

CEO gender, critical mass of board gender diversity, and ESG performance: UK evidence

ABSTRACT

Purpose

This study investigates the relationship between CEO leadership, gender homophily and corporate environmental, social, and governance (ESG) performance. We also investigate whether it is essential to have a critical mass of women directors on the board to create a significant power of gender diversity in leadership positions.

Design/methodology/approach

Our study is based on firms listed on the London Stock Exchange (FTSE-All-Share) from 2011 to 2019. CEO characteristics and other board variables were collected from BoardEx, and ESG data, and other related variables were collected from Eikon database.

Findings

We find a critical mass of female directors contributes to ESG performance suggesting that token representation of female directors on boards limits their effectiveness. We do not find support for the gender homophily perspective, our findings suggest that the effectiveness of female CEOs does not depend on the existence of a critical mass of female directors. Female directors and female CEOs are less likely to be associated with ESG activities when firms experience poor financial performance. We also find that younger female CEOs have a positive impact on ESG performance. Furthermore, we find female CEOs with shorter tenure are more likely to improve ESG performance. Overall, our findings suggest a substitutional effect between having female CEOs and gender diverse boards.

Originality/value

This study contributes to the debate on gender homophily in the boardroom and how that may affect ESG practices. It also complements existing academic research on female leadership and ESG performance and has important implications for senior management and policymakers.

Keywords: CEOs, ESG performance, gender, critical mass, homophily.

1. INTRODUCTION

Board diversity has caught the attention of academic scholars, policymakers, and the media (see Elmagrhi et al., 2019; Nguyen et al., 2020; Kara et al., 2022; Shohaieb et al., 2022; Kizys et al., 2023; Liu et al., 2023). Various initiatives relating to better gender balance in business leadership have been adopted in many countries (Mensi-Klarbach and Seierstad, 2020; Martínez-García et al., 2022). The Davies Report (2011) *“Women on Boards”*, for instance, urges UK publicly listed companies to increase the existence of female directors on the board arguing that it should help enhance business operations (Al-Shaer and Harakeh, 2020; Brahma et al., 2021). Corporate leaders exercise considerable influence on ESG (environmental, social and governance) practices where gender diversity in leadership is a key factor (Rao and Tilt 2016; Birindelli et al., 2019; Allemand et al., 2022).

Companies with better ESG performance demonstrate better accountability and responsibility towards society and the environment and, thus can gain a competitive advantage and maintain sustainable development (Li et al., 2020). Female leaders are associated with communal qualities and more likely to work closely with stakeholders and prioritise ESG strategies (Alonso-Almeida et al., 2017). Prior literature linked board gender diversity with ESG practices (Bear et al., 2010; Hafsi and Turgut, 2013; Al-Shaer and Zaman, 2016; Ben-Amar et al., 2017; Nadeem et al., 2017). For example, Byron and Post (2016) find that female representation on the board is positively associated with CSR performance, and Post et al. (2011) and Glass et al. (2016) find that firms with more than three female directors have better CSR reporting practices. Despite the rich debate on board gender diversity, there is limited evidence on the effect of female CEOs on ESG practices. Birindelli et al. (2019) focus on the banking sector in EMEA (Europe, Middle East, and Africa) region and analyse the impact of women leaders on environmental performance for the period 2011-2016. The authors find that CEO gender diversity is an essential driver of environmental performance,

and that female CEOs empower the critical mass of women on corporate boards to engage in environmental initiatives. Similarly, Glass et al. (2016), examining the influence of female CEOs on environmental performance of Fortune 500 firms for the period 2001-2010, find that diversity at leadership level is more effective at fostering environmental strategies. Moreover, Liu (2018) finds that female CEOs are significantly correlated with less environmental fines, particularly in firms with low presence women on the corporate board.

Focusing on board leadership and ESG performance, this paper adds to existing literature through an examination of gender homophily in the boardroom. While prior research has tended to focus on examining board gender diversity and ESG, this paper also focuses on the role of female CEO leadership and considers how diversity of the board affects ESG performance. Recognising that the appointment of female CEOs and women on boards can affect strategic decisions and performance (Schopohl, et al., 2021; Post et al., 2022), our paper also explores the substitutional effect of having a female CEO and a critical mass of female directors on the board while also considering the age and tenure of CEOs as well as the financial strength of firms.

We provide a unique contribution to literature in several ways. First, we contribute to the debate on gender homophily in the boardroom and how that may affect ESG practices. Prior literature mostly focuses on board gender diversity and ESG, whereas we focus on female CEOs and their impact on ESG performance. Moreover, prior studies that examine the role of female CEOs tend to focus on their impact on environmental performance in particular (Glass et al., 2016; Birindelli et al., 2019; De Masi et al., 2022). In this study, we focus on ESG performance measured by ESG scores which provides a holistic view of firms' responsibility towards society and the environment (Duque-Grisales and Aguilera-Caracuel, 2021).

Second, our study investigates whether it is essential to have female CEOs and a critical mass of female directors on the board to create a significant power of gender diversity

in leadership positions leading to better ESG performance. It also investigates the gender homophily perspective where a higher degree of social similarity between the CEO and board members improves the firm's competence to create positive outcomes (Glass et al., 2016). Thus, we add to the existing literature by examining whether the effect of female CEOs relies on the existence of a critical mass of females on the board.

Third, unlike prior studies that examine female leadership from the ESG perspective in non-UK contexts, for example, the US (see Atif et al., 2021), China (see McGuinness et al., 2017) or international industry-specific datasets (see Kara et al., 2022), our study stands out by focusing specifically on the UK context. Focusing on the UK context is driven by the specific guidelines and initiatives outlined in the Davies Report (2011), which called for increasing gender diversity on corporate boards of UK publicly listed companies. The UK also has a unique institutional context with a "comply or explain" corporate governance code (FRC, 2016). Terjesen et al. (2015) and Al-Shaer and Harakeh (2020) suggest that scholars will need to examine the developing nature of gender diversity issues as corporate governance codes become amended and updated. Our study uses a sample of companies listed on the London Stock Exchange (FTSE-All-Share) from 2011 to 2019. The chosen period enables us to investigate the impact of female CEOs on ESG performance after the publication of the Davies Report (2011).

We find female CEOs have a positive impact of ESG performance. Consistent with the critical mass theory, we also find a critical mass of female directors on the board is needed to have a positive effect, i.e., a symbolic representation of women on corporate boards does not impact on ESG performance. To investigate the gender homophily perspective, we use an interaction variable between female CEOs and the proportion of female directors on the board. Our results show that the efficacy of female CEOs does not depend on high representation of women directors on the board suggesting that a female director that is given

the power and offered a CEO position is likely to have a positive impact on ESG performance. There is a substitutional effect of having a female CEO and a critical mass of female directors on the board. Our results suggest that male CEOs are more likely to be associated with higher ESG scores because of increased female presence on boards. Thus, we do not find support for the gender homophily perspective.

We run additional analyses to explore whether the impact of female CEOs on ESG performance is affected by the tenure and age of CEOs. The results suggest that female CEOs are more likely to promote and engage in sustainability practices when they have been in their roles for a shorter period than longer tenure CEOs. Moreover, younger female CEOs are positively associated with ESG performance. When we further explore the influence of financial performance on the impact of female CEOs on ESG performance we find that female CEOs positively affect ESG performance in high performing firms. Further, we find that female CEOs of companies operating in the sustainability-sensitive sector are more likely to improve ESG performance. Finally, our findings hold for a matched sample analysis using propensity score matching (PSM) and entropy balancing technique.

The remainder of the paper is structured as follows. Section 2 explains the theory and develops hypotheses. Section 3 presents the methodology. In section 4, we present our empirical results and discuss these results and conclude in section 5. Finally, section 6 discusses the study's implications and suggestions for future research.

2. THEORY AND HYPOTHESES DEVELOPMENT

2.1. Female CEOs and ESG Performance

Upper echelon theory has been used to explain that top executives' values and characteristics are essential in shaping organisational outcomes and strategic decisions (Hambrick and Mason, 1984; Hambrick, 2007), including ESG decisions (Legrand et al., 2019).

Senior managers who are socially oriented are more likely to favour the advancement of sustainable practices (Li et al., 2017; Shahab et al., 2018). There is growing consensus that gender is another characteristic of senior managers that can influence their values and views, and thus decision processes (Shahab et al., 2020; Nguyen et al., 2021). Prior literature show various evidence on how Female CEOs can affect business strategies and performance (Huang and Kisgen, 2013; Cumming et al., 2015; Elmagrhi et al., 2019). For example, Baixauli-Soler et al. (2015) discuss that women on boards benefit the monitoring and control functions as women sometimes demonstrate more conservative behaviour. Faccio et al. (2016) and Byron and Post (2016) discuss that female CEOs are perceived to be risk averse. In contrast, Adams and Funk (2012) mentioned that female directors are more risk-loving than male directors. Ullah et al. (2022) conclude that female directors with foreign experience can enhance environmental performance.

The gender difference perspective predicts that the existence of female CEOs affects firms' strategic decisions and actions, and that female CEOs are more likely, than their male peers, to pursue sustainability-related policies (Glass et al., 2016; Liu, 2018; Birindelli et al., 2019). Female leaders are more likely to emphasise non-financial metrics such as employee relations, customer satisfaction, and the environment (Bao et al., 2014). Female directors are also more likely to pursue stakeholder-focused outcomes and long-term strategies (Glass et al., 2016; Al-Shaer and Zaman, 2016), and tend towards more communal and relation-building approaches (Li et al., 2017). Cumming et al., (2015) conclude that women are more sensitive to ethical issues. Although many prior studies find that female CEOs are more likely than men to support environmental activities, Walls et al. (2012) conclude that having more women on the board are associated with fewer environmental concerns. Similarly, Glass et al. (2016) find that women directors have no effect on environmental practice. A recent study by Menga and Zhu (2023) investigates the influence of female executives on ESG performance using a

Chinese sample and shows that female involvement in management correlates with improved ESG performance. Additionally, Yahya (2023) explores the relationship between female leadership and the ESG performance of Nordic firms, concluding that women in leadership positions help to improve firms' social and environmental performance. In the UK, existing research has mainly concentrated on examining the influence of board gender diversity on ESG performance, with less emphasis on the role of female CEOs in this context. For example, Arayssi et al. (2016) suggest that an increase in the representation of women directors directly correlates with enhanced ESG disclosure, and Al-Shaer and Zaman (2016) show that board gender diversity is likely to enhance sustainability reporting quality. Albitar et al. (2020) argue that board gender diversity can positively influence environmental, social, and governance (ESG) practices. They conclude that board gender diversity acts as a moderator, influencing the relationship between ESG disclosure and firm performance. In another study (Albitar et al., 2023), the authors find that gender diversity has a constructive impact on the overall CSR tone, particularly for companies exhibiting high ESG performance.

Overall, women can be given power by improving their role on the board and offering them a leadership role (Dobija et al., 2021). This should enable them to focus on long-term objectives that they are more interested in, and shape strategies and organisational outcomes. As a result, we expect female CEOs are likely to have a positive influence on ESG performance. Thus, our first hypothesis is:

Hypothesis 1: Firms with female CEOs have higher ESG performance than those with male CEOs.

2.2. Critical Mass and ESG Performance

Female directors can be committed to ESG practices due to functional differences between males and females (Cook and Glass, 2018). Women are more likely to pursue different types of businesses and communicate with various stakeholders than their male peers, leading to

improvements in ESG practices (Yarram and Adapa, 2021). A token representation of a female member on the board may increase her scrutiny which creates performance pressure on the sole female director and leads her to imitate the behaviours of majority directors (Yarram and Adapa, 2021), and might limit her ability to express her opinion and share her experiences (Cook and Glass, 2018; Main and Gregory-Smith, 2018). Due to her sole representation on the board, a female director may be denied the required resources to initiate an organisational change (Acker, 2006). On the other hand, gender balanced teams perform better than male-dominated groups (Lauring and Villesèche, 2019). A critical mass of female directors creates an effective balance of the board so that their diverse experiences is considered when formulating the corporate strategy (Glass et al., 2016).

