Female directors, board committees and firm performance

Colin P. Green[a,*] and Swarnodeep Homroy[b]
[a]Norwegian University of Science and Technology, [b]University of Groningen

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Abstract

A number of studies have found little economic impact of board gender diversity on firm performance. We return to this issue in the context of large European firms. Our contribution is twofold. First, using information on the gender of CEOs children as a source of exogenous variation in female director appointments, we demonstrate a robust positive effect of female board representation on firm performance. Second, while previous work has considered female representation broadly, we focus on membership of board committees as a proxy for active involvement in corporate governance. We demonstrate economically meaningful positive effects on performance of female representation on board committees. Our evidence is supportive of an economic rationale for increased female representation on corporate boards.

Key Words: Gender, Diversity, Firm Performance, Board Committees

JEL Codes: G30, G34, J16

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* Corresponding author: Norwegian University of Science and Technology, Trondheim. Email: Colin.green@ntnu.no

1 Introduction

There is an increasing focus on gender diversity on executive boards. While the share of female employment in large firms has increased dramatically in the United States and the European Union, this has not been reflected in the gender composition of executive boards (Black and Juhn, 2000; Bertrand and Hallock, 2001). Growing concerns about gender equality have led to a large number of regulations across the world that aim to increase female representation on corporate boards. Board gender diversity has also become an important criterion for institutional investment and listings by such socially responsible indices as the FTSE4Good Index and the Domini 400 Social Index (Adams and Ferreira, 2009). Proposals to increase the proportion of female directors are premised upon the idea that this will be beneficial for governance, and ultimately, firm performance.

A complication with these initiatives is that the focus on representation may miss the actual integration of female directors into firm governance. This is, perhaps, reflected in the lack of consistent evidence on the performance-impact of female representation on corporate boards. The economic implications of board gender diversity may be ambiguous if decisions to increase female representation on boards are, in part, driven by social and political pressures that raise concerns regarding token representation. For instance, using a sample of US firms, Adams and Ferreira (2009) in fact find a negative impact of having females on the board on firm performance, despite better attendance records and more effective monitoring in firms with more gender-balanced boards. While for the UK, Gregory-Smith, Main and O'Reilly (2014) find no evidence that the gender composition of the board affects firm performance. Whilst the effect on the firm performance of board gender diversity has been extensively researched, recent work highlights the importance of board committees in the functioning of the board (Adams, 2003; Adams, Hermalin and Weisbach, 20010; Guo and Masulis, 2015). This is important because boards do most of their work through committees, and we know much less about how committee composition affects performance than we know about the effects of board composition. Female representation on committees is likely to be a more effective measure of board gender diversity, and likely to have a more direct effect on firm performance. While regulatory and institutional pressures may lead to the appointment of female directors on the board, they do not ensure the participation of appointed female directors in the governance mechanism. Therefore, appointment to committees reflects integration of female directors in the governance mechanism. Diverse boards can benefit from better matching of skills to functions, and appointment of female directors to decision-making committees can be a source of competitive advantage.

Against this backdrop, the objective of this paper is to provide new evidence on the performance impact of female director appointment to board committees. To this end, we use data from large publicly listed European firms. Most of the existing studies on the impact on the firm performance of gender-diverse boards are based on institutional settings where female representation is, in effect, binary. This is an important point as estimates derived from these settings effectively provide the

effect of appointing the first female director (O'Reilly and Main, 2012; Torchia, Calabrŏ, and Huse, 2011). It is difficult to extrapolate the effect of moving towards an equal gender representation from these settings where the proportion of female directors in the median firm is zero. Our setting is advantageous in this respect due to wider variation in female board representation in many European countries when compared to the US and the UK. In our setting, over 50% of our sample firms have more than one female director, while about 10% of boards are gender-balanced. This, we argue, allows us to more informatively address this issue.

We examine the impact on firm performance of female directors on the board and on committees. This, we argue, allows us to examine the impact of female directors on firm performance when they are in a greater position to influence the governance mechanism. We focus on assignments to the nomination, audit, and compensation committees. We focus on these three committees because they are consistently present across all firms, and cover the three core functions of the board (Adams and Ferreira, 2009; Guo and Masulis, 2015). We construct a measure of the proportion of female directors on the three committees taken together and examine the effect of that on firm performance. While studying the performance impact of board gender diversity, it is important to control for the endogenous appointment of female directors. In addition to controlling for a range of firm and board characteristics, we include firm and year fixed effects to mitigate time-invariant omitted variable bias.

A remaining concern is what determines changes in representation. To address this, we use two-stage least squares estimation to control for time-varying unobservables. It is well known that CEOs influence the process of director appointments to committees and to boards in general (Shivdasani and Yermack, 1999; Coles, Daniel, and Naveen, 2014). We instrument the appointment of female directors using information on the gender-composition of the CEO's children as a source of exogenous variation. There is evidence that the gender composition of children affects parental preferences (Washington, 2008; Cronqvist and Yu, 2017). The premise of our identification strategy is that male CEOs who parent a daughter are more likely to appoint female directors to boards and committees, but the gender of the CEOs' children should not directly affect firm performance. We perform an array of tests aimed at examining the relevance of the instrument and the plausibility of the exclusion restriction.

We find that whilst female representation on corporate boards has a modest impact on performance, the effect of female representation on board committees is economically more meaningful. A one standard deviation increase in the proportion of female directors on committees increases *ROA* by 0.06 of a standard deviation. In comparison, a one standard deviation increase in female board representation increases ROA by 0.026 of a standard deviation. In other words, an addition of each female director on the board (and committees) is associated with an approximate 0.1% (0.4%) increase in *ROA*. In comparison, a one standard deviation increase in female committee (board) representation improves market-to-book ratio by 0.05 (0.11) of a standard deviation. The

economic magnitude of the gender effects are comparable to the effect of industry-specific expertise of directors. For example, Dass, Kini, Nanda, and Onal (2014) report that a one standard deviation increase in the proportion of directors with specific industry expertise increases firm performance by 0.14 of a standard deviation.

We attempt to reconcile the above results with previous evidence. We take a sample of UK firms in our data to reestimate our baseline specifications. The proportion of female directors on the board has no statistically significant association with the firm performance for UK firms, but the results of committee membership again reveal a positive impact on firm performance.

These results are timely considering the recent regulatory requirements for mandatory female representation on the boards of European firms. These range from the advisory requirements in the U.K., Netherlands, and Spain, the firm disclosure of their gender diversity policy in board recruitment in the US, through to enforced gender quotas in Germany, France, and Norway (Higgs, 2003; Davies, 2011). In particular, even though the estimated performance effects are modest, our results support the economic premise for gender diverse corporate boards.

In addition, our results contribute to a few different strands of research. First, it is related to the literature on diversity on corporate boards. Although a large empirical literature exists on the effects of board gender diversity, the endogenous appointment of female directors remains a major concern in interpreting the causal implications in the current literature. The prior literature has examined the performance effect of board gender diversity and found zero or negative association between female representation and firm performance (Adams and Ferreira, 2009; Gregory-Smith et al., 2014). These papers use a measure of the female connectedness of a board as an instrumental variable. In contrast, our identification strategy relies on the variation of the gender-composition of the CEO's children. This we argue is a better measure of exogenous variation to female director appointment than the network-based measure. Larger firms tend to have better-connected boards, and as such the measure of female connectedness of the board is likely to be associated with larger firms (Larcker, So, and Wang, 2013).

Second, our paper contributes to the burgeoning literature on board committees. In this literature, conventional wisdom is that boards do most of their work in committees (Adams, Hermalin, and Weisbach, 2010). Guo and Masulis (2015) show that nomination committee independence leads to more rigorous monitoring of the CEO. Defond et al. (2005) report a positive market reaction to the matching of director skills to committee appointments. However, a key distinction of our paper is that we focus on the gender composition of three important board committees, and how that affects firm performance.

Third, we contribute to the literature on the functioning of corporate boards. Specifically, we focus on the gender, education, and experience of individual directors as determinants of committee appointments. Adams (2003) argue that the set of committees indicate the important functions

of a board. Schwartz-Ziv and Weisbach (2013) analyze minutes of board committee meetings of Israeli firms to examine the relative time devoted by the board to managerial and supervisory roles. We contribute by providing evidence on how education, experience, and gender of directors affect the likelihood of appointment to board committees.

The rest of the paper unfolds as follows: section 2 reviews relevant literature on the gender composition of corporate boards, section 3 introduces the sample and the estimation methods employed for the analysis, section 4 presents the results and section 5 concludes.

2 Background and Existing Evidence

2.1 FEMALE REPRESENTATION ON BOARDS AND FIRM PERFORMANCE

The existing evidence on board composition in the corporate governance and management literature focuses primarily on the equity and the productivity impacts of female representation. Arguments in favour of increased representation of women on corporate boards traditionally stem from concerns about discrimination and moral justice. A key point of contention is the upward trend in female participation in the labour force (Black and Juhn, 2000) and the fact that while female labour force participation tripled between 1992-1997, they continue to represent a very small proportion of executive positions (Bertrand and Hallock, 2001). The apparent incongruence of female representation on boards and female representation in the labour force could be due to supply constraints, discrimination, or a combination of both. Disentangling these channels is empirically difficult, in part because applications for directorships are not publicly observed. Powell and Butterfield (1994) argue that discriminatory practices hinder the career progression of equally qualified women on to corporate boards. Farrell and Hersch (2005), and Gregory-Smith et al. (2014) examine the appointment of new directors and find that the incidence of female appointments is significantly higher if the immediate predecessor was a female. Such evidence of a non-neutral director appointment process ties in with the notion of tokenism. If the only time female directors are appointed is to replace outgoing female directors, then, in the absence of regulations, the low fraction of female directors on corporate boards will persist over time.[1]

There are two broad channels through which increased female representation is likely to influence firm performance. The first channel is through (reductions in) discrimination. If existing low levels of female representation reflect discriminatory gender bias in director appointments this will likely leave firms with a competitive disadvantage. This reflects efficiency losses due to discrimination in

[1] There are two ways to be an elected director for the first time: 'imposed' and 'nominated'. Boards can appoint a director within a financial year and in the following annual shareholders meeting this director is nominated for re-election; or the board first nominates the director in the proxy statement, and the director gets voted in by all the shareholders in the annual meeting. Imposed directors are the more common mode of first appointments.

a competitive setting (Becker, 1957). In this case, replacing less able male directors with relatively more able, more productive, female directors should increase firm performance. In the presence of statistical gender discrimination in the labour force, female directors are likely to be drawn from the higher end of the ability distribution of females. Therefore appointing these high ability individuals can improve firm performance. The second channel is through benefits from diversity. If diverse teams outperform homogenous teams (Kahane, Longley, and Simmons, 2013) increased female representation may lead to better firm performance in ways unrelated to discrimination. These gains are potentially bourne from a greater diversity of views in team and group decision making contexts. Kim and Starks (2017) show that the addition of female directors diversify the set of boards' expertise. Again, disentangling these channels is difficult. A more gender diverse board may be associated with improved decision making, more efficient monitoring, as well as the displacement of less able male directors (see Hermalin and Weisbach, 2003).

