (noted as "High Diversity" in Table 2) (dotted lines). The x-axis indicates months from the date of the event announcement.

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