Previous research argues that to improve the board's strategic decision-making process, female representation in the boardroom needs to reach a critical mass (Ben-Amar et al., 2013; Ben-Amar et al., 2017). Critical mass theory explains that female representation that increases a threshold or a critical mass helps provide new skills and expertise and therefore affects group performance (Kanter, 1977). A critical mass of women directors is crucial to impact the dynamics and processes within the board (Birindelli et al., 2019). Existing evidence suggests that at least three women on the board represent a critical mass (Torchia et al., 2011; Ben-Amar et al., 2017; Dobija et al., 2021). For example, Post et al. (2011) argue that a critical mass of female directors positively affects ESG reporting practices, Torchia et al. (2011) suggest that a critical mass of females on boards has a positive effect on firm innovation, and Cabeza-García et al. (2018) find that a critical mass of female directors increases ESG disclosure. De Masi et al. (2021) explore the impact of achieving a critical mass of women on boards on the environmental, social, and governance (ESG) score. Their findings suggest that having a critical mass of female board members positively influences each component of the ESG score. Consequently, when the number of women on the board reaches a critical mass,

typically three women or more, their voices gain prominence, their ideas are acknowledged, and they begin to exert a notable influence on the board dynamics (De Masi et al. 2021). Based on a sample from Italy, Cambrea et al. (2023) investigate the relationship between the presence of a critical mass of women in boardrooms and firm ESG performance. Their findings also indicate that a critical mass, defined as at least three female directors, is essential for enhancing ESG performance. Finally, Joecks et al. (2013) argue that a token representation of females on the board negatively affects performance but when a critical mass is achieved it is likely to have a positive impact on firm performance. Thus, focusing on the critical mass theory, our second hypothesis is:

Hypothesis 2: Firms with female CEOs and a critical mass of women on the board have higher ESG performance than those with male CEOs.

2.3. Gender Homophily and ESG performance

Homophily and the tendency of individuals to associate and interact with others with similar characteristics and backgrounds may be reflected in various dimensions such as culture, gender, ethnicity, education, and age (Birindelli et al., 2019; Berger et al., 2013; Barrios et al., 2022; Allemand et al., 2021). Background homophily originates from studying at the same schools or university, working for the same companies, and being together on other boards (Allemand et al., 2021). Cultural homophily can occur in the employment process, where managers are inclined to interact with and hire candidates from the same culture (Rivera, 2012). Race and ethnicity homophily have a direct impact on investment decisions (Gompers et al., 2016; Goenner, 2021). While we recognise that homophily can include different contexts such as educational background, culture, race, ethnicity, and nationality, in this study we focus on CEO gender homophily.

We define gender homophily as the interaction of female CEO and a critical mass of women on the board (Glass et al., 2016). The gender socialization theory explains that women and men behave differently when dealing with others. Men have individualistic and competitive behaviours while women have cooperative and altruistic behaviours (Birindelli et al., 2019). Women are inclined to more relationship building and participative in leadership roles (Glass et al., 2016) which can make them more focused on long-term outcomes and stakeholder interests, including environmental practices (Jain and Zaman, 2020; De Masi et al., 2022).

Studies examining the impact of gender homophily on ESG performance are limited. Research on board gender homophily are mainly based on US data (e.g., Glass et al., 2016; Glass and Cook, 2018, Liu, 2018), and tend to focus on a specific industry (e.g., Birindelli et al., 2019). Evidence suggests that CEOs prefer to appoint members on the board who are similar to them (Zhu and Westphal, 2014). Birindelli et al. (2019) conclude that female CEOs play an essential role in the nonlinear nexus between gender diversity and environmental performance and confirm the homophily perspective for the banking sector, and De Masi et al. (2022) show that gender homophily within the board has a positive impact on company's awareness of environmental issues. Similarities between the CEO and board members may impact the ability and willingness of majority leaders to shape organisational outcomes and future direction (Glass et al., 2016). Glass et al. (2016) argue that the benefit of female leaders may not be realised in the absence of gender homophily. Gender assimilation of the leadership team is likely to improve the authority of a female leader and her discretion over firm's decisions (Konrad et al., 2008). Shoham et al. (2017) argue that the existence of even one woman on the board has a positive effect on firm's sustainable strategies. This is more likely to happen with a female CEO since she has the voice and power to make a change (Dobija et

al., 2021). To examine the effect of gender homophily on ESG performance and consider the interaction of female CEOs and female directors on the board, we propose a third hypothesis:

Hypothesis 3: The impact of female CEOs on ESG performance is conditioned by a critical mass of women on the board.

[Figure 1 about here]

3. RESEARCH METHODS

3.1. Context and Sample

Different countries implement different policy reforms to promote gender diversity on corporate boards including quotas and soft targets (Mensi-Klarbach and Seierstad, 2020). Countries such as Norway and France implemented mandatory reforms (gender quota legislation) where companies are required to have minimum percentage of women on the board of directors in order to avoid legal sanctions such as delisting from the stock exchange (Mateos de Cabo et al., 2019; Nekhili et al., 2020). Other countries such as the United Kingdom and Australia have implemented voluntary reforms and provide gender diversity guidelines in corporate governance codes that require companies either to fulfil the recommendations or give their reasons for non-compliance, i.e., ‘comply or explain’ (Nekhili et al., 2020).

In the UK context, the appointment of women on boards remains voluntary. Brahma et al., (2021) mentioned that the rationale behind voluntary-based reform is to allow essential changes to corporate board culture within the business rather than coercive changes from the outside which may lead to a nominal increase in the percentage of women on boards. The publication of the first Davies Report, “Women on Boards,” in 2011 was one of the crucial steps to enhance board gender diversity policy reforms in the UK when FTSE 350 companies were encouraged to promote greater female representation on boards and to target a minimum 25% representation of female board members by 2015. Following that, as a response to Davies Report (2011), the UK Financial Reporting Council (FRC, 2014) published a report

which required firms to consider gender diversity in the assessment of board effectiveness and to disclose their policies on enhancing boardroom diversity on annual basis.¹

Our study is based on firms listed on the London Stock Exchange (FTSE-All-Share) from 2011 to 2019. We had an initial balanced sample of 2,250 firm-year observations. The chosen period is appropriate for our study as it permits us to explore the impact of female CEOs on ESG performance after the introduction of the Davis Report (2011) that highlighted gender diversity in corporate boards of listed companies. We use the BoardEx and Eikon databases to collect data for our variables. CEO characteristics and other board variables were collected from BoardEx, and ESG data, and other related variables were collected from Eikon database. We merge the two datasets collected from BoardEx and Eikon which caused some data loss. Further, due to missing data relating to board and financial variables, we end up with 1,540 firm-year observations. Our final unbalanced sample consists of 148 companies in 2011; 145 companies in 2012; 159 in 2013; 154 in 2014; 174 in 2015; 186 in 2016; 189 in 2017; 152 in 2018; and 233 in 2019². Table 1 provides the sample distribution.

[Table 1 about here]

3.2. Variables Definitions and Measurement

3.2.1. The dependent variable

We use ESG scores from Thomson Reuters Asset4 as the dependent variable (Duque-Grisales and Aguilera-Caracuel, 2021; Yarram and Adapa, 2021; Aliani et al., 2024). Research analysts

¹ In 2015 a summary report from Lord Davis reviewed the effectiveness of the Davies Report (2011) in increasing the number of female directors in FTSE companies. This 2015 report concluded that there was a significant increase in women on FTSE 350 boards and a dramatic decrease in the number of all-male boards: female directors on boards increased from 9.5% to 17.4% two years after the introduction of the Davies Report in 2011.

² Our companies operate in 11 different industries, spanning technology, telecommunication, healthcare, financial services, real estate, consumer discretionary, consumer staples, industrials, basic materials, energy, and utilities.

of Asset4 collect data from different sources including stock exchange filing and financial and sustainability reports (Eccles et al., 2014). The database provides a comprehensive assessment of a firm's ESG performance based on information disclosed on the ESG factors. Thomson Reuters calculates ESG scores by applying a percentile rank scoring linked to dimensions of environmental, social, and governance (Yarram and Adapa, 2021). As an alternative measure, we also use ESG data from Bloomberg (*ESG_bloomberg*) which provides insight into a firm's level of sustainability. Bloomberg's environmental and social and governance scores provide a data-driven measure of corporate environmental, social and governance performance that stakeholders can use to assess performance across a range of key issues, such as climate change, diversity, and health and safety. The disclosure scores range from 0.1 for companies that disclose a minimum number of data points to 100 for those that disclose every sustainability data point (Dorfleitner et al., 2015).

3.2.2. Independent and control variables

Our study examines the influence of female CEOs on ESG performance. *CEO_female* is measured using a dummy variable taking a value of 1 for female CEOs and 0 for male CEOs (Glass et al., 2016; Birindelli et al., 2019). We measure board gender diversity (*BOD_gender*) as the percentage of female directors on the board. Prior literature argues that female directors are more likely to be stakeholder-oriented and be involved in socially responsible activities (Al-Shaer and Zaman, 2016; Glass et al., 2016; Ben-Amar et al., 2017). We further investigate whether the impact of the increased participation of female directors results in a critical mass effect that leads to the improvement of ESG performance. We follow Schwartz-Ziv (2017) and Dobija et al. (2021) and include dummy variables representing the percentage of women representation in the boardroom, namely a share less than 10%, a share of at least 10%, a share of at least 20%, and a share of at least 40%.

We recognise the importance of controlling for board characteristics in examining the impact of female leadership positions on ESG performance (Glass et al., 2016; Al-Shaer and Zaman, 2016; Yarram and Adapa, 2021). We thus control for board characteristics. Prior literature argues that larger boards are more diverse and include directors from different background and expertise could lead to greater commitment to CSR activities (Ben-Amar et al., 2017; Zaid et al., 2020; Zhang et al., 2021; Kizys et al., 2023). Bugeja et al. (2012) however notes that although larger boards may be less effective in monitoring and play a legitimacy role that influences decisions related to sustainability (Michelon and Parbonetti, 2012). Board size is measured as the number of directors on the board. A higher proportion of independent directors helps increase monitoring and facilitate greater interest in ESG (Al-Shaer and Zaman, 2016; Zhang et al., 2021). We include board independence measured as the proportion of independent directors on the board. The number of board meetings held in a year can enhance discussion and decision-making process regarding various ESG activities (Liao et al., 2018). Board meeting is measured by the frequency of annual board meetings. We also control for the presence of sustainability committee because firms that have such a committee are more likely to support ESG initiatives (Al-Shaer and Zaman, 2016; Birindelli et al., 2019; Haque and Ntim, 2020; Jain and Zaman, 2020). Sustainability committees can engage in dialogue with stakeholders and help provide advice on various sustainability issues and push forward the planning and implementation of sustainable projects (Al-Shaer et al., 2021). SUSCOM is a binary variable which takes a value of 1 if a board-level sustainability committee exists, 0 otherwise.³

Lastly, we control for firm-characteristics, including firm size, leverage, profitability, TOBINSQ, firm loss, and industry and year dummies. Larger firms are highly visible and

³ In additional tests, we also control for CEO age and CEO tenure representing the time the CEO has spent on the role.

more likely to undertake activities that have substantial social impact (Ben-Amar et al., 2017; Birindelli et al., 2019). Moreover, profitable firms with cash and resources and are more likely to be able to invest in sustainable development (Hussain et al., 2018; Glass et al., 2016). These firms can plan for sustainable projects and afford the cost of such projects, whereas firms suffering from financial losses may refrain from engaging in sustainable projects due to their critical financial position (Chen et al., 2021). Highly leveraged firms incur monitoring costs and are likely to reduce such costs by increasing information provision, including ESG-related information (Al-Shaer et al., 2021; Birindelli et al., 2019). Finally, different industries exhibit different levels of sustainability attributes (Post et al., 2011). Hence, engaging in ESG initiatives may be particularly important in certain industries.

3.3. Econometric Model

To examine the impact of female leadership on ESG performance and test for the first hypothesis, we use the model below:

$$ESG_score = \beta_0 + \beta_1 CEO_female + \beta_2 BODSIZE + \beta_3 BODIND + \beta_4 BODMEET + \beta_5 SUSCOM + \beta_6 SIZE + \beta_7 ROA + \beta_8 TOBINSQ + \beta_9 LOSS + \beta_{10} LEV + \beta_{11} Industry\ dummies + \beta_{12} Year\ dummies \in \quad (1)$$

Equation 2 tests the second hypothesis and the impact of female CEO and critical mass of female directors on the board on ESG performance:

$$ESG_score = \beta_0 + \beta_1 CEO_female + \beta_2 WOMENless10\% + \beta_3 WOMEN10\% + \beta_4 WOMEN20\% + \beta_5 WOMEN40\% + \beta_6 BODSIZE + \beta_7 BODIND + \beta_8 BODMEET + \beta_9 SUSCOM + \beta_{10} SIZE + \beta_{11} ROA + \beta_{12} TOBINSQ + \beta_{13} LOSS + \beta_{14} LEV + \beta_{15} Industry\ dummies + \beta_{16} Year\ dummies \in \quad (2)$$

Equation 3 tests our third hypothesis relating to gender homophily and ESG performance:

$$ESG_score = \beta_0 + \beta_1 CEO_female + \beta_2 WOMENless10\% + \beta_3 WOMENless10\% \times CEO_female + \beta_4 WOMEN10\% + \beta_5 WOMEN10\% \times CEO_female + \beta_6 WOMEN20\% + \beta_7 WOMEN20\% \times CEO_female + \beta_8 WOMEN40\% + \beta_9 WOMEN40\% \times CEO_female + \beta_{10} BODSIZE + \beta_{11} BODIND +$$

$$\beta_{12}BODMEET + \beta_{13}SUSCOM + \beta_{14}SIZE + \beta_{15}ROA + \beta_{16}TOBINSQ + \beta_{17}LOSS + \beta_{18}LEV + \beta_{19}Industry\ dummies + \beta_{20}Year\ dummies + \epsilon \quad (3)$$

All regressions include year and industry fixed effects, and industry dummies are created based on the SIC one-digit industry classification. Detailed variable definitions are provided in Appendix 1.