In practice, the existing literature focuses primarily on the overall effect of female representation on firm performance. Empirical evidence suggests that board composition has no significant effect on firm performance and even that the effect of board gender diversity on firm performance can be negative (Larcker, et al. 2007; Adams and Ferreira, 2009; Ahern and Dittmar, 2012; Gregory-Smith et al. 2014). Gul, Srinidhi, and Ng (2011) find that female representation on boards improves stock price informativeness through increased public disclosure. These results are typically based on either the study of boards with only one female director or mandatory enforcement of regulations on female board representation. Thus, these results could capture the effect of tokenism, rather than the causal impact, of female representation on firm performance.

The majority of studies on female representation on corporate boards examine US firms (Adams and Ferreira, 2009; Gul, Srinidhi, and Ng, 2011; Torchia et al. 2011). Little empirical evidence exists from European nations [see Gregory-Smith et al. (2014) for the UK and Ahern and Dittmar (2012), Eckbo, Nygaard and Thorburn (2016), Dale-Olsen et al. (2016) for Norway]. European firms differ from US firms in that a larger proportion are family-controlled in Europe, a lower prevalence of dual-class shareholding, and the existence of tiered boards (Ferreira and Kirchmaier, 2012; Faccio and Lang, 2002). Christiansen, Lin, Perreira, Topalova, and Turk (2016) provide the only evidence on gender diversity in senior corporate positions across European countries. Using data from over 2 million European firms for the year 2013, they find a positive association between gender diversity in senior positions and firm performance. The positive association is stronger in sectors with a more feminised workforce, and in knowledge-intensive sectors.

2.2 BOARD COMMITTEES, MONITORING, AND FEMALE DIRECTORS

Boards of directors have the fiduciary responsibility of acting on behalf of the shareholders (Fama and Jensen, 1983). In practice, the board delegates most of the responsibilities to committees

(Adams, 2003; Guo and Masulis, 2015). Some of these committees are formed ad-hoc for a specific task, whilst standing committees are delegated with specific, narrowly defined functions. Important decisions of the boards are initiated in these committees, and there is evidence that delegation of responsibilities to committees facilitates effective governance (Billmoria and Piderit, 1994; Adams, 2003). The recommendations of these committees are placed before the full board for deliberation (Klein, 1998). The number and functions of these committees vary across firms, and roles are sometimes combined. For instance, all firms in the S&P 500 sample have at least one standing committee, with the average firm having three committees. The most common among these committees are the audit committee, the nomination committee, and the compensation committee. The audit committee focuses on the appointment of independent auditors and management of internal financial performance, the nomination committee recommends the appointment of new directors to the board, and the compensation committee deals with compensation and benefits for executives. Directors can directly influence CEO pay, the nomination of new directors, quality of financial reporting, etc. if they serve on smaller groups with primary responsibilities of these tasks (Adams, Hermalin, and Weisbach, 2010). In our sample, the mean tenure of directors on these committees is 4.8 years.

Recent evidence suggests that the composition of board committees is important for governance. For example, Shivdasani and Yermack (1999) find that when the CEO is on the nomination committee, firms appoint fewer independent directors. Guo and Masulis (2015) show that firms with fully independent nomination committees have a higher sensitivity of forced CEO turnover to firm performance, and nomination committee independence is important even when firms have independent boards. In contrast, Anderson and Bizjak (2003) find that compensation committee independence and the presence of CEO on the compensation committee does not affect executive compensation, while committee independence does affect the timing of earnings announcement (Michaely, Rubin, and Vedrashko, 2014).

Despite the importance of board committees to corporate governance, the mechanisms of how individual directors are appointed to the board committees is not well understood. There are no regulatory guidelines on the number, and composition of these committees. Whilst there is evidence that director expertise matters (Güner, Malmendier and Tate, 2008; Goldman, Rocholl, and So, 2009; Dass et al., 2014), there is limited evidence on the committee assignment of directors with relevant expertise. Defond et al. (2005) find a positive market reaction to the appointment to audit committees of outside directors with financial expertise.

If the appointment of female directors is merely a compliance requirement, then female directors will be less likely to be appointed to committees if not for obvious benefits to the functioning of these committees. Adams and Ferreira (2009) find that female directors in US firms are 3.5 percentage points more likely to be appointed to at least one of the board committees and that the female directors are over-represented in monitoring related committees but under-represented in

compensation committees. Through their appointment on these committees, female directors can influence the governance mechanism more directly. Whilst the effect of female board representation on firm performance is examined in economic literature, the evidence on the effect of female representation on the board committees is scarce.

3 Data

3.1 DATA SOURCE

The primary database used in the analysis is BoardEx. This provides information on board composition and director networks for listed European firms. We use a sample of EuroTop 100 firms for the period 2004-2015.[2] EuroTop 100 is the largest firms, in terms of market capitalisation, listed in any of stock exchanges of the European Union. Firms that appear at least once in the EuroTop 100 are followed for the full sample period as long as they remain listed. The sample firms are drawn from eleven western European countries: Belgium (5), Denmark (7), France (24), Germany (21), Italy (10), Netherlands (13), Norway (3), Spain (11), Sweden (4), Switzerland (14), and the United Kingdom (30).[3] One potential concern is that the results with EuroTop 100 firms can be idiosyncratic, and not generalizable. Our choice of sample is driven by the completeness of the information set required for the empirical analysis. In addition, and as discussed later, the instrumental variable in our sample is created using a news-based algorithm, which is heavily weighted towards larger firms. We address this concern in two ways. First, we use an enhanced sample of firms listed in the major European indices in the period 2004-2015.[4] We use this enhanced sample to test the robustness of our baseline results. Second, in appendix II we provide a comparison of EuroTop 100 firms with that of FTSEurofirst 300 (index of 300 largest European firms ranked by market capitalisation), FTSE 350 (index of 350 largest firms listed in UK, by market capitalisation), and S&P 500 (index of 500 largest US firms, by market capitalisation). The distribution of size, net market capitalisation, dividend yield, weight of the largest and top 10 holdings of the constituents of EuroTop 100 is similar to that of S&P 500, and to a lesser extent to the other U.K. comparator. These mitigate the concerns that our results could be an artefact of the sample selection.

We use information on individual directors on the boards of these firms. We drop observations on individual directors observed in only one period in a given firm. We augment this database

[2] We choose this sample period because of better coverage and consistency of BoardEx data.

[3] Some European countries have recently introduced legislative quotas on board gender diversity. This includes Italy (effective 2015), France (effective 2017), Germany (effective 2016), Belgium (effective 2017), and advisory targets in Netherlands, Spain and the United Kingdom. All these legislations come into effect at the end of our sample period. The only legislation that overlaps with our sample period is Norway (effective 2008). Our results are robust to the exclusion of Norwegian firms from the sample.

[4] Firms listed in CAC 40 (France), FTSE 100 (UK), DAX 40 (Germany), BEL-20 (Belgium), OMX (Sweden, Finland), FTSE MIB (Italy), AEX (Netherlands), PSI-20 (Portugal), MDAX (Spain), and SMI (Switzerland) are included in the enhanced sample.

with a range of financial performance measures from Datastream. Firms with unavailable financial performance data were excluded. The final sample consists of an unbalanced panel of 177 firms with 16,647 director-year observations. Table 1 presents descriptive statistics for selected firm, board and individual director characteristics.

[Insert Table 1 near here]

In further extensions, we differentiate between samples of UK-firms, and non-UK European firms, which allows us to compare our findings with respect to the evidence from UK firms. On average, UK firms are comparable in size to European firms, but with lower profitability and lower volatility of stock prices.

3.2 KEY VARIABLES AND SUMMARY STATISTICS

We only focus on non-executive independent female directors of whom females constitute 2,618 or 14.26% of the sample. We use both *de-jure* and *de-facto* measures of female representation on corporate boards. First, we use *Any Female,* which is a binary indicator of the presence of at least one female board member in a given firm-year. As a point of comparison, while only 25% of the sample firms in Adams and Ferreira (2009) have more than one female director, over 50% of our sample firms have more than one female director.

This is the commonly used measure of female director appointments and is also the one used in compliance guidelines. The *Proportion of Female Directors on Board* is the ratio of female directors to total directors. An average board in our sample has 18.68% female representation, compared with 8.5% in the US sample (Adams and Ferreira, 2009) and 5% in the UK sample (Gregory-Smith et al., 2014).

However, these above measures do not necessarily reflect the integration of female directors in the governance mechanism. We introduce a *de-facto* measure of female representation in governance: *Proportion of Female in Committees* which is the ratio of the combined number of female directors on three key committees (audit committee, nomination committee, and compensation committee) to the total number of directors on these committees.[5] *A priori,* directors who sits on one or more of these committees are more likely to influence the governance mechanism through her influence on the proposals and decisions of these committees. The proportion of female directors on the three key committees is an important variable for our empirical strategy as it measures the extent to which female directors are integrated into the governance mechanism of the firm. A

[5] The three committees we consider covers the three basic functions of the board, and are consistently present in all sample firms. There are other standing committees like environment committee, risk committee, etc. which are present less systematically.

total of 1,227 or 46.8% of the female directors in our sample are members of at least one of the three governance committees.[6] The proportional representation of female directors on committees is greater than that on the board. Conditional of being on the board, female directors of European firms have an even chance of being on at least one committee.

In table 2, we compare firm-year and board-year characteristics for firms with at least one female director and firms without a female director. Firms with at least one female director are on average larger, perform better in terms of return on assets, and have higher stock price volatility. These findings suggest that female representation on corporate boards is associated with firm characteristics and performance outcomes.