4. EMPIRICAL RESULTS

4.1. Descriptive Statistics and Correlation

Table 2 Panel A provides the summary statistics of the variables used in our analysis. The mean value of *ESG_score* is 47.431 which is lower than the value of 48.81 reported in Alkaraan et al. (2022) for a sample of FTSE All-Share firms for the period 2013-2018 and higher than the value of 18.67 reported in Nadeem et al. (2017) for a sample of firms listed on the Australian Stock Exchange for the period 2010-2014. The mean value of *Social_score* is 47.765 which is lower than the mean value of 79.43 reported in Baraibar-Diez and Odriozola (2019) for a sample of UK firms for the period 2005-2015 and the mean value of 61.158 reported in Duque-Grisales and Aguilera-Caracuel (2021) for a sample of firms operating in Latin America between 2011 and 2015, and the mean value of *Environmental_score* is 39.277 which is lower than the value of 76.7 reported in Baraibar-Diez and Odriozola (2019) and the value of 56.01 reported in Omran et al. (2020) for a sample of companies from South Africa for the period 2014-2018. Finally, the alternative measure of ESG performance collected from Bloomberg data is *ESG_bloomberg* and it has a mean value of 43.533 which is higher than the value of 23.830 reported in Dorfleitner et al. (2015).

The descriptive statistics show that the percentage of boards with female CEOs (*CEO_female*) is on average 7.5% and the percentage of female directors on boards (*BOD_female*) is 19.1%. Between these female directors, we have an average of 76% of female independent directors (*Female_independent*) and 24% of female executive directors

(*Female_executive*) on the board. The average CEO age is 52 years old, and the average tenure of CEOs is 8 years. We find the mean board size (*BODSIZE*) is 8.576, independent directors (*BODIND*) account for 56.6% of board members, and the mean number of board meetings is 8.660. On average, 63.6% of our sample firms have a board level sustainability committee. With respect to firm-specific variables, we find mean firm size (*SIZE*) is 21.191 measured using the natural log of total assets, mean ROA is 0.058, mean *TOBINSQ* is 0.892, and mean *LEV* is 0.481. On average, 14.2% of our sample firms have reported a loss during our sample period.

Table 2 Panel B reports the means and t-tests for firms with and without female CEOs. We find that the subsample of firms that have female CEOs have higher *ESG_scores* (mean value is 6.464 and is significant at $p < 0.01$), higher *Social_score* (mean value is 6.252 and is significant at $p < 0.01$), and higher *Environmental_score* (mean value is 4.292 and is significant at $p < 0.01$).

Table 3 reports the correlation matrix for variables used in our analysis. We find *ESG_score*, *Social_score*, and *Environmental_score* have a significant and positive correlation with *CEO_female*, *BOD_female*, *CEO_age*, *CEO_tenure*, *BODSIZE*, *BODIND*, *SUSCOM*, and *SIZE*. No correlation coefficient between two explanatory variables exceeds 0.8. As a result, there is no evidence of serious multicollinearity. The variance inflation factor (VIF) values range from 2.05 to 2.70 with a mean value of 2.40.

[Tables 2 and 3 about here]

4.2. Multivariate Analysis

4.2.1. Female CEOs and ESG performance

Table 4 displays the results of the multivariate regression using pooled OLS estimator as a baseline model in investigating the impact of *CEO_female* on ESG performance.⁴ We run the regression model separately for *ESG_score*, *Social_score*, and *Environmental_score*. Results show that *CEO_female* is positive and significant at 1% level with *ESG_score*, *Social_score*, and *Environmental_score* suggesting that female CEOs are more likely to promote ESG practices than male CEOs. The results are consistent with the argument that female leaders are more likely to promote ESG initiatives (Yarram and Adapa, 2021), and represent an essential driver for sustainability (Glass et al., 2016; Liu, 2018; Birindelli et al., 2019). The result supports our first hypothesis and suggest that female CEOs can improve ESG performance.

Our results also show that *BOD_female* is positive and significant at 1% level with *ESG_score*, *Social_score*, and *Environmental_score* consistent with findings in prior literature (e.g., Bear et al., 2010; Byron and Post, 2016; Al-Shaer and Zaman, 2016; Aliani et al., 2024) indicating that sustainability performance improves with an increase in the percentage of female directors. Among other corporate governance variables, we find *BODSIZE* and *BODIND* have a significant and positive association with ESG scores. The presence of sustainability committee (*SUSCOM*) is positive and significant at 1% level with ESG scores. These results demonstrate the positive role that corporate governance plays in improving ESG performance (Liao et al., 2015; Liao et al., 2018; Husted et al., 2019).

[Table 4 about here]

4.2.2 Critical mass of female directors and ESG Performance

Table 5 tests our second hypothesis on the effect of female CEOs and a critical mass of women on the board on ESG performance. We use distinct dummies representing the different shares

⁴ We would like to note that our dependent variable has little variations across year for each firm as shown the descriptive statistics of *CEO_female*. Therefore, we have used pooled OLS regression with clustered standard errors and made the standard errors robust to heteroskedasticity. Due to the nature of our sample characteristics panel analysis using fixed or random effects was not an appropriate choice.

of women participation on the board (Schwartz-Ziv, 2017; Dobija et al., 2021). We ran the regression for a share of less than 10% (WOMENless10%) in column 1, a share of at least 10% (WOMEN10%) in column 2; a share of at least 20% (WOMEN20%) in column 3; and a share of at least 40% (WOMEN40%) in column 4. We expect the highest effect to be achieved when the share of women is above 10% i.e., when there is a critical mass. The results show that *CEO_female* is positive and significant at 1% level in all models regardless of the share of female participation on the board. As for board gender diversity variables, our results reveal that the share of women participation on the board lower than 10% is significant at 1% level and negatively associated with *ESG_score* while the share of women between 20% and 40% is significant and positively associated with *ESG_score* (at 1% level in columns 2 and 3 and 10% level in column 4). This suggests that a minimum share of women is required to exercise an effective influence on the board. When the share is 40% or more, the statistical power is reduced (10% level in column 4). The results indicate that a token representation of female directors on the board does not enable them to effectively influence decision-making regarding ESG initiatives. Consistent the critical mass theory, our finding in Table 5 supports our second hypothesis and suggests that it takes a critical mass of women representation on the board (20%-40%) to have an impact on ESG performance.

[Table 5 about here]

4.2.3. Gender homophily and ESG performance

Table 6 shows the results for our third hypothesis of whether the impact of female CEOs on ESG performance is conditioned by a critical mass of women on the board. We add the dummy variables of different shares of female directors in the boardroom and interaction variables between each share and *CEO_female*. The interaction variable between WOMENless10% and *CEO_female* is positive and significant at 10% level while the interaction

variables between *CEO_female* and women share on the board (20%-40%) are negative and significant at 1 % level. The results suggest that female CEOs do not necessarily empower the critical mass of women on the board to pursue sustainability initiatives.

There is a substitutional effect of having a female CEO and a critical mass of female directors on the board. Male, rather than female, CEOs, are more likely to have higher ESG performance due to increased female representation on the board. Our finding does not support the homophily perspective and the notion that individuals who share similarities and common features or values are likely to establish strong social relations (Birindelli et al., 2019). The effectiveness of female CEOs does not seem to depend on a high proportion of female representation on the board. Our result suggests that as the number of female representations on the board increases, greater benefits towards sustainability initiatives will be achieved for male CEOs rather than female CEOs.⁵ This finding contrasts with Birindelli et al.'s (2019) study that focuses on the banking sector and suggests that women CEOs could empower the critical mass of women on the board to pursue strong sustainability initiatives. Their study is industry-specific; thus, their findings cannot be generalised to companies operating in various industrial sectors. Overall, the results in Table 6 do not support our third hypothesis that the impact of female CEOs on ESG performance is conditioned by a critical mass of women on the board. In a supplementary file, we replicate the tests in Tables 4-6 after excluding financial firms from our study's sample, and the results are consistent with the main findings.

[Table 6 about here]

4.3. Additional Analyses

In examining the effect of female CEOs and board gender diversity on ESG, it is important to understand that gender effects may be subsumed by other CEO characteristics, board

⁵ We repeat the regression tests in Table 3 using the *Social_score* and *Environmental_score* and our untabulated results are qualitatively similar.

characteristics, as well as firm-specific attributes. We, thus, perform several additional analyses that control for female directors' composition (i.e., whether executive or independent), CEO tenure, CEO time of appointment, CEO age, financial performance, industry effect, and the pre and post Hampton-Alexander Review effect. We also use an alternative measure of our dependent variable, that is ESG data from Bloomberg which provides an insight into a firm's level of sustainability.

Prior research shows that female independent directors influence sustainability practices (Al-Shaer and Zaman, 2016). We examine if the gender homophily effect on *ESG_score* differs for female independent directors compared to female executive directors. We replace board gender diversity variable (*BOD_female*) with female independent directors (*Female_independent*) and female executive directors (*Female_executive*) and interact these two variables with *CEO_female* and display the result in Table 7. Result shows that *Female_executive* is positive and significant at 1% level with *ESG_score*, whereas *Female_independent* is not significant. The interaction variables between *CEO_female* and *Female_independent* and *Female_executive* respectively, are negative and significant at 1 % level. Our result indicates that there is a substitutional effect of having a female CEO and female executive directors on the board in relation to ESG. Moreover, in order for female independent directors to pursue ESG initiatives, they will need to be empowered by a male CEO. Our finding shows that the effectiveness of female CEOs does not depend on the existence of female directors on the board.⁶

[Table 7 about here]

⁶ We repeat the regression tests in Table 7 using the *Social_score* and *Environmental_score* and our untabulated results are qualitatively similar.

We further explore whether the impact of female CEOs on ESG performance is affected by the tenure of CEOs and report the result in Table 8. We divide the sample into firms with short tenure CEOs (that is if the tenure of CEOs is below the median, 5.08) and firms with CEOs with longer tenure (that is if the tenure of CEOs is above the median, 5.08). The results show that *CEO_female* is positive and significant at 1% level with *ESG_score*, *Social_score*, and *Environmental_score* for the subsample firms with short tenure CEOs, and it shows no significant impact on ESG scores for the subsample of firms with long tenure CEOs. The results suggest that female CEOs are more likely to promote and engage in sustainability practices when they have been in their roles for a shorter period than longer tenure CEOs. *BOD_female* remains positive and significant at 1% level with *ESG_score*, *Social_score*, and *Environmental_score* for both subsamples.

We further investigate whether the effect of *CEO_female* on ESG is affected by the time of CEO appointment. Following Green and Homroy (2018), we classify CEO appointments as “Outside” if the new CEO has been employed in the firm for less than two years at the time of appointment as the CEO. This classification results in 60% outside CEO appointments within our sample and 40 % internal CEO appointments. We divide the sample into firms with Outside CEOs and firms with Inside CEOs. The untabulated result shows that Outside CEOs are more likely to promote ESG initiatives and engage in sustainability projects than internal candidates who may be more inclined to continue the firm’s current policies.⁷

[Table 8 about here]

In Table 9, we divide the sample into high performing firms and low performing firms based on ROA (if a company is reporting a negative ROA, it belongs to the low performing

⁷ The results are untabulated in the interests of brevity and are available on request.

subsample).⁸ The results shows that *CEO_female* has a positive and significant impact on ESG scores for the subsample of high performing firms and it shows weaker effect for the low performing firms' subsample. We also find similar results for *BOD_female* suggesting that female directors are less likely to engage in costly sustainable activities when their firms are experiencing poor financial performance.

We further explore the high performing firms subsample and examine the impact of CEO tenure by looking into firms in this subsample with short tenure CEOs and firms with CEOs with longer tenure. The results in Table 10 show that *CEO_female* has a positive and significant association at 1% level with *ESG_score*, *Social_score*, and *Environmental_score* for firms with short tenure CEOs compared with firms that have longer tenured CEOs in the subsample of high performing firms.⁹

[Tables 9 and Table 10 about here]

We further explore whether the impact of female CEOs on ESG performance is affected by the age of CEOs and divide the sample into firms with younger CEO (i.e., CEOs aged below the CEO average age of 52 years) and firms with older CEOs (i.e., CEOs aged higher than the average age of 52 years). The results reported in Table 11 show that *CEO_female* has a positive and significant impact association with ESG scores for the subsample of firms that is led by younger female CEOs indicating that female CEOs who are younger engage more in sustainability projects that affect positively on ESG performance.