[Insert Table 2 near here]

The comparison of firms with and without female directors suggests that firm characteristics can influence female representation on corporate boards. In our subsequent empirical analysis, we include a set of covariates such as firm size, profitability, and stock-price volatility to control for differences in firm characteristics. The association between board gender diversity and performance may vary with the choice of firm performance measure (Erhardt, et al. 2003; Smith et al. 2006). The primary measure of firm performance for our analysis is *Return on Assets* (*ROA*). To test the robustness of our results, we use other standard measures of performance: Tobin's q approximated by market-to-book value ratio *(MTBV)* and *Total Shareholders Return (TSR).* We control for risk in a firm's operational environment using the standard deviation of monthly stock returns over the previous 12-month period. The natural logarithm of annual sales is used to control for firm size.[7] We also include standard controls for board characteristics: board size and board independence (percentage of independent directors on the board).[8]

The appointment of individual directors to boards, and assignment to committees, as well as the directors' impact on firm performance, could be driven by the skills and experience. Using information available from BoardEx, we construct identifiers for directors with Ph.Ds and Chartered Financial Accountants (CFA), and directors with previous experience in committees. 9% of directors have Ph.Ds, 11% have CFA, and 12.5% of all directors have previous experience of being on committees within the sample of EuroTop 100 firms. We aggregate these measures at a firm-year level.[9]

[6] In our data, 14.22% of female directors are assigned to committees in the UK, and 12.68% in the US. The comparable figures are 8.87% for the US (Adams and Ferreira, 2009) and 8.19% for the UK (Gregory-Smith, et al, 2014).

[7] We check the robustness of our results to other measures of firm performance and firm size.

[8] In the case of two-tier boards, board size is the linear summation of the number of directors on both the management and the supervisory board. The definition of independent director varies marginally across countries. However, the basic premise for a director to be considered independent is that she will not be a current or a former employee, a relative of a sitting executive, or has business relations with the firm.

[9] We test the robustness of the director experience measure by including the experience of committee membership in all quoted boards covered by BoardEx. The results are qualitatively similar.

As described in more details in the next section, we use information on the gender composition of CEOs' children as a measure of exogenous variation in female director appointments. The data on CEO children are collected from BoardEx World of CEOs *Beta*, which provides detailed biographies of CEOs and other executives of listed firms in Europe, North America, and other parts of the world. We augment this information with publicly available sources like Reuters, the Financial Times, Wikipedia, etc. Using a combination of the CEOs' first names, second names, firm names, and keywords like "daughters", "children", "family", "marriage", etc. we search the internet for information on the CEOs' children. From these sources, we were able to identify the gender of the children for 255 of 286 unique CEOs in our data.[10] The average CEO in our sample has 2.27 children and 1.14 daughters. This is comparable to the average family size of 2.3 across 28 European Union member states (Eurostat, 2015). The distribution of CEO children and daughters is presented in table 3. Of all the CEOs, 97.3% have at least one children, and of that 62.12% have at least one daughter.[11] Daughters comprise 49.6% of all CEO children, which is consistent with the gender ratio of 1.01 across the European Union (Eurostat, 2015).

[Insert Table 3 near here]

4 Empirical strategy

Our initial approach is to estimate variants of the following model which aims to provide evidence on the association between female participation and firm performance:

$$y_{it} = \beta F_{it-1} + \gamma Z_{it-1} + f_i + h_t + \varepsilon_{it} \tag{1}$$

where y_{it} is a measure of firm performance, β captures the strength of association of female board representation F, and Z is a vector of firm characteristics.[12] Firm characteristics, performance, and female board representation can be co-determined. Therefore, all independent variables, including the measure of female representation on the board, are lagged by one period. f_i and h_t represent firm and year fixed effects, respectively.

Recent evidence suggests that boards do most of their work through committees. It is therefore plausible that directors assigned to committees are better placed to influence board governance and

[10] The proportion of CEO for whom we have information on the children is higher than that of Cronqvist and Yu (2016). This is presumably because they use a sample of S&P 500 firms, whereas we focus on only the largest 100 firms, CEOs of which are more visible in the media.

[11] This number is comparable with Cronqvist and Yu (2017) who report that about 4% of US CEOs have no children. Washington (2008) reports average family size over 2 for US senators with 14% having no children.

[12] Existing studies use either contemporaneous female representation (Adams and Ferreira, 2009) or lagged measures (Gregory-Smith, et al. 2014). We choose to use lagged measures (one period) but stress that results are very similar if we use contemporaneous measures. These estimates are available upon request.

ultimately firm performance. With this in mind, we seek to examine whether the appointment of female directors to board committees is associated with better firm performance. We investigate the impact of female representation on committees to firm performance:

$$y_{it} = \theta C_{it-1} + \gamma Z_{it-1} + f_i + h_t + \nu_{it} \tag{2}$$

where y_{it} is a measure of firm performance, C_{it-1} is the proportion of female directors on audit, nomination and compensation committees combined, and Z is a vector of firm characteristics. The estimate on θ reflects the impact of female directors on firm performance, conditional on their being appointed on the committees. Our main estimates focus on the proportions of the board and the committees that are female, but in the subsequent analysis we also examine the effect of having at least one female on the board, and three or more female directors on the board and greater than 50% of the committees being female.

4.1 IDENTIFICATION STRATEGY

A key challenge to causal interpretation is that there may be omitted unobservable characteristics that simultaneously affect firm performance and the appointment of female directors, to both the board and to committees. We adopt a number of approaches to this problem. First, we use firm fixed effects to control for any time-invariant firm characteristics that may influence both underlying profitability and the likelihood of appointing female directors. Doing so provides within firm effects of changes in gender diversity on firm performance. An additional concern may be that there may be time-varying factors that influence both changes in board gender diversity and firm profitability. This leads us to, in addition, pursue an instrumental variables strategy which takes the form of a 2SLS analogue of equations (1) and (2).

Potential candidates for valid instruments are few. We rely on two established results. First, it is well known that CEOs influence the process of director appointments to committees, and to boards in general (Shivdasani and Yermack, 1999; Coles, Daniel, and Naveen, 2014). Second, it has been shown that child gender affects parental preferences for a range of social and economic outcomes (Warner and Steel, 1999; Washington, 2008; Oswald and Powdthavee, 2010). In essence, parenting a daughter shapes the father's identity (Akerlof and Kranton, 2000; Chen and Li, 2009). More closely related to our work Cronqvist and Yu (2017) shows for a sample of US firms that corporate social responsibility expenses are higher for firms whose CEOs parent a daughter. We extend this strand of the literature and use information on the gender composition of CEOs' children as a predictor of appointment of female directors on boards, and assignment to committees.

The underlying identifying assumption in this literature is that nature randomly allocates child's gender conditional on parental characteristics. In turn, fathers who parent both daughters and sons

are shown to have increased sympathy towards feminist issues, compared to fathers who parent only sons (Warner, 1991). We rely on this, in combination with the observation that only 1.3% of our sample firms have a female CEO. This leads us to instrument female board/committee membership using the gender of the CEO's children. The identification strategy is premised on the assumption that parenting a female child makes the CEO more likely to appoint a female director, but the gender of the child does not influence firm performance directly.

It is important to note that we use the "treatment" of a female child as our instrumental variable and not the "dosage", i.e. our IV is a binary variable of having at least one female child and not the proportion of female children.[13] Some studies in political economy and the management ethics literature have used the gender composition of children, whilst others have used a binary indicator for daughter (Washington, 2008; Cronqvist and Yu, 2017). We adopt the latter approach because the agents could choose a fertility stopping rule that will impact upon the gender composition of the children. In such a case there will be a correlation between the number of children and the preference of the parents for one particular gender, which will render the instrument invalid (Clark, 2000).

We specify an indicator CEO daughter, which equals 1 if the CEO has a daughter, or 0 otherwise. The effect of child gender on the preferences can differ by parents' gender (Washington, 2008). Therefore, we only include male CEOs who parent a daughter. The average age of the sample CEOs is 58 years. As a result, family formation decisions are likely to have occurred before their tenure. This leads identification to be generated from CEO turnover within the sample period, where a CEO who parents a daughter is replaced by a CEO who does not parent a daughter (and *vice-versa*). Of the 149 events of CEO turnover in our sample period, there are 112 such cases. Given that all models include firm fixed effects, identification is generated from CEO turnover in the sample period. In table 4 we compare characteristics of firms with CEOs who parent a daughter, and firms with CEOs who do not parent a daughter. There seems to be no significant difference in the means of firm characteristics and CEO turnover likelihood, except the three measures of female representation discussed above. This supports our hypothesis that firms with CEOs who have daughters appoint more female directors.

[Insert Table 4 near here]

[13] We rely on the CEOs not practicing sex-selective abortions, however, the possibility of sex-selective adoption remains. Another possible source of attenuation bias is that CEOs may maintain secrecy over a subset of their children, particularly if they are conceived out of wedlock. Finally, CEOs may have children from multiple marriages, or marriages with stepchildren, for which the data is not reliable.

5 Results and analysis

5.1 FEMALE REPRESENTATION, COMMITTEES, AND FIRM PERFORMANCE

Table 5 presents estimates of the effect of gender diversity on firm profitability. Our baseline measures of firm performance and female representation are the return on assets (ROA) and the *Proportion of Female Directors on Board.* We report OLS estimates, fixed effects estimate that aim to hold time-invariant firm characteristics constant, and finally, IV estimates where firm fixed effects are also included. What is the clear from these estimates it that increased gender diversity is clearly related to higher firm profitability in our setting. The ordinary least squares estimates are positive and statistically significant. These are reduced substantially once firm fixed effects are included. Nonetheless, they remain statistically different from zero and of an economically meaningful magnitude, a one standard deviation increase in gender diversity increases ROA by 0.026 of a standard deviation.[14] These results are presented in panel A of table 5.

A remaining concern is that these estimates may still be subject to bias as a result of time-varying, unobserved, influences on firm profitability and gender diversity. To address this, we instrument gender diversity using the presence of a CEO with at least one daughter as described in the previous section. The first stage estimates are presented in appendix C. Controlling for firm characteristics, board characteristics, and director education and experience this instrument is positively, and statistically significantly associated with the female director appointments on boards. The appointment of a CEO with a daughter leads to an approximate doubling in female representation on boards and committees. The instrument clearly passes standard thresholds for weak instruments ($F\text{-}Stat = 21.76$), as reported in columns 3 and 6 of table 5. While this estimation strategy does affect the magnitude of the gender diversity effect on firm profitability, it remains positive and statistically significant. The parameter estimate moves back in the direction of the OLS estimates, the magnitude of the effect is just over a half of that reported in column 1 of panel A.

[Insert Table 5 near here]

In summary, our results suggest that gender-diverse corporate boards are associated with better firm performance, but the association is smaller after controlling for across firm variations. The statistically significant positive association persists after attempting to control for the potential endogeneity of the appointment of female directors. However, the economic effect of the performance gains from female representation on corporate boards is modest.

[14] The economic impact is arrived at by multiplying the standard deviation of the proportion of female directors (14.5) with the coefficient on %Female on Board$_{t-1}$ from Column 3 of Table 5 (0.011), and dividing the product by the standard deviation of the ROA (6.108).