[Table 11 about here]

⁸ ROA can provide a firm-specific measure of profitability and it has been widely used in academic research as a measure of corporate financial performance (McGuire et al., 1988; Iwata & Okada, 2011)

⁹ We replicate the test for low performing firms subsample, our results were insignificant.

In untabulated results, we explore the industry influence on the impact of female CEOs on ESG by dividing the sample into sustainability-sensitive industry subsample and non-sustainability-sensitive subsample. Following prior studies (see for e.g., Deegan and Gordon, 1996; Al-Shaer and Zaman, 2019), we identify firms in the utilities, chemical, mining, oil and gas, forest and paper products, aerospace and defence industries, tobacco, and beverage industries as sustainability-sensitive because their operations have greater impact on the environment and communities, whereas companies that belong to financial services, technology and telecommunication, consumer services, and health care industries are identified as non- sustainability-sensitive industries.¹⁰ Our findings show *CEO_female* has a positive and significant association at 5% level with *ESG_score*, *Social_score*, and *Environmental_score* for companies operating in the sustainability-sensitive industries only. *BOD_female* remains positive and significant at 1% level with *ESG_score*, *Social_score*, and *Environmental_score* for both subsamples.

The Davies Report, “*Women on Boards*” was introduced in February of 2011 to help improve female representation on boards and promote equal opportunities for women. In 2016, the Hampton-Alexander review continued the work of Lord Davies in the Davies Report and focuses on increased female representation on FTSE boards.¹¹ Since our sample starts in 2011 and ends in 2019, we examine whether the Alexander-Hampton Review has had an incremental effect additional to that of Davies Report in increasing female board representation. We, thus, divide our sample into two subsamples before and after 2016 and

¹⁰ We have 992 companies (64.42%) belong to the non-sustainability sensitive industries and 584 companies (35.58%) belong to the sustainability-sensitive industries. Companies in the following the Industry Classification Benchmark (ICB) codes: 50 (Industrials), 55 (Basic Materials), 60 (Energy), 65 (Utilities) are classified as sustainability sensitive.

¹¹ The UK government established the Hampton Alexander Review in 2016 to hold FTSE 350 companies to account for the lack of representation of women in leadership positions. The report recommends FTSE100 companies have 33% females in leadership teams by 2020. A recent review of the Hampton Alexander Report in 2022 acknowledged the success of the Hampton-Alexander Review. The review highlights that FTSE 350 reporting on gender progress will be critical to driving actions and improving gender balance in senior leadership positions. Interestingly, the review also shows that the voluntary target for FTSE 350 has increased to a minimum of 40% female representation by the end of 2025.

report the result in Table 12. The result shows that *CEO_female* is positive and significant with ESG scores before and after the Hampton-Alexander Review suggesting that female CEOs are more likely to promote sustainability practices than male CEOs during the two periods. The result indicates that both the Davies Report (2011) and the Hampton-Alexander Review have been successful in increasing representation of female directors on British boards which has also helped to improve ESG performance.¹²

[Table 12 about here]

We finally use an alternative measure of our dependent variable *ESG_score* by using ESG disclosure data from Bloomberg (*ESG_bloomberg*) and report the findings in a supplementary file.¹³ Overall findings are qualitatively similar to the baseline analysis. However, when female representation is higher than 40%, we do not find any statistical difference as compared to the ratio below 40%. This finding suggests that too high female representation on the board may not provide additional value to the board's ESG practices. In general, the findings support the first and second hypotheses and do not support the third hypothesis that the effectiveness of female CEOs depends on the existence of a critical mass of female directors on the board.

4.4. Endogeneity Analysis

We address endogeneity concerns using the PSM approach (Leuven and Sianesi, 2003) and the entropy balancing method (Hainmueller, 2012). The PSM approach can alleviate the potential hidden bias (Al-Shaer et al., 2023; Rosenbaum, 2005), and reduce heterogeneities

¹² We further examine the critical mass effect and whether the impact of female CEOs on ESG performance is conditioned by a critical mass of women on the board before and after the Hampton-Alexander Review. The results were qualitatively consistent with our baseline findings.

¹³ Table S1 investigates the first and second hypotheses on the impact of *CEO_female* and a critical mass of female directors on ESG performance, and Table S2 investigates the third hypothesis of whether the impact of female CEOs on ESG performance is conditioned by a critical mass of women on the board by adding the dummy variables of different shares of female directors in the boardroom and interaction variables between each share and *CEO_female*.

between firms with high and low female CEOs (Liu, 2018). Moreover, the entropy balancing method helps mitigate the potential self-selection bias that can arise from the observable characteristics (Treepongkaruna et al., 2022). Female directors might self-select to join firms that are more ESG-motivated, giving rise to the potential problem of reverse causality (Liu, 2018). The entropy balancing method helps deal with the potential issue of reverse causality.

First, we test the main findings on a matched sample using the PSM approach to address the endogeneity issue and report the findings in a supplementary file. We start with matching observations between firms with all male CEO observations to firms with female observations. Thus, we match each treatment firm-year to one or more control firm-years (with replacement) using propensity score matching (PSM). In doing so, we first run a probit model that uses *CEO_female* as the dependent variable and determinants of *CEO_female* such as CEO and board attributes as regressors. We then estimate the propensity score and match based on this for each year-industry group, using a 1% radius matching approach (Shipman et al., 2017). We then re-estimate our model for the matched sample and report our results. Overall, our findings are qualitatively similar to previous findings and show support for our hypotheses that female CEOs have a positive and significant impact on ESG performance and show no support for the gender homophily perspective.¹⁴

Second, we apply the entropy balancing to generate an alternative sample and address endogeneity concerns (Hainmueller and Xu, 2013; Hainmueller, 2012). To apply entropy balancing, we generate a binary variable that includes the treatment and control groups – the control group can be reweighted to match the covariate moments in the treatment group. Our variable of interest is *CEO_female*. The treatment group is created by assigning a value of 1 for female CEOs and the control group is created by assigning a value of 0 for male CEOs. We

¹⁴ Table S3 in the supplementary file replicates the baseline analysis which tests for the effect of female CEOs on ESG performance and Table S4 tests for the gender homophily effect on ESG performance.

then re-estimate our model for the matched sample and report our results. Overall, findings are qualitatively similar to our baseline results.¹⁵

5. DISCUSSION AND CONCLUSION

This paper investigates the impact of women in leadership positions on ESG performance of firms listed on the London Stock Exchange during the period 2011-2019. Our analysis reveals important results. First, we find female CEOs have a positive impact on ESG performance. Women leaders are more likely to embrace relationship-building approach and leadership styles which play a role in promoting sustainable initiatives (Harjoto et al., 2015; Glass et al., 2016). Second, we examine the impact of board gender diversity on ESG performance and find that a critical mass (between 20%-40%) of female directors leads to higher ESG scores. This is consistent with previous studies (Post et al., 2011; Ben-Amar et al., 2017; Dobija et al., 2021) that have focused on different contexts and did not investigate the role of female CEOs on ESG performance. Consistent with the critical mass theory (Bear et al., 2010; Harjoto et al., 2015), our findings suggest that a critical mass of female directors may result in new perspectives, experience, and skills being reflected in board decision-making and positively affect corporate sustainability practices. It is noteworthy that the benefits of having female directors on the board will be attained when having a critical mass of female directors on the board. A token representation of female directors limits their effectiveness as it is highly likely that a sole female member will replicate the behaviour of the majority directors on the board (Yarram and Adapa, 2021).

Third, we investigate gender homophily effect on ESG performance using an interaction variable between female CEOs and the participation of women directors on the

¹⁵ Table S5 in the supplementary file replicates the baseline analysis which tests for the effect of female CEOs on ESG performance and Table S6 tests for the gender homophily effect on ESG performance.

board. Social minority groups who share common values are likely to build stronger ties and facilitate collaboration on multiple tasks (Berger et al., 2013; Glass et al., 2016; Birindelli et al., 2019). Our findings do not align with gender homophily perspective and suggest that the effectiveness of female CEOs does not depend on the presence of large group of women directors on the board. Male, rather than female, CEOs are more likely to have higher ESG performance as a result of increased female representation on the board. We run multiple sensitivity tests based on CEO, board, and firm-specific characteristics. We also control for endogeneity using the propensity score matching (PSM) approach and entropy balancing technique and our main results hold.

The findings of our study extend existing evidence on female leadership and social sustainability performance (e.g., Al-Shaer and Zaman, 2016; Ben-Amar et al., 2017; Liu, 2018; Dobija et al., 2021) and suggest that firms with female CEOs have higher ESG performance than those with male CEOs. The result supports the upper echelon theory that explains the impact of the gender attribute of senior managers in shaping sustainability-related strategic decision (Li et al., 2017; Birindelli et al., 2019). Results also suggest that a critical mass of female directors is essential to influence the board processes and actions and support the critical mass theory that explains an increase in female representation beyond a specific threshold or a critical mass creates an effective balance on boards (Harjoto et al., 2015; Luring and Villesèche, 2019; Mensi-Klarbach and Seierstad, 2020). A critical mass of female directors helps to bring new skills and perspectives which will be reflected in board decision-making and positively affect ESG actions. A token representation of female directors on the board does not enable them to effectively influence decision-making regarding ESG initiatives. A sole female director creates performance pressure to replicate the behaviour of majority directors (Yarram and Adapa, 2021) and limits her ability to acquire resources to initiate innovative strategies including ESG-related activities.

When CEOs and board members share similar traits, including gender, they are likely to share common interests and goals which will shape organisational outcomes and future direction (Glass et al., 2016). We thus investigate gender homophily effect on ESG performance. Our findings indicate the effectiveness of female CEOs does not depend on the presence of a critical mass of women directors on boards, and thus does not support the gender homophily perspective, suggesting that the benefit of female leaders and their discretion over firms' decisions can be realised in the absence of gender homophily. Male, rather than female, CEOs are more likely to be associated with higher ESG performance as a result of increased female representation on the board.

Finally, gender effects may be subsumed by other CEO characteristics. In particular, young and short tenure CEOs are more likely to influence the engagement in sustainable projects and positively impact ESG performance. Moreover, outside CEOs (i.e., when the new CEO has been employed in the firm for less than two years at the time of appointment as the CEO) are more likely to promote ESG initiatives than internal candidates who may be more inclined to continue the firm's current policies.

6. IMPLICATIONS AND FUTURE RESEARCH AVENUES

Our results complement existing academic research on female leadership and ESG performance and have important implications for senior management and policy makers. First, we highlight the importance of female directors having the opportunity to reach the top ladder of management to affect sustainability performance. Our sample of UK companies shows a low frequency of female CEOs (only 7.5%) as compared to male CEOs. Therefore, UK companies may need to consider the appointment of women CEOs who are more likely to pursue long-term strategies and achieve stakeholder-oriented outcomes. Companies directed by female CEOs seem effective and able to promote sustainable strategies. On the other hand, companies that are directed by male CEOs and committed to sustainable strategies may

benefit from increasing the share of women directors on their boards. A token representation of female members on the board however does not help promote ESG practices.

Our results have important implications for policy makers. Companies will need to continue adherence to the Davies Report recommendations and set up an internal policy that focuses on gender diversity in corporate boards by developing measurable objectives for implementation. The findings are particularly useful amidst the growing calls to combat climate change. Female leaders are more likely, than their male peers, to spread environmental awareness and help achieve environmental objectives, which can be essential for environmental policymaking.

The finding of this study contributes to the debate in the management and accounting literatures on whether soft or hard regulations lead to the intended increase in female representation on corporate boards (Mensi-Klarbach and Seierstad, 2020). Our evidence suggests that voluntary targets for female participation on boards promote effective strategic choices including those related to ESG. Finally, this study has moved forward the scholarly debate in the management literature on gender homophily and female leadership and indicates the importance of a critical mass of female directors on the board, particularly for companies with male leadership to influence the decision-making process related to ESG initiatives. Moreover, it is important to have female CEOs with certain characteristics such as young short tenured CEOs to enhance the engagement in sustainable projects and positively impact ESG performance.

Our paper broadens the door for future research on female leadership and sustainability performance. For example, it would be interesting to investigate the influence of other diversity attributes of directors (e.g., ethnic minorities) on ESG performance. Furthermore, homophily can include contexts beyond gender e.g., educational background, nationality, and language spoken. Further research could investigate the effect of these

attributes on ESG strategies and performance. Researchers are also invited to investigate the role of the CFO and its attributes in this context. Future research can investigate the role of ownership structure in the association between female CEOs and ESG performance and address endogeneity concerns by utilizing the two-stage least squares (2SLS) method and/or the Difference in Difference (DID) test by identifying an exogenous shock, such as regulation or governmental policies that may affect corporate implementation of ESG practices. Finally, our findings are restricted to companies listed on the London Stock Exchange. Future research can examine the effect of female leadership positions in different institutional contexts and explore international variations.