We now examine whether the earlier effects of gender board diversity on firm profitability are altered when we focus on female representation on committees. To provide some initial information appendix D provides descriptive evidence on the determinants of committee membership. These are estimates from linear probability models of the likelihood of a director being on any of the three key committees (audit, nomination, and compensation), and each separately. Overall, female directors are more likely to be assigned to any of the three committees. This hides some heterogeneity insofar as they are more likely to be on the audit committee and less likely to be on the nomination committee. We introduce controls for educational qualifications and previous experience and allow these to vary by gender. Directors with CFA and previous committee experience are more likely to be assigned to committees. Female directors with previous committee experience additionally increase the likelihood of committee assignment, over and above the unconditional gender effect.

With this as background, we now examine whether the earlier effects of gender board diversity on firm profitability are altered when we focus on female representation on committees. Panel B of table 5 presents the estimates related to this issue. In columns 1 and 2, we report the ordinary least squares (OLS) and firm fixed-effects estimates (FE) of the effect of the proportion of female directors on committees on ROA. We follow this again with 2-stage least square instrumental variable (IV) estimates analogous to those presented for the earlier board level estimates in column (3).

In all the specifications, the proportion of female directors on key committees has a positive and statistically significant effect on firm performance. The effect of gender diversity on committees on firm performance is of an order of magnitude larger than those reported earlier at the board level. For the estimates with firm fixed effects, this is 3 times larger, while for the IV estimates this is just under twice as large. Focusing on this latter estimates, this suggests a substantial increase in firm profitability resulting from increased female participation in firm governance and decision making. To quantify this, a one standard deviation increase in the proportion of females in committees increases ROA by 0.06 of a standard deviation.

We mount a similar analysis using $MTBV$ as the dependent variable, the results of which are presented in table 6. Similar to the previous analysis, we find that the effect of female representation in committees is stronger than board representation. The economic effect of female representation on $MTBV$ are larger compared to the effect on ROA. A one standard deviation increase in females on committees (board) increase $MTBV$ by 0.11 (0.05) of a standard deviation. These effects are comparable to the effect of directors' expertise reported by Dass et al. (2014). One possible explanation for the stronger effect of female representation on $MTBV$ compared to ROA is that investors perception of the expected profitability of the firm improves with the appointment of female directors.

[Insert Table 6 near here]

Our general finding is that the integration of female directors in the functioning of the boards leads to greater performance gains from board diversity. Existing studies estimate only the impact of female representation (but not participation), which could partially explain their findings of zero or negative impact on the firm performance of female board representation. The impact of female committee representation on firm performance is a novel result, highlighting the possible tokenism in female director appointments on boards. Although we find a positive and statistically significant association of female representation and firm performance, it is important to note that the performance effect is still modest. A one standard deviation change in female representation is equivalent to adding two female directors on the board, and the associated change in *ROA* is about 0.2%. Despite the modest performance effects, these results provide an economic rationale for female appointments, particularly to committees where they can influence governance.[15]

5.2 ADDITIONAL RESULTS AND ROBUSTNESS

5.2.1 Threats to identification

We run a series of robustness tests for our instrument to ensure that confounding factors are not driving our results. The important results are presented in panels A-D of table 7. We do not have complete and reliable information on the birth years of CEO children. A potential source of bias may arise from the fact the daughters were born after the CEO completed his tenure, and therefore are unlikely to have affected his choice. Given the median CEO in our sample is 58.9 years, it is uncommon for a CEO in our sample to have a daughter during, or after his tenure. To attenuate this concern, we restrict our sample to CEOs who are over 45 years and are not from the founding family. These restrictions do not alter our baseline results (panel A).

Another concern with using the gender of children is that the CEO could have used a fertility stopping rule, which can potentially violate the exogeneity of the gender composition of his children. It has been proposed that the gender of the first-born child is a more exogenous gender measure (Washington, 2008; Cronqvist and Yu, 2017). In a sub-sample of our CEO children data, we can identify the ordering of the children. Of the 255 CEOs for whom we have information on children, we know the order of birth for the children on 193 CEOs. In column 1 of panel B, we test for potential fertility stopping rules. We regress the number of CEO children after the first child on an indicator of whether the first child was a daughter. A fertility stopping rule will imply a positive association, whereby parents continue to have children after they have a daughter if they prefer sons. The coefficient is -0.09, and statistically insignificant at conventional levels. Therefore we find no evidence of CEOs using fertility stopping rules.

[15] In unreported results, we investigate possible mechanisms through which female representation can affect firm performance. Specifically, we examine the effect of female board representation on total CEO pay and fraction of the variable pay. We do not find any effect of female representation on total CEO pay, but female representation seems to be associated with higher proportion of variable pay.

Next, we regress *Proportion of Female on Board* on the indicator for whether the first born child was a daughter. The results are presented in column 2 of panel B, with the full set of control variables. The coefficient is 0.219 and is statistically significant. This coefficient is similar that of our first stage IV estimates as presented in column 1 of appendix C**.** Therefore it does not seem that the birth order of the CEOs children affects our central results.

CEO's preferences for female appointment to boards or societal equity can be affected by parenting a daughter, or parenting a child irrespective of the gender. For example, if a CEO parents both daughters and sons, any discrimination in the labour market may be more visible to them in relative terms, or parenthood generally could increase prosocial views. We seek to examine this in two ways. First, in column 1 of panel C, we use an indicator, which is 1 if the CEO has a child of any gender. The coefficient is positive and statistically significant at 1% levels. However, the 'child effect' subsumes any 'daughter effect', as a result, this is not a clean test. In column 2, we include an indicator for CEO Son, in addition to the indicator for CEO Daughter. Whilst the coefficient on *CEO Son* indicator is positive, it is not statistically significant at standard levels. The effect of daughter remains qualitatively similar to our baseline results. Therefore it does not seem that having a son affects the CEOs preference for appointing female directors, and the children-effect in column 1 is driven by the daughter-effect.

[Insert Table 7 near here]

It can be argued that healthier and more productive CEOs could be more fertile, and this could impact positively on firm performance. If that is the case, CEOs with larger families are statistically more likely to have daughters, compared to CEOs with a smaller family. 8.80% of our sample CEOs have one child, 47.33% have two children, 31.36% have three children, 6.46% have four children, and the rest have more than four children. In panel D, we control for the number of CEO children in the baseline first-stage IV regressions. The coefficient on the number of CEO children is 0.113 and is not statistically significant at standard levels. The CEO daughter coefficient remains unchanged, and retains its statistical significance. It does not appear that CEO family size poses a significant concern to our instrumental variable strategy.

In column 2 of panel D, we estimate the effect of 2.7% of our sample CEOs who do not have any children. The CEO daughter effect on female director appointment remains qualitatively similar, and the estimated coefficient on the indicator for CEO with no children is not statistically significant at 10% levels.

One concern with using news-based information is that the current CEOs will be over-represented in the media, compared to previous CEOs. This may induce bias in the identification of the gender of CEO children. However, we have been able to identify the gender composition of 88.23% of current CEOs and 90.98% of former CEOs' children. The difference in the mean number of daughters

parented by current and former CEOs in 0.02, and is not statistically significant. Therefore, this type of survivor bias in the sample does not seem to be a major concern for our analysis.[16]

Could existing female directors influence the choice of CEOs, and in particular, the probability of hiring a CEO with a daughter? We estimated models where the main coefficient of interest was the proportion of female on board prior to the turnover event, the dependent variable was incoming CEO has a daughter, and the other explanatory variables largely follow appendix C. We found no evidence that existing gender diversity on the board influences the probability of hiring a CEO with a daughter.

More broadly, we investigate whether board gender diversity affects the appointment of CEOs. While several studies show that internal candidates have a higher likelihood of being appointed as the CEO as they are more likely to continue with firm's current policies than outside CEOs (Hermalin and Weisbach, 1998; Parrino, 1997; Helmich and Brown, 1972). Markets view the appointment of CEOs from outside the firm more favourably than internal promotions (Borokhovich, Parrino, and Trapani, 1996). We classify CEO appointments as "Outside" if the new CEO has been employed in the firm for less than 2 years at the time of appointment as the CEO. This classification results in 34% outside CEO appointments within our sample. In the remaining cases, an internal candidate is appointed as the CEO. Among this 34%, about two-thirds of the CEO join the firm at the time of succession. We found no statistically significant effects of female board representation on the likelihood of outside CEO appointments.[17]

A more general concern is that our baseline models with firm fixed effects are identified by events of CEO turnover, which are often preceded by poor firm performance, or a shock to profitability (Kaplan and Minton, 2012; Gregory-Smith et al, 2009). Therefore, the positive association between female representation and ROA can reflect the reversion of performance to the mean after the appointment of the new CEO. To examine this issue we restrict our sample to firms which experience at least one event of CEO turnover within the sample period. This allows us to examine the performance effect of female representation within a set where mean reversion is equally likely for all firms. We present the OLS, FE, and IV results in table 8. The IV estimates for these firms compare the effects of changes in gender board/committee composition on firm performance for firms 'treated' by CEOs with daughters relative to firms with CEOs with only sons, or no children. The results are qualitatively similar to our baseline results. This attenuates the concern that our results are solely driven by reversion to mean performance around events of CEO turnover.

[Table 8 around here]

[16] An alternate strategy could be to consider how growing up with sisters affects male attitudes (Healy and Malhotra, 2013). However, we were only able to gain information on CEOs' siblings for 94 CEOs (37%). We used this information to estimate first stage IV regressions with a dummy for CEO has a sister. CEO with a sister has a positive effect on female board and committee female representation. These effects are sizeable but imprecise: 0.176 [s.e. 0.113] for boards; 0.168 [s.e. 0.106] for committees.

[17] These results are not presented in the interests of brevity and are available on request.

Our identification strategy relies on the gender of his child influencing social preferences of the CEO. It is plausible that these preferences manifest themselves not only in the appointment of female directors to committees but also in other aspects that affect firm outcomes. For example, Cronqvist and Yu (2017) present evidence that suggests that firms with CEOs parenting a daughter spend more on CSR. Dahl, Deszö, Ross (2012) show that male CEOs pay employees slightly less after fathering a child. Most relevant to us, they present evidence that fathering a daughter increases employee wages, particularly those of women. In both cases (CSR and increased female pay) this is likely to increases firm costs, and reduce profits in the short run. This will lead to a conservative bias towards zero for our main variable of interest. Nevertheless, this raises general concerns regarding the validity of our exclusion restriction. Whilst ruling out all alternate channels through which parenting a daughter can affect the CEO's choices is difficult, we conduct a range of tests aimed at attenuating these concerns. First, we examine if parenting a daughter affects other firm outcomes directly. In particular, we test if parenting a daughter increases the planning horizon of the CEO and/or makes the CEO more risk-averse. To do so, we first use two standard measures of the planning horizon: capital expenditure (CapEx); and research and development expenditure (R&D). We then focus on two measures of the riskiness of the firm's position: debt-to-capital ratio (DC Ratio); and the debt-to-equity ratio (DE Ratio). Table 9 provides reduced-form estimates of the effect of CEOs with a daughter on these outcomes. There appears to be no association between our instrument and these firm outcomes.