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Figure 1: Research Framework

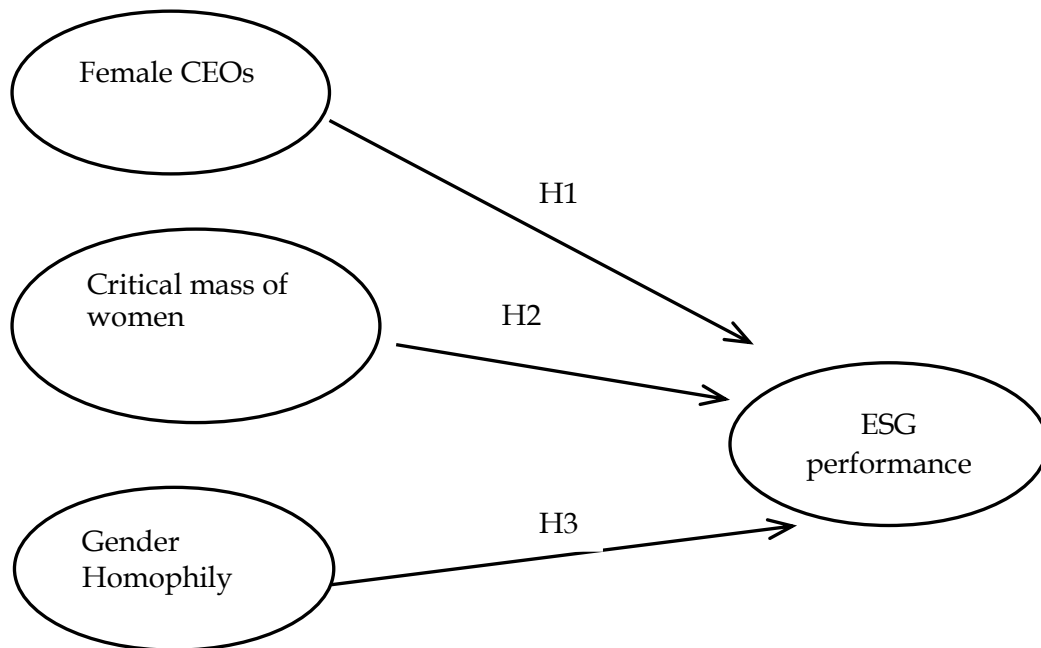


Table 1- Sample Distribution

Year	Number of firms per year	Percent
2011	148	9.61
2012	145	9.42
2013	159	10.32
2014	154	10
2015	174	11.3
2016	186	12.08
2017	189	12.27
2018	152	9.87
2019	233	15.13
Total	1,540	100

Table 2- Descriptive Statistics

Panel A: Descriptive Stats					
Variable	No	Mean	SD	Max	Min
ESG_score	1540	47.431	17.629	93.948	1.352
Social_score	1540	47.765	19.864	96.783	1.372
Environmental_score	1540	39.277	24.660	97.138	0.000
ESG_bloomberg	1540	43.533	9.128	77.266	7.384
CEO_female	1540	0.075	0.263	1.000	0.000
BOD_female	1540	0.191	0.118	0.600	0.000
WOMENless10%	1540	0.164	0.371	1.000	0.000
WOMEN10%	1540	0.835	0.371	1.000	0.000
WOMEN20%	1540	0.489	0.500	1.000	0.000
WOMEN40%	1540	0.047	0.211	1.000	0.000
Female_executive	1540	0.241	0.344	1.000	0.000
Female_independent	1540	0.758	0.343	1.000	0.000
CEO_age	1540	52.000	6.000	76.000	35.000
CEO_tenure	1540	8.000	7.000	35.000	2.000
BODSIZE	1540	8.576	2.035	27.000	3.000
BODIND	1540	0.566	0.135	0.857	0.000
BODMEET	1540	8.660	3.046	40.000	2.000
SUSCOM	1540	0.636	0.481	1.000	0.000
SIZE	1540	21.191	1.462	27.060	17.616
ROA	1540	0.058	0.088	0.330	-0.287
TOBINSQ	1540	0.892	0.093	1.080	0.314
LOSS	1540	0.142	0.349	1.000	0.000
LEV	1540	0.481	0.198	1.128	0.080

Panel B: Means: Subsample for ESG Performance			
	ESG_score	Social_score	Env_score
CEO_female=1	4.040	4.045	3.779
CEO_female=0	3.747	3.731	3.412
<i>t-test</i>	6.464***	6.252***	4.292***

Variables are as defined in Appendix 1.

Table 3- Correlation Matrix

Variable																
ESG_score	1															
Social_score	0.8652*	1														
Environmental_score	0.7307*	0.5905*	1													
CEO_female	0.1628*	0.1576*	0.1108*	1												
BOD_female	0.3203*	0.3039*	0.1635*	0.1987*	1											
CEO_age	0.1273*	0.1028*	0.1798*	-0.0338	0.1070*	1										
CEO_tenure	0.0580*	-0.0232	0.0890*	-0.0777*	-0.0232	0.3530*	1									
BODSIZE	0.2867*	0.2487*	0.2139*	0.0898*	0.1117*	0.1535*	0.0782*	1								
BODIND	0.4100*	0.3012*	0.2061*	0.0614*	0.2958*	0.0934*	-0.0494	0.1110*	1							
BODMEET	-0.0809*	-0.0149	-0.0915*	-0.0099	-0.0793*	-0.1064*	-0.1128*	-0.1342*	-0.0402	1						
SUSCOM	0.4765*	0.4251*	0.4432*	0.0510*	0.0762*	0.1039*	0.0456	0.1921*	0.1839*	-0.0603*	1					
SIZE	0.4718*	0.4331*	0.3816*	0.1574*	0.1905*	0.2005*	0.04	0.5363*	0.3440*	-0.1280*	0.3373*	1				
ROA	-0.0372	-0.0745*	-0.0841*	-0.045	0.1003*	-0.0745*	-0.0074	-0.0908*	0.0568*	-0.0860*	-0.1014*	-0.2222*	1			
TOBINSQ	-0.0860*	-0.0772*	-0.0980*	-0.0052	-0.0401	0.0006	0.1010*	-0.0787*	-0.0764*	0.0065	-0.1581*	-0.1759*	0.1785*	1		
LOSS	-0.0141	0.0161	-0.0084	-0.0448	-0.1107*	-0.0221	-0.0542*	0.0031	-0.0856*	0.0651*	-0.0106	0.0095	-0.6187*	-0.1079*	1	
LEV	0.0423	0.0576*	-0.0199	0.0128	0.003	-0.0802*	-0.0255	0.0175	-0.0161	0.1125*	-0.02	0.0601*	-0.0670*	-0.052	0.0508	1

This table reports the Pearson correlation matrix between the variables used in the study. Variables are as defined in Appendix 1.

Table 4- Female CEOs and ESG Performance

Variable	ESG_score	Social_score	Environmental_score
CEO_female	0.1349*** [6.00]	0.1571*** [4.82]	0.1232*** [2.65]
BODSIZE	0.0169*** [2.68]	0.0103 [1.51]	0.0171** [1.98]
BODIND	0.6365*** [7.88]	0.3732*** [3.99]	0.0301 [0.20]
BODMEET	0.0039 [1.14]	0.0115*** [2.81]	0.0003 [0.04]
SUSCOM	0.3226*** [9.82]	0.3139*** [8.92]	0.4938*** [9.56]
SIZE	0.0776*** [8.02]	0.1041*** [9.89]	0.1639*** [9.36]
ROA	0.3688** [1.97]	0.5243** [2.45]	0.3846 [1.07]
TOBINSQ	-0.0791 [-0.74]	-0.1751 [-1.33]	-0.3959* [-1.84]
LOSS	0.0743** [2.03]	0.0946** [2.18]	0.0402 [0.61]
LEV	0.1251** [2.23]	0.1651*** [2.76]	0.0135 [0.14]
Industry	Included	Included	Included
Year	Included	Included	Included
Intercept	1.2047*** [4.91]	0.8248*** [3.37]	-0.4461 [-1.07]
R-squared	0.4655	0.4112	0.4467
F-stat.	36.99***	29.03***	28.93***
N	1540	1540	1540

*, ** and *** indicate statistical significance at 10%, 5% and 1% levels, respectively. Variables are as defined in Appendix 1.

Table 5- Critical Mass and ESG Performance

Variable	ESG_score	ESG_score	ESG_score	ESG_score
CEO_female	0.1427*** [5.97]	0.1427*** [5.97]	0.1311*** [5.27]	0.1420*** [5.76]
WOMENless10%	-0.1071*** [-2.73]			
WOMEN10%		0.1071*** [2.73]		
WOMEN20%			0.1150*** [5.46]	
WOMEN40%				0.0514* [1.95]
BODSIZE	0.0148** [2.15]	0.0148** [2.15]	0.0121* [1.76]	0.0164** [2.41]
BODIND	0.6416*** [7.83]	0.6416*** [7.83]	0.6471*** [7.99]	0.6931*** [8.44]
BODMEET	0.0019 [0.56]	0.0019 [0.56]	0.0037 [1.08]	0.0023 [0.66]
SUSCOM	0.3104*** [9.51]	0.3104*** [9.51]	0.3144*** [9.60]	0.3136*** [9.47]
SIZE	0.0717*** [6.33]	0.0717*** [6.33]	0.0688*** [6.09]	0.0734*** [6.44]
ROA	0.3254* [1.69]	0.3254* [1.69]	0.3351* [1.72]	0.3497* [1.80]
TOBINSQ	-0.0983 [-0.89]	-0.0983 [-0.89]	-0.054 [-0.50]	-0.0803 [-0.73]
LOSS	0.0626 [1.64]	0.0626 [1.64]	0.0639* [1.67]	0.0554 [1.44]
LEV	0.1224** [2.14]	0.1224** [2.14]	0.1282** [2.25]	0.1318** [2.28]
Industry	Included	Included	Included	Included
Year	Included	Included	Included	Included
Intercept	2.1694*** [4.39]	2.0623*** [4.19]	1.9711*** [4.07]	2.0193*** [4.09]
R-squared	0.4711	0.4711	0.4765	0.466
F-stat.	36.47***	36.58***	36.98***	35.82***
N	1540	1540	1540	1540

* p<0.1, ** p<0.05, *** p<0.01. where WOMENless10%= 1 if the share of women on the board is below 10%, 0 otherwise; WOMEN10%= 1 if the share of women on the board is at least 10%, 0 otherwise; WOMEN20%= 1 if the share of women on the board is at least 20%, 0 otherwise; WOMEN40%= 1 if the share of women on the board is at least 40%, 0 otherwise. Variables are as defined in Appendix1.

Table 6- The Effect of Gender Homophily on ESG Performance

Variable	ESG_score	ESG_score	ESG_score	ESG_score
CEO_female	0.1567*** [7.76]	0.4050*** [2.66]	0.3267*** [8.03]	0.1885*** [7.84]
WOMENless10%	-0.1098*** [-2.83]			
WOMENless10%* CEO_female	0.2729* [1.62]			
WOMEN10%		0.1098*** [2.78]		
WOMEN10%* CEO_female		-0.2729** [-2.80]		
WOMEN20%			0.1229*** [5.63]	
WOMEN20%* CEO_female			-0.2438*** [-5.13]	
WOMEN40%				0.1206*** [3.40]
WOMEN40%* CEO_female				-0.1809*** [-3.27]
BODSIZE	0.0177*** [2.74]	0.0177*** [2.74]	0.0140** [2.15]	0.0191*** [2.98]
BODIND	0.6657*** [8.31]	0.6657*** [8.31]	0.6782*** [8.59]	0.7173*** [8.98]
BODMEET	0.0024 [0.69]	0.0024 [0.69]	0.0041 [1.23]	0.0029 [0.83]
SUSCOM	0.3200*** [9.85]	0.3200*** [9.85]	0.3249*** [9.93]	0.3278*** [9.81]
SIZE	0.0822*** [8.60]	0.0822*** [8.60]	0.0774*** [8.04]	0.0832*** [8.63]
ROA	0.3964** [2.13]	0.3964** [2.13]	0.4117** [2.18]	0.4082** [2.17]
TOBINSQ	-0.1164 [-1.07]	-0.1164 [-1.07]	-0.0686 [-0.65]	-0.0875 [-0.80]
LOSS	0.0762** [2.08]	0.0762** [2.08]	0.0763** [2.09]	0.0661* [1.80]
LEV	0.1163** [2.04]	0.1163** [2.04]	0.1202** [2.13]	0.1220** [2.12]
Industry	Included	Included	Included	Included
Year	Included	Included	Included	Included
Intercept	1.2388*** [5.00]	1.1290*** [4.60]	1.2361*** [5.07]	1.0923*** [4.43]
R-squared	0.4611	0.4611	0.4684	0.4568
F-stat.	35.35***	35.35***	36.73***	35.44***
N	1540	1540	1540	1540

*, ** and *** indicate statistical significance at 10%, 5% and 1% levels, respectively. Variables are as defined in Appendix 1.