[Table 9 around here]

Next, CEOs with daughters could enact female-friendly policies that improve the productivity of the workforce, which in turn improves firm performance. This effect is likely to be stronger in sectors where the share of women in the workforce is higher. We do not observe the share of female workers for individual firms in our sample. Instead, we base our analysis on the share of women in employment across industry-groups from Christiansen et al. (2016) and Do, Levchenko and Raddatz (2016) using data from OECD annual labour force statistics. The average share of women in the industry-groups of our sample firms is 38%. This is lower than the EU average of female labour force participation as some of the sectors with a high proportion of women are not represented in our sample. We estimate our baseline specification for subsamples of firms where the share of women in the workforce is above and below 40%. We find the effect of CEO-daughters on female committee representation is similar for both subsamples, as are the performance effects of female representation. Therefore, it does not seem that our results are driven by unobserved factors that the CEO might influence in firms where the share of women in the workforce is large.

Further, CEOs with daughters can implement strategies that attract more female customers. This effect, we argue, is likely to be stronger when the firm is selling a final product, rather than an intermediate product. Therefore, we estimate our baseline specifications for subsamples of firms

that sell final products/services and firms that sell intermediate products. Once again, we find the effect of CEO-daughters on female committee representation is similar for both subsamples, as are the performance effects of female representation. In these subsample analyses, the associations of CEO-Daughter with female board and committee representation are similar to the baseline specifications, although in some of the subsamples the tests are of low power reflecting small sample sizes. Nevertheless, these results partially attenuate concerns about the exclusion restriction. These results are presented in panels A and B of online appendix I respectively.

5.2.2 Additional robustness tests

We conduct a range of furthers tests aimed at ensuring the robustness of our baseline results. First, we use an alternative identification strategy where we examine the market reaction of board appointment of female directors, and assignment to committees. Using data on the date of announcement of director appointments from BoardEx, we conduct an event study to examine how investors react to female director appointments on the board. This empirical design controls for any firm-specific effects in female director appointments. We use announcement date of director appointments from EuroTop 100 firms within our sample period. Appointments are excluded if the announcement date is not available, or overlaps with other major corporate announcements. This yields a sample of 321 female director appointments, and 334 other director appointments.[18]

We calculate the cumulative abnormal returns (CAR) around the announcement date for 3-day and 7-day windows, and regress the CARs on the *Female* indicator, with firm and industry controls. On average, there are no statistically significant announcement effects for female director appointments to boards for both 3-day and 7-day windows.[19] Further, we investigate the subset of female director appointments for which committee assignments are simultaneously announced. This reduces our sample to 210 female director and 228 male director appointments. While positive, the announcement effect of female board appointment is not statistically significant. However, the announcement of the assignment of a female director to a key committee is associated with a positive and statistically significant price reaction. The results are presented in table 10.

[Table 10 around here]

To what extent do our novel results simply reflect a different institutional setting? Our data allows us to address this by attempting to reconcile our results with those existing for the UK. We

[18] It is possible that female directors are appointed to replace existing female directors (Gregory-Smith et al., 2014). If that is the case, then the second announcement of appointing a female director may not add to the stock of female directors. In our analysis, we only use additions: announcements where the count of female directors on the board increases from 1 to 2.

[19] We use information from the Announcement Date field of BoardEx, and check for the robustness of our results using Effective Date. The results are similar in magnitude and significance.

report the estimates with firm fixed effects separately for the subsample of UK firms. We provide fixed effects and instrumental variable regression results for both *Proportion of Female on Board*, and *Proportion of Female in Committees* in table 11. This exercise provides some interesting insights. First, the effect on the firm performance of the proportion of female directors on the board for the UK sub-sample is not statistically significant at conventional levels. This is consistent with the results of Gregory-Smith et al (2014) that there are no performance gains for UK firms from board gender diversity. Second, the effect on firm performance of the proportion of female directors on board committees for the UK sub-sample is both positive and statistically significant. These results suggest that full economic benefits of female representation could be internalized by integrating directors through committee appointments. This reinforces our previous point that the traditional measures of board gender diversity do not reflect the degree of integration of the female directors in the governance mechanism.

[Table 11 around here]

More generally, our data are drawn from large firms across different European countries that differ in their governance regimes. Our baseline specifications are estimated with firm fixed effects which partially mitigates this insofar as all firms are nested within countries. However, these countries vary in the composition and the functioning of the board (for example, German and Dutch firms have two-tiered boards), and may also vary in how committees function. We examine two variations in governance settings which appear particularly likely to be relevant. First, compensation committees are likely to function in a substantially different way in countries with binding Say on Pay (SoP) legislation compared to countries with advisory say on pay (footnote here what this means and which countries). Denmark, Netherlands, Norway, and Sweden have binding SoP legislations. We estimate our baseline specifications for the subsample of firms in countries with binding SoP and subsample of firms with advisory SoP. The results, presented in panel A of online appendix II, suggests that the performance effects of female board and committee representation are essentially the same for firms in both the subsamples. Second, we split the sample into subsamples of firms with two-tier boards and one-tier boards. We find similar effects of female board and committee representations on firm performance. These results are presented in panel B of online appendix II, and show that our results hold across different board and committee regulations across European countries.

A further concern is the variation of governance regulations within countries over time. Our baseline specifications are estimated with year dummies which absorb some of the variations across time at the firm level. However, this may miss country-specific changes over time. To investigate this we estimate our baseline specifications with country-specific linear time trends. The results presented in panel A of online appendix III are qualitatively similar to that of the main results. The magnitude of the performance effect of female representation is smaller compared to the baseline results. The performance effect of female representation on boards could also vary over time.

For example, the implementation of board gender quotas in Norway may have changed the normative expectation of female representation on corporate boards in other countries. We examine the relative performance effects of female representation before and after the year 2008 when the Norwegian board gender quotas were implemented. The results are presented in panel B of online appendix III. We find stronger effect of female board representation on firm performance in the post-2008 period, and comparable performance effects of female committee representation in both the periods.[20]

The results of the subsample analyses are reported from firm-fixed effects regressions. This is due to low power on the two-stage IV estimates for each subsample. In online appendix V, we present the first-stage estimates of the effect of CEO daughter on female representation in committees for each of the subsamples discussed above. We find a positive association of our IV with the proportion of female directors on committees, albeit with varying statistical significance. These results provide support to our empirical strategy insofar as they are indicative of CEOs with daughters broadly leading to greater female board representation across a range of institutional settings.

We compare the performance effects of female representation using different measures of firm performance in online appendix V. The results are qualitatively similar for all the measures of firm performance.

Next, we present our results when we rely upon an instrumental variable previously used in the literature: the fraction of male directors on the board of firm i who sit on other boards (firms other than i) with at least one female director (Adams and Ferreira, 2009; Gregory-Smith et al. 2014). The argument is that if male directors of the board of firm i have exposure to other boards with female directors, then they are more likely to appoint female directors to their own board. However, this should not impact upon firm performance, except through the appointment of female directors on the board. Similarly, we attempt to control for endogeneity in the committee appointments by using the proportion of male members who sit on other boards with at least one female committee member. The results, presented in online appendix VI, are qualitatively similar to our baseline estimates. However, using this instrument the magnitude of the performance impact of female representation is much larger than our preferred estimates.

In online appendix VII we present estimates where our measure of female representation is a binary indicator of at least one female director on the board. This is both a standard measure used in the literature (Adams and Ferreira, 2009) but the interpretation fits with current estimates of gender diversity in settings with very low levels of female representation. The coefficient on the binary indicator is negative. This suggests that the appointment of the first female director does not enhance firm performance. When combined with our main results this provides suggestive

[20] In separate specifications, we also estimate our baseline specifications with industry-year fixed effects. Our main results are unaffected by this.

evidence that the benefits of female representation may only appear with more than one female director. Schwartz-Ziv (2015) find that boards with a minimum of three female directors are more active at board meetings than those without such representation. We follow a similar approach in our fixed effects setting to examine the role of critical mass. Consistent with the critical mass hypothesis, we find that the presence of at least three female directors is associated with a positive effect on firm performance. Further, firms with at least 50% female directors on the committees seem to have stronger performance effects than firms that do not have such representation.

In the baseline specification, *Proportion of Female in Committees* is calculated as the proportion of female directors to the total number of director on committees. We use an alternate measure: the proportion of female in committees, conditional on being on the board. We find a stronger association between female committee membership and firm performance.[21]

An array of additional tests were done to ensure the robustness of the results with respect to sample selection, different specifications of the variables and the models. First, we test our baseline fixed effects specifications with a larger sample of European firms. The results are qualitatively similar to the baseline specifications. Second, we test the robustness of our results with alternate measures of firm performance and firm size. The estimates of *Proportion of Female on Board*, and *Proportion of Female in Committees* are qualitatively similar to the baseline estimates. We estimated GMM models of our baseline specifications, using Arellano-Bond two-stage method to control for potential endogeneity in firm performance and female director appointments. Again, neither of these checks undermine our baseline results. Finally, we examined whether the impact of female representation is heterogeneous across industries. We do this by splitting our sample by broad industry classification (services and manufacturing), the resulting estimates of *Proportion of Female on Board* and *Proportion of* Female in Committees are qualitatively similar for both sub-groups. Our results also stand when we include industry-time fixed effects to our baseline specifications.

In summary, the results of the performance impact on the firm performance of female representation are different from that of the existing evidence. This is possibly due to higher participation of female directors in the governance mechanism through their presence on the key committees. The UK and US evidence shows the impact of having (a few) female directors on the board compared to none, whereas we provide evidence of having an involved role of female directors, and appointing them in key committees to influence governance, and performance. Together, these results support our central hypothesis that firms benefit from female director appointments, only when they are integrated into the governance mechanism.

[21] We also construct other measures of diversity using the nationalities of independent directors, irrespective of their gender. We find a weak positive association of director nationality on firm performance. However, we find no statistically significant CEO/daughter effect on the appointment of directors of other nationalities.

6 Conclusion

Greater gender diversity in corporate decision making is a central theme of current governance regulations. Current research that focuses on gender diversity on corporate boards find no, or even a negative, effect of female board representation on firm profitability. This lack of economic benefits from female board representation means that any case for greater gender diversity needs to be structured around arguments for equity and moral justice. We return to this issue in the setting of large listed European firms where the level of female board representation is higher than that of the US and the UK.

The innovation of this paper is twofold. Existing research has focused on the effect of representation on corporate boards. While a prerequisite for involvement in firm decision making, board representation does not guarantee it. We seek to more closely proxy involvement in decision making by focusing on gender diversity on key board committees. Specifically, we investigate the effect of the assignment of female directors to three important board committees on firm performance. Directors on audit, nomination, and compensation committees can directly influence the core functions of corporate governance, and through that firm performance. Our second innovation is to adopt an identification strategy which we believe gets us closer to the causal effect of gender diversity on firm performance. We use the observation that the gender composition of children influences parental preferences. With this in mind, we use whether the CEO has a daughter as a source of exogenous variation in the probability of female representation on the firm's board and committees. We demonstrate that hiring a CEO who has a daughter has sizeable effects on board gender diversity. While not the focus of this paper this is an important finding in and of itself as it provides further evidence on the potential effects of exposure to diversity on (male) preferences and behaviour.

We demonstrate modest but economically meaningful effects of female board representation on firm performance. These effects are markedly larger for committee membership. Whilst these effects are modest, our results provide evidence that greater female representation, especially when integrated more closely into the governance mechanism, increases firm profitability. These results are important as they provide an economic basis for increased gender diversity. They also suggest that regulatory efforts focused solely on increased board representation are unlikely to unlock the full benefits of gender diversity in corporate decision making. Future research that identified the causal mechanisms through which gender diversity improves firm performance would further tighten the focus of these regulations.

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Table 1
Descriptive statistics

	N	Mean	Std. Dev.	Minimum	Maximum
Firm Characteristics					
Return on Assets (ROA)	1,582	6.643	6.108	-09.28	38.95
Ln Sales	1,582	17.558	0.921	14.39	20.02
Market-to-Book Value (MTBV)	1,582	2.866	5.792	-58.37	86.00
Stock Price Volatility	1,582	0.939	0.913	0.05	9.44
HHI	1,582	0.212	0.329	0.095	0.608
Capital Expenditure (/Sales)	1,517	0.457	0.339	0.103	0.716
R&D (/Sales)	1,470	0.116	0.423	0.004	0.502
Debt-to-Capital Ratio (DC Ratio)	1,580	0.1233	0.5077	2.478	21.516
Debt-to-Equity Ratio (DE Ratio)	1,580	0.0422	0.0265	0.0180	0.0624
Board Characteristics					
Board Size	1,582	16.963	5.942	6.00	36.00
Proportion Independent Directors	1,582	0.477	0.278	0.00	0.910
Chairman-CEO	1,582	0.154	0.228	0.00	1.00
Firm has Female Directors	1,582	0.911	0.285	0.00	1.00
Firm has One Female Director	1,582	0.175	0.379	0.00	1.00
Proportion of Female on Board	1,582	0.185	0.145	0.00	0.889
Proportion of Female in Committees	1,582	0.152	0.162	0.00	0.602
Nomination Committee Size	1,582	3.941	2.473	0.00	16.00
Audit Committee Size	1,582	4.208	1.461	0.00	8.00
Compensation Committee Size	1,582	3.432	1.949	0.00	9.00
Director Characteristics					
No. of CEO daughters	255	1.147	1.912	0.00	4.00
Time on Board	16,647	5.756	5.269	0.00	54.90
Time in Role	16,647	4.535	4.238	0.00	47.72
Ph.D.	16,647	0.091	0.343	0.00	1.00
CFA	16,647	0.114	0.436	0.00	1.00
Other Directorships (Listed Firms)	16,647	0.880	1.744	0.00	9.00
Previous Experience in Committees	16,647	0.125	0.404	0.00	1.00
Executive Age (years)	16,647	58.115	8.097	26.00	90.00

Notes: See Appendix A for variable definitions.

Table 2

Comparisons of firms with and without at least one female director

	No Female Directors mean	*At Least One Female Director-Mean*	*p-value*
Ln Sales	15.296	17.614	0.272
MTBV	3.025	2.819	0.000
ROA	5.869	6.697	0.000
HHI	0.208	0.213	0.000
Board Size	15.140	17.152	0.072
Proportion Independent Directors	0.471	0.478	0.110
Executive Age	59.035	58.013	0.000
Nomination Committee Size	3.849	3.950	0.066
Audit Committee Size	3.283	4.308	0.000
Compensation Committee Size	3.541	3.420	0.010

Note: This table presents key summary statistics for firm-years with no female directors and firm-years with at least one female director. All variables are winsorized at 1%-level.

Table 3
Distribution of CEO children and daughters

	CEO Children (1)	CEO Daughters (2)
0	2.7%	39.55%
1	8.80%	40.04%
2	47.33%	16.92%
3	31.36%	2.13%
4	6.46%	1.36%
5+	3.35%	0.00%

Note: The modal CEO has 2 children and one daughter.
These counts include both adopted and biological children.

Table 4
Comparisons of firms with and without the CEOs parenting a daughter

Variable	*No Daughters* *Mean*	*At Least One Daughter* *Mean*	*p-value*
Any Female	0.85	0.94	0.001**
Proportion of Female on Board	0.170	0.198	0.000***
Proportion of Female in Committees	0.122	0.184	0.000***
Ln Sales	17.21	17.22	0.218
Board Size	16.11	16.20	0.292
Proportion of Independent Directors	0.471	0.471	0.212
CEO Turnover	0.12	0.09	0.209
Executive Age	59.14	59.22	0.231
Nomination Committee Size	3.91	3.88	0.303
Audit Committee Size	4.30	4.07	0.197
Compensation Committee Size	3.42	3.55	0.229

Notes: Standard errors are clustered at the firm level. ***,**, and * denotes statistical significance at1 %, 5%, and 10% levels respectively.

Table 5
Female directors and firm performance (ROA)

	Dependent variable: Return on Assets					
	Panel A			Panel B		
	OLS	FE	IV	OLS	FE	IV
	(1)	(2)	(3)	(4)	(5)	(6)
Proportion of Female on Board$_{it-1}$	0.023***	0.005***	0.011***			
	(0.005)	(0.001)	(0.003)			
Proportion of Female in Committees$_{it-1}$				0.017***	0.015***	0.023***
				(0.006)	(0.002)	(0.007)
Ln Sales$_{it-1}$	0.300***	0.033***	0.050***	0.419***	0.031**	0.040**
	(0.049)	(0.007)	(0.023)	(0.049)	(0.015)	(0.020)
Stock Price Volatility$_{t-1}$	-0.206***	0.000	-0.003	-0.216***	-0.205	-0.221
	(0.007)	(0.026)	(0.003)	(0.065)	(0.169)	(0.169)
Board Size$_{it-1}$	-0.472***	-0.015**	-0.031*	-0.479***	-0.408*	-0.423*
	(0.010)	(0.008)	(0.016)	(0.010)	(0.209)	(0.216)
Proportion of Independent Directors$_{it-1}$	-0.064**	0.081***	0.077*	0.064***	0.062**	0.050**
	(0.002)	(0.015)	(0.035)	(0.002)	(0.002)	(0.017)
Ph.Ds$_{it-1}$	0.023	0.009	0.000	0.011	0.002	0.001
	(0.033)	(0.012)	(0.004)	(0.017)	(0.005)	(0.005)
CFAs$_{it-1}$	0.018	0.016	0.011	0.022	0.020	0.015
	(0.014)	(0.012)	(0.006)	(0.018)	(0.014)	(0.008)
Previous Committee Experience$_{it-1}$	0.019***	0.012***	0.006*	0.028***	0.025**	0.024**
	(0.003)	(0.005)	(0.004)	(0.010)	(0.012)	(0.012)
Other Directorships$_{it-1}$	0.009	0.007	0.000	0.004	0.003	0.003
	(0.008)	(0.005)	(0.002)	(0.009)	(0.004)	(0.003)
HHI	-0.013**	0.005	0.003	-0.011*	0.003	0.002
	(0.006)	(0.007)	(0.003)	(0.006)	(0.004)	(0.002)
Constant	26.98***	28.03***	33.10**	30.052***	29.18***	24.66***
	(0.898)	(0.927)	(3.987)	(0.894)	(0.999)	(4.41)
Firm fixed effects	No	Yes	Yes	No	Yes	Yes
Year dummies	Yes	Yes	Yes	No	Yes	Yes
Observations	1,582	1,582	1,582	1,582	1,582	1,530
First Stage $F-Stat$			14.15			22.66
R^2	0.255	0.208	0.220	0.201	0.211	0.250

Notes: We present results for two meaures of representation: Proportion of Females on the Board (panel A) and Proportion of Female in Committees (panel B). Within each pan -el, we present OLS results, estimates with firm-fixed effects, and IV estimates with an indicator for the CEO parenting a daughter as the instrument. Robust standard errors, clustered at the firm level are in the parentheses. ***, **, and * indicate significance at 1% 5% and 10% levels respectively.

Table 6
Female directors and firm performance ($MTBV$)

	Dependent variable: MTBV					
	Panel A			Panel B		
	OLS	FE	IV	OLS	FE	IV
	(1)	(2)	(3)	(4)	(5)	(6)
Proportion of Female on Board$_{it-1}$	0.019***	0.007***	0.022***			
	(0.004)	(0.002)	(0.006)			
Proportion of Female in Committees$_{it-1}$				0.020***	0.025***	0.044***
				(0.006)	(0.004)	(0.009)
Control Variables	Yes	Yes	Yes	Yes	Yes	Yes
Constant	19.67***	22.45***	24.77***	26.50***	28.71***	26.37***
	(0.670)	(1.241)	(4.008)	(0.765)	(1.318)	(4.424)
Firm fixed effects	No	Yes	Yes	No	Yes	Yes
Year dummies	Yes	Yes	Yes	No	Yes	Yes
Observations	1,582	1,582	1,582	1,582	1,582	1,530
First Stage $F-Stat$			14.15			22.66
R^2	0.249	0.236	0.257	0.194	0.229	0.273

Notes: We present results for two meaures of representation: Proportion of Females on the Board (panel A) and Proportion of Female in Committees (panel B). Within each pan -el, we present OLS results, estimates with firm-fixed effects, and IV estimates with an indicator for the CEO parenting a daughter as the instrument. Robust standard errors, clustered at the firm level are in the parentheses. ***, **, and * indicate significance at 1% 5% and 10% levels respectively.