Table 7- The Effect of Female Independent Directors vs. Female Executive Directors

Variable	ESG_score	ESG_score	ESG_score	ESG_score
CEO_female	0.1777*** [8.60]	0.2767*** [5.91]	0.1458*** [6.43]	0.2193*** [6.93]
Female_ind	0.017 [1.24]	0.0212 [1.47]		
Female_ind* CEO_female		-0.0734*** [-2.71]		
Female_executive			0.0445*** [3.66]	0.0555*** [4.17]
Female_executive* CEO_female				-0.0759*** [-3.18]
BODSIZE	0.0147** [2.11]	0.0145** [2.07]	0.0110* [1.74]	0.0091 [1.40]
BODIND	0.6286*** [7.45]	0.6280*** [7.43]	0.6843*** [8.52]	0.6995*** [8.66]
BODMEET	0.0012 [0.35]	0.0015 [0.44]	0.0015 [0.43]	0.0008 [0.23]
SUSCOM	0.3330*** [9.99]	0.3339*** [9.99]	0.3299*** [9.75]	0.3288*** [9.73]
SIZE	0.0858*** [8.82]	0.0854*** [8.77]	0.0895*** [9.31]	0.0904*** [9.43]
ROA	0.3943** [2.05]	0.4075** [2.11]	0.4224** [2.21]	0.4319** [2.26]
TOBINSQ	-0.1121 [-1.03]	-0.1176 [-1.08]	-0.1272 [-1.17]	-0.1127 [-1.04]
LOSS	0.0847** [2.16]	0.0863** [2.20]	0.0895** [2.28]	0.0903** [2.30]
LEV	0.0787 [1.31]	0.0781 [1.30]	0.0893 [1.52]	0.0878 [1.50]
Industry	Included	Included	Included	Included
Year	Included	Included	Included	Included
Intercept	0.9495*** [3.93]	0.9405*** [3.88]	0.8803*** [3.67]	0.8763*** [3.66]
R-squared	0.4621	0.4631	0.4656	0.4671
F-stat.	39.34***	38.35***	39.34***	38.70***
N	1136	1136	1136	1136

*, ** and *** indicate statistical significance at 10%, 5% and 1% levels, respectively. Female_ind represents the number of female independent directors on the board and Female_executive represents the number of female executive directors on the board. Other Variables are as defined in Appendix 1.

Table 8- Long Tenure CEOs vs. Short Tenure CEOs

Variable	Subsample of firms with long tenure CEOs (<i>above the median 5.08</i>)			Subsample of firms with short tenure CEOs (<i>below the median 5.08</i>)		
	ESG_score	Social_score	Environmental_score	ESG_score	Social_score	Environmental_score
CEO_female	0.0935 [1.31]	0.1113 [1.26]	0.1471 [1.15]	0.1716*** [3.70]	0.1759*** [3.60]	0.1730*** [2.72]
BOD_female	0.7953*** [4.64]	0.8149*** [3.82]	1.6408*** [5.29]	0.4475*** [3.15]	0.3008** [2.01]	0.9807*** [3.65]
BODSIZE	0.0097 [1.06]	0.0045 [0.40]	0.0078 [0.47]	0.0152** [1.99]	0.0041 [0.51]	0.0186 [1.30]
BODIND	0.7877*** [5.97]	0.4718*** [2.87]	0.1467 [0.61]	0.4516*** [4.12]	0.1828 [1.59]	-0.1311 [-0.63]
BODMEET	0.0092 [1.61]	0.0199*** [2.80]	0.0139 [1.33]	0.0033 [0.77]	0.0055 [1.22]	-0.0019 [-0.24]
SUSCOM	0.2867*** [8.03]	0.2790*** [6.28]	0.5266*** [8.04]	0.3584*** [10.97]	0.3496*** [10.17]	0.5165*** [8.33]
SIZE	0.0708*** [4.83]	0.0973*** [5.34]	0.1548*** [5.86]	0.0875*** [6.21]	0.1136*** [7.66]	0.1590*** [6.02]
ROA	0.1869 [0.66]	0.6477* [1.85]	-0.2762 [-0.54]	0.3937* [1.78]	0.3946* [1.69]	0.3862 [0.91]
TOBINSQ	-0.1522 [-0.79]	-0.2505 [-1.05]	-0.6135* [-1.78]	0.0314 [0.18]	0.0348 [0.19]	-0.0539 [-0.17]
LOSS	-0.0044 [-0.08]	0.0058 [0.08]	-0.0378 [-0.37]	0.0992* [1.92]	0.1134** [2.08]	-0.0133 [-0.14]
LEV	-0.0295 [-0.36]	0.1263 [1.23]	-0.3374** [-2.26]	0.2509*** [3.40]	0.2105*** [2.71]	0.2347* [1.69]
Industry	Included	Included	Included	Included	Included	Included
Year	Included	Included	Included	Included	Included	Included
Intercept	1.4833*** [4.10]	1.1222** [2.50]	-0.2743 [-0.43]	0.7682** [2.37]	0.3559 [1.04]	-0.7229 [-1.19]
R-squared	0.453	0.3936	0.5	0.5277	0.5138	0.4504
F-stat.	14.72***	12.01***	17.12***	21.23***	19.87***	15.81***
N	763	763	763	777	777	777

*, ** and *** indicate statistical significance at 10%, 5% and 1% levels, respectively. Variables are as defined in Appendix 1.

Table 9- High performing Firms vs. Low Performing Firms

Variable	High performing firms			Low performing firms		
	ESG_score	Social_score	Environmental_score	ESG_score	Social_score	Environmental_score
CEO_female	0.1252*** [3.25]	0.1425*** [3.14]	0.1241** [1.98]	0.3756* [2.00]	0.4618* [1.90]	0.151 [0.55]
BOD_female	0.5281*** [4.60]	0.4412*** [3.26]	1.1555*** [5.18]	0.5564 [1.55]	0.6752* [1.68]	0.9011* [1.68]
BODSIZE	0.0176*** [2.89]	0.0071 [0.99]	0.0165 [1.39]	-0.0042 [-0.20]	0.0075 [0.31]	-0.0221 [-0.69]
BODIND	0.5995*** [6.85]	0.3455*** [3.35]	-0.0682 [-0.40]	0.9158*** [3.08]	0.6566* [1.97]	0.5305 [1.22]
BODMEET	0.0014 [0.37]	0.0099** [2.20]	-0.0052 [-0.69]	0.0121 [1.35]	0.0182* [1.81]	0.0148 [1.13]
SUSCOM	0.3163*** [12.79]	0.3230*** [11.08]	0.4974*** [10.26]	0.3811*** [4.47]	0.2917*** [3.06]	0.4818*** [3.80]
SIZE	0.0808*** [7.41]	0.1131*** [8.80]	0.1773*** [8.40]	0.0789** [2.42]	0.0967*** [2.65]	0.1673*** [3.51]
ROA	0.4535** [2.26]	0.6941*** [2.93]	0.9504** [2.43]	0.2738 [0.57]	0.3772 [0.70]	-0.8343 [-1.17]
TOBINSQ	-0.1584 [-1.18]	-0.2737* [-1.74]	-0.3858 [-1.50]	0.2619 [0.70]	0.2367 [0.57]	-0.4296 [-0.80]
LOSS	-0.1206 [-0.75]	-0.0387 [-0.20]	0.0338 [0.11]	0.0893** [1.97]	0.1001* [1.91]	-0.0052 [-0.06]
LEV	0.1792*** [3.21]	0.2047*** [3.11]	0.0751 [0.70]	0.0148 [0.08]	0.1192 [0.59]	-0.0585 [-0.22]
Industry	Included	Included	Included	Included	Included	Included
Year	Included	Included	Included	Included	Included	Included
Intercept	1.2852*** [5.04]	0.8450*** [2.81]	-0.618 [-1.25]	1.4224*** [4.45]	1.0746*** [2.90]	-0.4749 [-0.81]
R-squared	0.4844	0.4317	0.45	0.4835	0.4017	0.4804
F-stat.	31.39***	25.69***	26.95***	14.49***	13.17***	15.42***
N	1322	1322	1322	218	218	218

*, ** and *** indicate statistical significance at 10%, 5% and 1% levels, respectively. Variables are as defined in Appendix 1.

Table 10- Long Tenure CEOs vs. Short Tenure CEOs for a Subsample of High Performing Firms

Variable	CEO tenure above the median 5.08			CEO tenure below the median 5.08		
	ESG_score	Social_score	Environmental_score	ESG_score	Social_score	Environmental_score
CEO_female	0.0935 [1.31]	0.1113 [1.26]	0.1471 [1.15]	0.1716*** [3.70]	0.1759*** [3.60]	0.1730** [2.02]
BOD_female	0.7953*** [4.64]	0.8149*** [3.82]	1.6408*** [5.29]	0.4475*** [3.15]	0.3008** [2.01]	0.9807*** [3.65]
BODSIZE	0.0097 [1.06]	0.0045 [0.40]	0.0078 [0.47]	0.0152** [1.99]	0.0041 [0.51]	0.0186 [1.30]
BODIND	0.7877*** [5.97]	0.4718*** [2.87]	0.1467 [0.61]	0.4516*** [4.12]	0.1828 [1.59]	-0.1311 [-0.63]
BODMEET	0.0092 [1.61]	0.0199*** [2.80]	0.0139 [1.33]	0.0033 [0.77]	0.0055 [1.22]	-0.0019 [-0.24]
SUSCOM	0.2867*** [8.03]	0.2790*** [6.28]	0.5266*** [8.04]	0.3584*** [10.97]	0.3496*** [10.17]	0.5165*** [8.33]
SIZE	0.0708*** [4.83]	0.0973*** [5.34]	0.1548*** [5.86]	0.0875*** [6.21]	0.1136*** [7.66]	0.1590*** [6.02]
ROA	0.1869 [0.66]	0.6477* [1.85]	-0.2762 [-0.54]	0.3937* [1.78]	0.3946* [1.69]	0.3862 [0.91]
TOBINSQ	-0.1522 [-0.79]	-0.2505 [-1.05]	-0.6135* [-1.78]	0.0314 [0.18]	0.0348 [0.19]	-0.0539 [-0.17]
LOSS	-0.0044 [-0.08]	0.0058 [0.08]	-0.0378 [-0.37]	0.0992* [1.92]	0.1134** [2.08]	-0.0133 [-0.14]
LEV	-0.0295 [-0.36]	0.1263 [1.23]	-0.3374** [-2.26]	0.2509*** [3.40]	0.2105*** [2.71]	0.2347* [1.69]
Industry	Included	Included	Included	Included	Included	Included
Year	Included	Included	Included	Included	Included	Included
Intercept	1.4833*** [4.10]	1.1222** [2.50]	0.0811 [0.13]	0.5276 [1.61]	-0.0249 [-0.07]	-0.7334 [-1.21]
F-stat.	11.39***	15.69***	13.95***	11.49***	13.17***	11.42***
R-squared	0.453	0.3936	0.5001	0.5277	0.5138	0.4504

*, ** and *** indicate statistical significance at 10%, 5% and 1% levels, respectively. Variables are as defined in Appendix 1.