Table 7
Threats to Identification

Panel A: Age of CEO Daughters (CEO age $\succeq$ 45 and non-family CEOs)

	Proportion of Female on Board	Proportion of Female in Committees
	(1)	(2)
CEO daughter	0.213***	0.220***
	(0.062)	(0.066)
Firm characteristics	Yes	Yes
Year dummies	Yes	Yes
Firm fixed effects	Yes	Yes

Panel B: Fertility Stopping Rules and First Born Effect

	No. of CEO children after first child	Proportion of Female on Board
	(1)	(2)
First born CEO daughter	-0.090	0.219***
	(0.165)	(0.061)
Firm characteristics	Yes	Yes
Year dummies	Yes	Yes
Firm fixed effects	Yes	Yes

Panel C: Daughter Effect vs Children Effect

	Proportion of Female on Board	
	(1)	(2)
CEO children	0.226***	
	(0.070)	
CEO daughter		0.233***
		(0.057)
CEO son		0.084
		(0.061)
Firm characteristics	Yes	Yes
Year dummies	Yes	Yes
Firm fixed effects	Yes	Yes

Panel D: Family Size Effect

	Proportion of Female on Board	
	(1)	(2)
CEO daughter	0.216***	0.219***
	(0.066)	(0.059)
No. of CEO children	0.113	
	(0.071)	
CEO with no children		0.022
		(0.055)
Firm characteristics	Yes	Yes
Year dummies	Yes	Yes
Firm fixed effects	Yes	Yes

Notes: Panel A presents the results for subsample of non-family CEOs over 45 years of age, panel B reports tests for fertility stopping rules, and the first-born effect, panel C presents results of tests for daughter vs. children effect, and panel D presents results for family size effects.

Table 8

Female directors, firm performance, and mean reversion

	Dependent variable: Return on Assets					
	Panel A			Panel B		
	OLS	FE	IV	OLS	FE	IV
	(1)	(2)	(3)	(4)	(5)	(6)
Proportion of Female	0.019**	0.007**	0.009***			
on Board$_{it-1}$	(0.008)	(0.003)	(0.002)			
Proportion of Female				0.017**	0.012**	0.015***
in Committees$_{it-1}$				(0.007)	(0.006)	(0.004)
Control Variables	Yes	Yes	Yes	Yes	Yes	Yes
Constant	21.45***	24.33***	25.09***	26.50***	28.71***	26.37***
	(1.343)	(0.998)	(5.656)	(2.201)	(2.042)	(5.939)
Firm fixed effects	No	Yes	Yes	No	Yes	Yes
Year dummies	Yes	Yes	Yes	No	Yes	Yes
Observations	1,120	1,120	1,120	1,120	1,120	1,120
First Stage $F-Stat$			14.06			20.25
R^2	0.238	0.212	0.210	0.194	0.198	0.215

Notes: We test for possible confounding effects of mean-reversion in firm performance foll -llowing CEO turnover. We restrict our sample to firms which has a change in CEO over the sample period. We present OLS, FE and IV results for the effect of proportion of female -s on board (Panel A) and on committees (Panel B) on ROA. Robust standard errors cluste -red at firm level are in the parentheses. ***, **, and * indicate significance at 1%, 5%, and 10% levels, respectively.

Table 9

CEOs with daughters and other firm outcomes

Dependent Variable	CapEX	R&D	DC Ratio	DE Ratio
	(1)	(2)	(3)	(4)
CEO Daughter	0.044	0.018	0.003	0.012
	(0.035)	(0.012)	(0.002)	(0.009)
Control Variables	Yes	Yes	Yes	Yes
Year Dummies	Yes	Yes	Yes	Yes
Firm Fixed Effects	Yes	Yes	Yes	Yes
Constant	3.604***	4.418***	2.055***	3.334***
	(0.320)	(0.802)	(0.709)	(0.501)
Observations	1,517	1,470	1,580	1,580
R^2	0.214	0.193	0.318	0.329

Notes: We examine two possible channels: planning horizon (CapEx and R&D) and firm risk (Debt to Capital and Debt to Equity ratios. Robust standard errors are in brackets. *, **, and *** indicate significance at the 1%, 5% and 10% levels, respectively.

Table 10

Female director announcement returns

	CAR (-1, +1) (1)	CAR (-3 +3) (2)	CAR (-1, +1) (3)	CAR (-3, +3) (4)
Female on Board	0.058	0.031		
	(0.044)	(0.025)		
Female in Committees			0.031***	0.024**
			(0.011)	(0.012)
Control Variables	Yes	Yes	Yes	Yes
Year Dummies	Yes	Yes	Yes	Yes
Industry Dummies	Yes	Yes	Yes	Yes
R^2	0.199	0.182	0.210	0.161

Notes: This table presents market model adjusted announcement returns for app -ointment of a random sample of 500 female directors and 500 other independen -t non-executive directors. Appointments are excluded if the announcement date is not available, or overlaps with other major corporate announcements, resulting in a sample of 321 female-, and 334 other director appointments. The abnormal returns presented here are over 3-day and 7-day event windows. Columns (1) and (2) show that the results for appointment of female directors to boards and columns columns (3) and (4) show results for 210 events of concurrent announce -ment of female director appointments to committees. All specifications include full set of control variables with year and industry dummies. ***, **, and * indicate significance at 1%, 5%, and 10% levels respectively.

Table 11

Female directors and firm performance: UK sub-samples

	Dependent Variable: Return on Assets			
	Fixed Effects		Instrumental Variable	
Variable	(1)	(2)	(3)	(4)
Proportion of Female	0.007		0.008	
on Board$_{it-1}$	(0.004)		(0.006)	
Proportion of Female		0.011**		0.006**
in Committees$_{it-1}$		(0.005)		(0.003)
Constant	26.18***	26.09***	20.02***	18.66***
	(1.609)	(1.621)	(0.018)	(0.056)
Firm fixed effects	Yes	Yes	Yes	Yes
Year dummies	Yes	Yes	Yes	Yes
Observations	493	493	493	493
R^2	0.282	0.261	0.197	0.169

Notes: This table presents the results of the performance impact of board gen -der diversity for a sub-sample of UK firms from the Eurotop100. Robust stand -ard errors clustered at the firm level reported in the parentheses. ***, ** , and * indicate significance at 1%, 5% and 10% levels, respectively.

Appendix A Variable summary and data description

Key Variables	Source	Description
Firm Characteristics		
Return on Assets	Datastream/Worldscope	Net Income/Total Assets
Sales	Datastream/Worldscope	Annual sales ('000 US$)
Market-to-Book Value (MTBV)	Datastream/Worldscope	Market-to-Book value
Stock Price Volatility	Datastream/Worldscope	Volatility in annual stock price
HHI	Author's calculation	Sum of squares of the market share of each firms in an industry
Board Characteristics		
Board Size	BoardEx	No. of directors on the board
Proportion of Independent Directors	BoardEx	Fraction of independent directors
Proportion of Female on Board	BoardEx	Fraction of female directors on board
Proportion of Female in Committees	BoardEx	Fraction of female directors on committees
Nomination Committee Size	BoardEx	Number of directors on the nomination committee
Audit Committee Size	BoardEx	Number of directors on the audit committee
Compensation Committee Size	BoardEx	Number of directors on the compensation committee
Director Characteristics		
CEO Daughter	BoardEx World of CEOs and Public Sources	Indicator for a male CEO parenting at least one daughter.
Female	BoardEx	Gender of the individual director
Time on Board	BoardEx	No. of years as a director on the board
Time in Role	BoardEx	No. of years in the current role
Ph.D.	BoardEx	Director has a doctorate degree
CFA	BoardEx	Director is a qualified Chartered Financial Accountant
Other Directorships	BoardEx	Number of other boards a director sits on
Previous Experience in Committees	BoardEx	Indicator for committee membership in previous roles.
Executive Age	BoardEx	Age in years

Appendix B

Comparison of our sample with other indices

Attributes	EuroTop100	FTSEurofirst 300	FTSE 350	S&P 500
Number of Constituents	100	318	351	506
Average Mkt Cap (US$ Mn)	40,434	21,430	8,375	40,838
Dividend Yield %	3.89	3.60	3.54	2.12
Weight of Largest Constituent	3.70	3.61	5.81	3.25
Top 10 holdings (% of Index)	25.68	24.94	36.43	21.28
Proportion of Female on Board	18.531	16.302	10.544	9.843
Proportion of Female in Committees	15.200	14.877	14.224	12.682

Notes: This table presents the comparison of our sample with FTSEurofirst300, FTSE 350 and S&P 500 firms. Our sample from EuroTop100 index is similar to the other indices in terms of market capitalisation, dividend yield, weights of top 10 holdings etc.

Appendix C

First-stage instrumental variable regressions

	Dependent Variable	
	Proportion of Female on Board$_t$	Proportion of Female in Committees$_t$
	(1)	(2)
CEO daughter	0.207***	0.219***
	(0.055)	(0.046)
Ln Sales$_{it-1}$	0.322**	0.269**
	(0.164)	(0.126)
Stock Price	0.070	0.081
Volatility$_{it-1}$	(0.064)	(0.059)
Board Size$_{it-1}$	0.075**	0.061
	(0.043)	(0.052)
Proportion of Indepen	0.051	0.066**
-dent Directors$_{it-1}$	(0.057)	(0.034)
Ph.Ds$_{it-1}$	0.000	0.003
	(0.002)	(0.002)
CFAs$_{it-1}$	0.012**	0.128**
	(0.005)	(0.063)
Previous Committee	0.089***	0.236***
Experience$_{it-1}$	(0.020)	(0.071)
Other Directorships$_{it-1}$	0.034*	0.016
	(0.018)	(0.011)
HHI	0.000	0.002
	(0.004)	(0.002)
Constant	8.431***	6.653***
	(2.344)	(1.909)
Firm fixed effects	Yes	Yes
Year dummies	Yes	Yes
Observations	1,530	1,530
F-statistics	14.15	22.66
R^2	0.192	0.169

Notes: Robust standard errors clustered at the firm level are in the parentheses. ***, **, and * indicate significance at 1%, 5% and 10% levels, respectively.