Table 11- Old CEOs vs. Young CEOs

Variable	CEO age in this subsample above the median 52			CEO age in this subsample below the median 52		
	ESG_score	Social_score	Environmental_score	ESG_score	Social_score	Environmental_score
CEO_female	0.1491*	0.2108*	-0.0417	0.1090***	0.0907*	0.2177**
	[2.01]	[2.03]	[-0.35]	[2.61]	[1.74]	[2.44]
BOD_female	0.4799**	0.3028	0.7704**	0.6423***	0.6786***	1.4212***
	[2.49]	[1.40]	[2.50]	[5.15]	[4.35]	[5.25]
BODSIZE	0.0102	0.0097	0.0181	0.0220***	0.0153	0.0248
	[1.15]	[0.97]	[1.28]	[2.84]	[1.58]	[1.46]
BODIND	0.6020***	0.3613**	0.3769	0.6819***	0.3921***	-0.0308
	[4.06]	[2.17]	[1.58]	[7.10]	[3.26]	[-0.15]
BODMEET	0.0059	0.0089	0.0135	0.0032	0.0144***	-0.0036
	[0.95]	[1.27]	[1.31]	[0.84]	[3.06]	[-0.44]
SUSCOM	0.4990***	0.4622***	0.6682***	0.1840***	0.1982***	0.3490***
	[11.93]	[9.86]	[9.71]	[6.71]	[5.77]	[5.89]
SIZE	0.0742***	0.0940***	0.1479***	0.0837***	0.1224***	0.1345***
	[4.54]	[5.12]	[5.62]	[6.65]	[7.77]	[4.96]
ROA	0.8053***	0.8683***	1.3843***	-0.0312	0.1614	-0.1496
	[2.70]	[2.60]	[2.83]	[-0.16]	[0.65]	[-0.35]
TOBINSQ	-0.1008	-0.022	-0.3094	-0.1634	-0.3067*	-0.5138*
	[-0.45]	[-0.09]	[-0.88]	[-1.15]	[-1.72]	[-1.68]
LOSS	0.1093*	0.1451**	0.1989*	0.0385	0.0387	-0.0652
	[1.71]	[2.03]	[1.96]	[0.88]	[0.71]	[-0.69]
LEV	0.0781	0.113	0.0801	0.1453**	0.1898***	0.0576
	[0.74]	[0.96]	[0.47]	[2.55]	[2.66]	[0.47]
Industry	Included	Included	Included	Included	Included	Included
Year	Included	Included	Included	Included	Included	Included
Intercept	1.2861***	0.9144**	-0.8679	1.1703***	0.5142	0.3475
	[3.17]	[2.01]	[-1.14]	[4.08]	[1.43]	[0.57]
R-squared	0.4697	0.4151	0.473	0.5218	0.4548	0.4676
F-stat.	14.96***	12.27***	15.26***	21.40***	16.70***	16.91***
N	716	716	716	824	824	824

*, ** and *** indicate statistical significance at 10%, 5% and 1% levels, respectively. Variables are as defined in Appendix 1.

Table 12- Female CEOs and ESG Performance before and after Hampton-Alexander Review

Variable	Before Hampton-Alexander Review			After Hampton-Alexander Review		
	ESG_score	Social_score	Environmental_score	ESG_score	Social_score	Environmental_score
CEO_female	0.1604*** [3.15]	0.1738*** [2.89]	0.1738** [2.29]	0.1033*** [2.80]	0.1226** [2.40]	0.1397* [1.79]
BOD_female	0.4858*** [3.28]	0.5263*** [3.01]	0.5263*** [3.01]	0.5680*** [3.98]	0.5819*** [3.61]	1.2429*** [3.89]
BODSIZE	0.0109 [1.34]	0.0047 [0.49]	0.0047 [0.49]	0.0187** [2.38]	0.0122 [1.39]	0.0138 [0.79]
BODIND	0.7126*** [6.01]	0.4241*** [3.03]	0.4241*** [3.03]	0.5336*** [4.54]	0.3271** [2.47]	-0.255 [-0.95]
BODMEET	0.0039 [0.84]	0.0126** [2.27]	0.0126** [2.27]	0.0031 [0.60]	0.0042 [0.73]	0.0024 [0.20]
SUSCOM	0.3159*** [9.72]	0.2864*** [7.45]	0.2864*** [7.45]	0.3100*** [9.00]	0.3133*** [8.06]	0.6501*** [8.39]
SIZE	0.0779*** [5.77]	0.1169*** [7.32]	0.1169*** [7.32]	0.0936*** [6.38]	0.0941*** [5.69]	0.1919*** [5.80]
ROA	0.0853 [0.35]	0.358 [1.26]	0.358 [1.26]	0.5613** [2.24]	0.4203 [1.49]	0.5065 [0.90]
TOBINSQ	0.0952 [0.54]	-0.0553 [-0.26]	-0.0553 [-0.26]	-0.2325 [-1.38]	-0.2541 [-1.33]	-0.5002 [-1.32]
LOSS	0.0435 [0.84]	0.1046* [1.70]	0.1046* [1.70]	0.1347** [2.52]	0.0909 [1.51]	0.1124 [0.94]
LEV	0.0488 [0.68]	0.0655 [0.77]	0.0655 [0.77]	0.2713*** [3.34]	0.3231*** [3.53]	0.2141 [1.17]
Industry	Included	Included	Included	Included	Included	Included
Year	Included	Included	Included	Included	Included	Included
Intercept	0.7788** [2.17]	0.0431 [0.10]	0.0431 [0.10]	0.5853* [1.69]	0.6303 [1.61]	-1.1815 [-1.49]
R-squared	0.408	0.3766	0.3766	0.5941	0.5179	0.5053
F-stat.	25.08***	20.93***	24.37***	26.13***	19.18***	18.04***
N	819	819	819	721	721	721

*, ** and *** indicate statistical significance at 10%, 5% and 1% levels, respectively. Variables are as defined in Appendix 1.

Appendix 1- Variable Definition

ESG_score	Represents the overall company score of the environmental, social, governance pillars from the Thomson Reuters Eikon Database.
Social_score	Represents the social pillar from the Thomson Reuters Eikon Database.
Environmental_score	Represents the environmental pillar from the Thomson Reuters Eikon Database.
CEO_female	Dummy variable takes a value of 1 for female CEO and 0 for a male CEO.
BOD_female	The percentage of women on the board
WOMENless10%	Dummy variable equal to 1 if the share of women on the board is below 10, and zero otherwise.
WOMEN10%	Dummy variable equal to 1 if the share of women on the board is at least 10%, and zero otherwise.
WOMEN20%	Dummy variable equal to 1 if the share of women on the board is at least 20%, and zero otherwise.
WOMEN40%	Dummy variable equal to 1 if the share of women on the board is at least 40%, and zero otherwise.
CEO_age	CEO age either calculated from DOB or known from the disclosed information.
CEO_tenure	The time the CEO has spent on the role
BODSIZE	Number of directors on the board
BODIND	Proportion of independent directors on the board
BODMEET	The number of board member during the year.
SUSCOM	An indicator variable takes a value of 1 if a sustainability committee exists, 0 otherwise.
SIZE	Natural log of total assets
ROA	Return on assets measured by net income over total assets
TOBINSQ	Sum of firm equity value, book value of long-term debt, and current liabilities divided by total asset
LOSS	A dummy variable equal to one when the current year's net income is negative, and zero otherwise
LEV	Leverage ratio measured by debt over total assets

Supplementary Material

Table S1- Using Alternative Measure of ESG performance: Replicating the results of Table 4&5.

Variable	ESG_bloomberg	ESG_bloomberg	ESG_bloomberg	ESG_bloomberg	ESG_bloomberg
CEO_female	3.0506*** [3.07]	3.3721*** [3.34]	3.3721*** [3.34]	3.3370*** [3.33]	3.4604*** [3.36]
WOMENless10%		-1.0296 [-1.17]			
WOMEN10%			1.0296** [2.47]		
WOMEN20%				1.1021** [2.88]	
WOMEN40%					-0.2153 [-0.25]
BODSIZE	0.2647* [1.72]	0.2837* [1.85]	0.2837* [1.85]	0.2607* [1.68]	0.2963* [1.92]
BODIND	3.1155 [1.34]	3.6345 [1.53]	3.6345 [1.53]	3.6692 [1.58]	4.2404* [1.86]
BODMEET	0.1016 [1.05]	0.0817 [0.83]	0.0817 [0.83]	0.0973 [0.99]	0.0792 [0.80]
SUSCOM	3.7142*** [6.65]	3.6717*** [6.52]	3.6717*** [6.52]	3.6942*** [6.61]	3.7109*** [6.62]
SIZE	2.3751*** [8.80]	2.4295*** [9.02]	2.4295*** [9.02]	2.3828*** [8.82]	2.4381*** [8.98]
ROA	7.7295* [1.74]	7.9234* [1.79]	7.9234* [1.79]	7.8834* [1.77]	8.2586* [1.84]
TOBINSQ	7.8085** [2.06]	7.1282* [1.90]	7.1282* [1.90]	7.2387* [1.92]	6.6627* [1.76]
LOSS	0.6548 [0.75]	0.6842 [0.78]	0.6842 [0.78]	0.6154 [0.71]	0.6082 [0.70]
LEV	-1.5527 [-1.01]	-1.6073 [-1.04]	-1.6073 [-1.04]	-1.5646 [-1.01]	-1.5234 [-0.98]
Industry	Included	Included	Included	Included	Included
Year	Included	Included	Included	Included	Included
Intercept	-23.2630*** [-3.49]	-22.4170*** [-3.34]	-23.4466*** [-3.50]	-22.4696*** [-3.36]	-22.9716*** [-3.41]
R-squared	0.4546	0.4518	0.4518	0.453	0.4507
F-stat.	25.7***	25.64***	25.64***	25.52***	25.27***
N	1,125	1,125	1,125	1,125	1,125

*, ** and *** indicate statistical significance at 10%, 5% and 1% levels, respectively. The dependent variable ESG_bloomberg is measured by using ESG disclosure data from Bloomberg. Variables are as defined in Appendix 1.

Table S2- Using Alternative Measure of ESG performance: Replicating the results of Table 6

Variable	ESG_bloomberg	ESG_bloomberg	ESG_bloomberg	ESG_bloomberg
CEO_female	3.3150*** [3.23]	6.5253*** [4.22]	2.9245* [1.79]	3.0257*** [2.60]
WOMENless10%	-1.0498 [-1.19]			
WOMENless10%* CEO_female	3.2104* [1.74]			
WOMEN10%		3.111*** [4.03]		
WOMEN10%* CEO_female		-3.2104* [-1.74]		
WOMEN20%			1.0638** [2.79]	
WOMEN20%* CEO_female			-0.5969* [-1.89]	
WOMEN40%				-0.9263 [-1.06]
WOMEN40%* CEO_female				2.5961 [1.21]
BODSIZE	0.2833* [1.85]	0.2833* [1.85]	0.2640* [1.70]	0.2949* [1.91]
BODIND	3.6811 [1.55]	3.6811 [1.55]	3.6384 [1.56]	4.1405* [1.81]
BODMEET	0.0811 [0.83]	0.0811 [0.83]	0.0966 [0.99]	0.0805 [0.80]
SUSCOM	3.6642*** [6.50]	3.6642*** [6.50]	3.6956*** [6.61]	3.6645*** [6.54]
SIZE	2.4305*** [9.02]	2.4305*** [9.02]	2.3835*** [8.81]	2.4446*** [9.01]
ROA	7.9108* [1.79]	7.9108* [1.79]	7.8693* [1.77]	8.2619* [1.84]
TOBINSQ	7.1345* [1.90]	7.1345* [1.90]	7.2007* [1.91]	6.3946* [1.68]
LOSS	0.6875 [0.79]	0.6875 [0.79]	0.6179 [0.71]	0.6359 [0.73]
LEV	-1.6336 [-1.05]	-1.6336 [-1.05]	-1.5359 [-0.99]	-1.4804 [-0.95]
Industry	Included	Included	Included	Included
Year	Included	Included	Included	Included
Intercept	-22.4374*** [-3.35]	-23.4872*** [-3.51]	-22.4549*** [-3.35]	-22.8300*** [-3.38]
R-squared	0.4519	0.4519	0.4531	0.4513
F-stat.	25.12***	25.45***	24.64***	24.87***
N	1125	1125	1125	1125

*, ** and *** indicate statistical significance at 10%, 5% and 1% levels, respectively. The dependent variable ESG_bloomberg is measured by using ESG disclosure data from Bloomberg. Variables are as defined in Appendix 1.

Table S3- The Impact of Female CEOs on ESG Performance Using the Propensity Score Matching (PSM)

Variable	ESG_score	Social_score	Environmental_score
CEO_female	0.2289*** [3.92]	0.2396*** [3.52]	0.1831** [2.32]
BODSIZE	0.006 [0.44]	-0.0005 [-0.03]	0.0148 [0.78]
BODIND	0.8262*** [4.02]	0.4224* [1.76]	0.081 [0.29]
BODMEET	0.0113 [1.40]	0.0250*** [2.67]	-0.0011 [-0.10]
SUSCOM	0.3172*** [5.77]	0.3453*** [5.39]	0.3098*** [4.08]
SIZE	0.0739*** [3.31]	0.1062*** [4.08]	0.1378*** [4.56]
ROA	1.0602*** [2.66]	1.3160*** [2.83]	0.6657 [1.23]
TOBINSQ	-0.1135 [-0.34]	-0.1157 [-0.30]	-0.2885 [-0.65]
LOSS	0.102 [1.14]	0.1017 [0.98]	0.1477 [1.21]
LEV	-0.0119 [-0.08]	-0.063 [-0.38]	-0.1055 [-0.55]
Industry	Included	Included	Included
Year	Included	Included	Included
Intercept	1.6229*** [2.76]	0.9564 [1.44]	0.4444 [0.56]
R-squared	0.439	0.4091	0.403
F-stat.	6.70***	5.76***	6.11***
N	302	302	302

*, ** and *** indicate statistical significance at 10%, 5% and 1% levels, respectively. Variables are as defined in Appendix 1.

Table S4- Testing for Gender Homophily Using the Propensity Score Matching (PSM)

Variable	ESG_score	ESG_score	ESG_score	ESG_score
CEO_female	0.1567*** [7.76]	0.4050*** [2.66]	0.3267*** [8.03]	0.1885*** [7.84]
WOMENless10%	-0.1098*** [-2.83]			
WOMENless10%* CEO_female	0.2483 [1.62]			
WOMEN10%		0.1098*** [2.83]		
WOMEN10%* CEO_female		0.2487* [-1.62]		
WOMEN20%			0.1229*** [5.63]	
WOMEN20%* CEO_female			-0.2438*** [-5.13]	
WOMEN40%				0.1206*** [3.40]
WOMEN40%* CEO_female				-0.1809*** [-3.27]
BODSIZE	0.0177*** [2.74]	0.0177*** [2.74]	0.0140** [2.15]	0.0191*** [2.98]
BODIND	0.6657*** [8.31]	0.6657*** [8.31]	0.6782*** [8.59]	0.7173*** [8.98]
BODMEET	0.0024 [0.69]	0.0024 [0.69]	0.0041 [1.23]	0.0029 [0.83]
SUSCOM	0.3200*** [9.85]	0.3200*** [9.85]	0.3249*** [9.93]	0.3278*** [9.81]
SIZE	0.0822*** [8.60]	0.0822*** [8.60]	0.0774*** [8.04]	0.0832*** [8.63]
ROA	0.3964** [2.13]	0.3964** [2.13]	0.4117** [2.18]	0.4082** [2.17]
TOBINSQ	-0.1164 [-1.07]	-0.1164 [-1.07]	-0.0686 [-0.65]	-0.0875 [-0.80]
LOSS	0.0762** [2.08]	0.0762** [2.08]	0.0763** [2.09]	0.0661* [1.80]
LEV	0.1163** [2.04]	0.1163** [2.04]	0.1202** [2.13]	0.1220** [2.12]
Industry	Included	Included	Included	Included
Year	Included	Included	Included	Included
Intercept	1.2388*** [5.00]	1.2364*** [5.10]	1.2361*** [5.07]	1.0923*** [4.43]
R-squared	0.4611	0.4611	0.4684	0.4568
F-stat.	35.35***	35.35***	36.73***	35.44***

*, ** and *** indicate statistical significance at 10%, 5% and 1% levels, respectively. Variables are as defined in Appendix 1.

Table S5- The Impact of Female CEOs on ESG Performance Using the Entropy Balancing

Variable	ESG_score	Social_score	Environmental_score
CEO_female	0.1307*** [9.17]	0.1326*** [7.37]	0.1754*** [7.01]
BODSIZE	0.0185*** [4.63]	0.0123** [2.45]	0.0168** [2.39]
BODIND	0.4475*** [6.35]	0.2013** [2.26]	-0.1246 [-0.99]
BODMEET	-0.0044* [-1.71]	0.0037 [1.14]	-0.0164*** [-3.60]
SUSCOM	0.3300*** [17.31]	0.3079*** [12.81]	0.5258*** [15.63]
SIZE	0.0839*** [10.22]	0.1052*** [10.16]	0.1864*** [12.87]
ROA	-0.1615 [-0.99]	-0.23 [-1.12]	-0.8157*** [-2.85]
TOBINSQ	-0.3709*** [-3.36]	-0.8110*** [-5.82]	-0.0996 [-0.51]
LOSS	0.0502 [1.34]	0.0257 [0.54]	-0.0224 [-0.34]
LEV	-0.1141** [-2.27]	-0.0423 [-0.67]	-0.5242*** [-5.92]
Industry	Included	Included	Included
Year	Included	Included	Included
Intercept	1.7373*** [8.22]	1.7404*** [6.53]	-0.8283** [-2.21]
R-squared	0.6134	0.5383	0.5759
F-stat.	60.52***	44.46***	50.53***
N	1136	1136	1136

*, ** and *** indicate statistical significance at 10%, 5% and 1% levels, respectively. Variables are as defined in Appendix 1.

Table S6- Testing for Gender Homophily Using Entropy Balancing

	ESG_score	ESG_score	ESG_score	ESG_score
CEO_female	0.1559*** [10.05]	0.3138*** [2.95]	0.3101*** [10.59]	0.1750*** [10.43]
WOMENless10%	-0.1209 [-1.63]			
WOMENless10%* CEO_gender	0.1579 [1.46]			
WOMEN10%		0.1209 [1.63]		
WOMEN10%* CEO_gender		-0.1579 [-1.46]		
WOMEN20%			0.1616*** [6.48]	
WOMEN20%* CEO_gender			-0.2297*** [-6.53]	
WOMEN40%				0.1062*** [3.49]
WOMEN40%* CEO_gender				-0.1100*** [-2.64]
BODSIZE	0.0181*** [4.05]	0.0181*** [4.05]	0.0130*** [3.02]	0.0213*** [5.10]
BODIND	0.5110*** [6.96]	0.5110*** [6.96]	0.4857*** [6.88]	0.4900*** [6.80]
BODMEET	-0.0046* [-1.72]	-0.0046* [-1.72]	-0.0021 [-0.80]	-0.0051** [-1.99]
SUSCOM	0.3217*** [15.90]	0.3217*** [15.90]	0.3238*** [16.93]	0.3409*** [16.43]
SIZE	0.0851*** [10.05]	0.0851*** [10.05]	0.0843*** [10.40]	0.0816*** [9.88]
ROA	-0.018 [-0.10]	-0.018 [-0.10]	-0.023 [-0.14]	0.0259 [0.16]
TOBINSQ	-0.3402*** [-2.92]	-0.3402*** [-2.92]	-0.2438** [-2.23]	-0.3936*** [-3.53]
LOSS	0.0791* [1.96]	0.0791* [1.96]	0.0531 [1.37]	0.0680* [1.80]
LEV	-0.1018* [-1.96]	-0.1018* [-1.96]	-0.1018** [-2.07]	-0.1576*** [-3.14]
Industry	Included	Included	Included	Included
Year	Included	Included	Included	Included
Intercept	1.5599*** [6.85]	1.6808*** [7.70]	1.5320*** [7.39]	1.7599*** [8.21]
R-squared	0.5828	0.5828	0.6154	0.6148
F-stat.	51.46***	51.46***	58.92***	58.78***
N	1136	1136	1136	1136

*, ** and *** indicate statistical significance at 10%, 5% and 1% levels, respectively. Variables are as defined in Appendix 1.

Table S7- The Impact of Female CEOs on ESG Performance Excluding the Financial Sector

	ESG_score	Social_score	Environmental_score
CEO_female	0.1565*** [3.62]	0.1857*** [3.66]	0.2141*** [2.66]
BODSIZE	0.0154** [2.37]	0.011 [1.44]	0.0168 [1.37]
BODIND	0.6985*** [7.55]	0.4585*** [4.22]	0.2193 [1.25]
BODMEET	0.0120*** [3.03]	0.0186*** [4.02]	0.0084 [1.12]
SUSCOM	0.3432*** [12.50]	0.3460*** [10.74]	0.5195*** [9.93]
SIZE	0.1048*** [9.36]	0.1276*** [9.71]	0.1989*** [9.43]
ROA	0.2822 [1.40]	0.5026** [2.13]	0.4199 [1.11]
TOBINSQ	-0.0092 [-0.07]	-0.0972 [-0.63]	-0.4 [-1.61]
LOSS	0.021 [0.50]	0.0581 [1.17]	-0.0068 [-0.09]
LEV	0.2396*** [3.90]	0.2416*** [3.35]	0.1918* [1.66]
Industry	Included	Included	Included
Year	Included	Included	Included
Intercept	0.0961 [0.36]	-0.398 [-1.27]	-1.2996*** [-2.58]
R-squared	0.4645	0.4148	0.4007
N	1255	1255	1255

*, ** and *** indicate statistical significance at 10%, 5% and 1% levels, respectively. Variables are as defined in Appendix 1.

Table S8- Testing for the Critical Mass Excluding the Financial Sector

	ESG_score	ESG_score	ESG_score	ESG_score
CEO_female	0.1486*** [3.44]	0.1486*** [3.44]	0.1483*** [3.44]	0.1438*** [3.26]
WOMENless10%	-0.0972*** [-2.80]			
WOMEN10%		0.0972*** [2.80]		
WOMEN20%			0.0836*** [3.07]	
WOMEN40%				0.0864 [1.48]
BODSIZE	0.0141** [2.17]	0.0141** [2.17]	0.0122* [1.86]	0.0159** [2.44]
BODIND	0.6453*** [6.86]	0.6453*** [6.86]	0.6531*** [7.00]	0.6861*** [7.39]
BODMEET	0.0119*** [3.01]	0.0119*** [3.01]	0.0124*** [3.15]	0.0122*** [3.09]
SUSCOM	0.3376*** [12.32]	0.3376*** [12.32]	0.3417*** [12.51]	0.3419*** [12.46]
SIZE	0.1029*** [9.20]	0.1029*** [9.20]	0.0996*** [8.84]	0.1045*** [9.34]
ROA	0.2684 [1.34]	0.2684 [1.34]	0.2594 [1.30]	0.2781 [1.38]
TOBINSQ	-0.0293 [-0.22]	-0.0293 [-0.22]	0.0082 [0.06]	-0.0004 [-0.00]
LOSS	0.0239 [0.56]	0.0239 [0.56]	0.0246 [0.58]	0.0196 [0.46]
LEV	0.2332*** [3.81]	0.2332*** [3.81]	0.2423*** [3.96]	0.2427*** [3.95]
Industry	Included	Included	Included	Included
Year	Included	Included	Included	Included
Intercept	0.248 [0.91]	0.1507 [0.56]	0.2354 [0.87]	0.0984 [0.37]
R-squared	0.469	0.469	0.4699	0.4657
N	1255	1255	1255	1255

* p<0.1, ** p<0.05, *** p<0.01. where WOMENless10%= 1 if the share of women on the board is below 10%, 0 otherwise; WOMEN10%= 1 if the share of women on the board is at least 10%, 0 otherwise; WOMEN20%= 1 if the share of women on the board is at least 20%, 0 otherwise; WOMEN40%= 1 if the share of women on the board is at least 40%, 0 otherwise. Variables are as defined in Appendix1.

Table S9- Testing for Gender Homophily Excluding the Financial Sector

	ESG_score	ESG_score	ESG_score	ESG_score
CEO_female	0.1410*** [3.22]	0.407* [2.64]	0.2988*** [4.09]	0.1708*** [3.62]
WOMENless10%	-0.1005*** [-2.89]			
WOMENless10%* CEO_gender	0.2668 [1.06]			
WOMEN10%		0.1005*** [2.89]		
WOMEN10%* CEO_gender		-0.2668* [-2.06]		
WOMEN20%			0.1008*** [3.61]	
WOMEN20%* CEO_gender			-0.2282** [-2.55]	
WOMEN40%				0.1422** [2.09]
WOMEN40%* CEO_gender				-0.2019* [-2.60]
BODSIZE	0.0138** [2.11]	0.0138** [2.11]	0.0102 [1.55]	0.0158** [2.42]
BODIND	0.6466*** [6.87]	0.6466*** [6.87]	0.6556*** [7.05]	0.6904*** [7.44]
BODMEET	0.0119*** [3.01]	0.0119*** [3.01]	0.0125*** [3.19]	0.0123*** [3.11]
SUSCOM	0.3368*** [12.28]	0.3368*** [12.28]	0.3421*** [12.56]	0.3444*** [12.54]
SIZE	0.1034*** [9.24]	0.1034*** [9.24]	0.1003*** [8.92]	0.1046*** [9.36]
ROA	0.2871 [1.43]	0.2871 [1.43]	0.2918 [1.46]	0.2854 [1.42]
TOBINSQ	-0.0334 [-0.25]	-0.0334 [-0.25]	0.0091 [0.07]	0.0074 [0.06]
LOSS	0.0249 [0.59]	0.0249 [0.59]	0.0262 [0.62]	0.0181 [0.43]
LEV	0.2335*** [3.81]	0.2335*** [3.81]	0.2376*** [3.89]	0.2408*** [3.92]
Industry	Included	Included	Included	Included
Year	Included	Included	Included	Included
Intercept	0.2422 [0.89]	0.1416 [0.53]	0.2243 [0.83]	0.0802 [0.30]
R-squared	0.4696	0.4696	0.4735	0.4672
N	1255	1255	1255	1255

*, ** and *** indicate statistical significance at 10%, 5% and 1% levels, respectively. Variables are as defined in Appendix 1.