Appendix D
Assignment of female directors on board committees

	Dependent Variable			
	Any Committee (1)	Audit Committee (2)	Nomination Committee (3)	Compensation Committee (4)
Female	0.098**	0.096***	-0.019**	0.001
	(0.044)	(0.010)	(0.009)	(0.009)
Female* Ph.D.	0.067	0.079	0.028	0.059
	(0.039)	(0.070)	(0.022)	(0.043)
Female* CFA	0.055	0.041**	0.009	0.044
	(0.029)	(0.020)	(0.015)	(0.036)
Female* Previous	0.033**	0.017**	0.040***	0.028**
Committee Experience	(0.014)	(0.008)	(0.016)	(0.013)
Ph.D.	0.113	0.145	0.108	0.100
	(0.277)	(0.212)	(0.093)	(0.122)
CFA	0.159**	0.212***	0.127	0.124**
	(0.070)	(0.056)	(0.088)	(0.061)
Previous Commitee	0.243***	0.281***	0.208**	0.221***
Experience	(0.081)	(0.075)	(0.102)	(0.094)
Other Directorships	0.012	0.008	0.019	0.014
	(0.022)	(0.006)	(0.013)	(0.025)
Chairman-CEO	0.215	0.232	0.188	0.200
	(0.187)	(0.222)	(0.165)	(0.183)
Time in Role	-0.0011	-0.001	-.000	-0.002***
	(0.000)	(0.000)	(0.000)	(0.000)
Ln Age	0.010***	0.004***	0.006***	0.006***
	(0.0004)	(0.000)	(0.000)	(0.000)
Board Size$_{t-1}$	-0.018***	-0.008***	-0.008***	-0.012***
	(0.000)	(0.000)	(0.000)	(0.000)
Proportion of Female	0.001***	0.001***	0.002***	0.001**
on Board$_{t-1}$	(0.000)	(0.000)	(0.000)	(0.000)
Proportion of Indepen	0.000	-0.0007***	0.000	0.004**
-dent Directors$_{it-1}$	(0.000)	(0.000)	(0.000)	(0.000)
ROA_{it-1}	0.000	-0.000	-0.001**	-0.002**
	(0.000)	(0.001)	(0.000)	(0.000)
Ln Sales$_{it-1}$	-0.024**	-0.013**	-0.029***	-0.021**
	(0.004)	(0.004)	(0.003)	(0.003)
Stock Price	0.002***	0.000	0.001**	-0.000
Volatility$_{it-1}$	(0.000)	(0.000)	(0.000)	(0.000)
HHI	0.000	0.000	0.001	0.000
	(0.000)	(0.000)	(0.003)	(0.000)
Year dummies	Yes	Yes	Yes	Yes
Number of female directors	1,136	665	471	427
Observations	16,647	15,246	14,937	15,132
R^2	0.308	0.267	0.195	0.222

Notes: All estimates are from linear probability models with firm fixed effects. Robust standard errors clustered at the firm levels are in the parentheses. ***, **, and * indic -ate significance at 1%, 5%, and 10% levels, respectively.

ONLINE APPENDICES

Online Appendix I

Heterogeneous Treatment Effects: Institutional Factors

This table presents the present the results for the tests on the comparability of our results across different countries in our sample. Panel A presents the results for countries with binding say-on-pay regulations (column -s 1 and 2) and countries with an advisory, or no say-on-pay regulations (columns 3 and 4). Panel B presents results for countries with two-tiered boards (columns 5 and 6) and countries with one tier boards (columns 7 and 8). Results from fixed effects regressions, and our baseline results hold in all these subsamples. Robust standard errors, clustered at the firm level are in brackets. ***, **, and * indicate significance at 1%, 5% and 10% levels, respectively.

	Dependent Variable: ROA							
	Panel A				Panel B			
	Binding Say on Pay		Advisory Say on Pay		Two-Tier Boards		One-Tier Boards	
	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)
Proportion of Female	0.009*		0.005***		0.006**		0.007***	
on Board$_{it-1}$	(0.004)		(0.001)		(0.003)		(0.003)	
Proportion of Female		0.012**		0.008**		0.019**		0.023***
in Committees$_{it-1}$		(0.004)		(0.003)		(0.006)		(0.004)
Control Variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year Dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Constant	2.803***	1.385**	2.005***	2.012***	3.271***	3.027***	1.191***	1.165***
	(0.450)	(0.317)	(0.534)	(0.102)	(0.252)	(0.151)	(0.114)	(0.145)
Observations	488	488	867	867	547	547	1,035	1,035
R^2	0.189	0.194	0.208	0.199	0.184	0.175	0.237	0.230

Online Appendix II

Heterogeneous Treatment Effects: Workforce feminization and Consumer preference

This table presents the results for alternate hypotheses that can drive our baseline results. Panel A results results are driven by firms in sectors where the share of women in the workforce is high, and in panel B we examine if the main results are driven by consumer preference for female directors. We present resul -ts from fixed effects regressions. Robust standard errors, clustered at the firm level are in brackets. ***, **, and * indicate significance at 1%, 5% and 10% levels, respectively.

	Dependent Variable: ROA							
	Panel A: Workforce				Panel B: Consumer Preference			
	% Women >0.40		% Women <0.40		Final Goods		Intermediate Goods	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Proportion of Female	0.014**		0.008***		0.009**		0.013***	
on Board$_{it-1}$	(0.004)		(0.002)		(0.003)		(0.004)	
Proportion of Female		0.018**		0.026***		0.025**		0.019***
in Committees$_{it-1}$		(0.006)		(0.008)		(0.010)		(0.005)
Control Variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year Dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	570	570	1,012	1,012	619	619	963	963

Online Appendix III

Time varying effects

We control for the potentially time-varying effects of female representation by using country-specific linear time trends in panel A, and splitting the sample at the year 2008 when the Norwegian gender quota for corporate boards came into force. Robust stan -dard errors, clustered at the firm level are given in brackets. ***, **, and * indicate significance at 1%, 5% and 10% levels, respectively.

	Panel A		Panel B			
	Country Specific Time trend		Pre-2008		Post-2008	
	(1)	(2)	(3)	(4)	(5)	(6)
Proportion of Female	0.002**		0.015**		0.039***	
on Board$_{it-1}$	(0.001)		(0.006)		(0.004)	
Proportion of Female		0.010***		0.020**		0.015***
in Committees$_{it-1}$		(0.002)		(0.007)		(0.003)
Control Variables	Yes	Yes	Yes	Yes	Yes	Yes
Year Dummies	No	No	Yes	Yes	Yes	Yes
Country-specific						
Time Trends	Yes	Yes	No	No	No	No
Firm Fixed Effects	No	No	Yes	Yes	Yes	Yes
Observations	1,582	1,582	558	558	1,014	1,014

Online Appendix IV

First stage regressions for the sub-sample analysis.

This table presents the first stage regressions for our instrumental variable approach for the different

Robust standard errors clustered at the firm level are in brackets. ***, **, and * indicate significance at 1%, 5%, and 10% levels, respectively.

	Dependent Variable: Proportion of Female on Committees			
	Panel A		Panel B	
	Binding Say on Pay	Advisory Say on Pay	Two-Tier Boards	One-Tier Boards
	(1)	(2)	(3)	(4)
CEO Daughter	0.194	0.218**	0.166	0.211**
	(0.099)	(0.103)	(0.088)	(0.069)
Control Variables	Yes	Yes	Yes	Yes
Year Dummies	Yes	Yes	Yes	Yes
Firm Fixed Effects	Yes	Yes	Yes	Yes
Observations	488	867	547	1,035
	Panel C		Panel D	
	% Women >0.40	% Women <0.40	Final Goods	Intermediate Goods
	(1)	(2)	(3)	(4)
CEO Daughter	0.214	0.188**	0.198**	0.207**
	(0.113)	(0.081)	(0.092)	(0.099)
Control Variables	Yes	Yes	Yes	Yes
Year Dummies	Yes	Yes	Yes	Yes
Firm Fixed Effects	Yes	Yes	Yes	Yes
Observations	570	1,012	619	963

Online Appendix V

Alternative measures of firm performance

This table compares the performance effects of female representation using different -measures of firm performance, viz. MTBV, and TSR. ROA results are presented in columns 1 and 2 for comparison with the baseline. All specifications include full set of controls. Robust standard errors clustered at the firm levels are in the parentheses. ***, **, and * indicate significance at 1%, 5%, and 10% levels, respectively.

	Dependent Variable					
	ROA		*MTBV*		*TSR*	
Variable	(1)	(2)	(3)	(4)	(5)	(6)
Proportion of Female	0.005**		0.007***		0.014**	
on Board$_{it-1}$	(0.002)		(0.002)		(0.006)	
Proportion of Female		0.015***		0.023***		0.036***
in Committees$_{it-1}$		(0.002)		(0.003)		(0.016)
Firm fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1,582	1,582	1,582	1,582	1,582	1,582
Adjusted R^2	0.211	0.209	0.200	0.186	0.261	0.219

Online Appendix VI

Female directors and firm performance: Adams and Ferreira (2009) instrument

We use proportion of male directors in who are outside directors on boards that have at least one female director as an instrument. Results are presented for ROA, MTBV, and TSR as measures of firm performance. All specifications include standard set of controls. Robust standard errors clustered at the firm level are in the parentheses. *** , **,and * represent significance at 1%, 5%, and 10% levels, respectively.

	Dependent Variable					
	ROA		*MTBV*		*TSR*	
Variable	(1)	(2)	(3)	(4)	(5)	(6)
Proportion of Female	0.364***		0.216**		0.277**	
on Board$_{it-1}$	(0.057)		(0.108)		(0.139)	
Proportion of Female		0.613***		0.505**		0.533**
in Committees$_{it-1}$		(0.277)		(0.255)		(0.271)
Firm fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1,582	1,582	1,582	1,582	1,582	1,582
Adjusted R^2	0.262	0.213	0.193	0.173	.221	0.199

Online Appendix VII

Traditional measures of female representation

This table presents the results of the impact on firm performance of female representation on boards using the traditional measure of female representation, viz. Any Female: binary indicator for at -st is AnyFemale$_{t-1}$. Robust standard errors clustered at the firm level are in the parentheses.***, ** and * indicate significance at 1 %, 5%and 10% levels, respectively.

	Dependent Variable: Return on Assets		
	(1)	(2)	(3)
Any Female$_{it-1}$	-0.156**		
	(0.059)		
Three or more		0.013***	
Female Directors$_{it-1}$		(0.003)	
>0.5 Females			0.020***
in Committees$_{it-1}$			(0.005)
Firm fixed effects	Yes	Yes	Yes
Year dummies	Yes	Yes	Yes
Observations	1,582	1,582	1,582
R^2	0.188	0.201	0.219

Online Appendix VIII

Reduced form estimates of CEO daughters on firm performance

Robust standard errors, clustered in brackets. ***, **, and * indicate significance at 1%, 5% and 10% levels, respectively.

	Dependent Variable: ROA			
	Panel A: Workforce		Panel B: Consumer Preference	
	% Women >0.40	% Women <0.40	Final Goods	Intermediate Goods
	(1)	(2)	(3)	(4)
CEO Daughter	0.001	0.002	0.004	0.004
	(0.003)	(0.002)	(0.005)	(0.007)
Control Variables	Yes	Yes	Yes	Yes
Year Dummies	Yes	Yes	Yes	Yes
Firm Fixed Effects	Yes	Yes	Yes	Yes
Observations	570	1,012	619	963