



Female Director and ESG Performance

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Accepted October 2023

ABSTRACT

In recent years, awareness of gender equality has risen, political and economic power are no longer dominated solely by the male. More and more female are appearing in leadership roles in politics and corporate organizations, and the era of gender equality is fully reflected in the power distribution of political participation and various kinds of organizations. While most academic research has focused on how female participation in senior management and board of directors affects financial and non-financial consequences, empirical studies on female participation in the board of directors of large-scale publicly traded firms and its impact on ESG performance are relatively rare due to limited data availability. Filling this research gap is the main research motivation of the study. Based on data from 1,590 non-financial industry listed firms in Taiwan from 2015 to 2020, this study examines whether the increase in female participation in the board of directors affects firm's ESG performance, particularly its ESG rating, ESG score, ranking within industries based on SASB's classification, and detailed information on scores and rankings for individual ESG aspects. Empirical evidence generally shows that higher level of female participation in the board of directors correspond to worse ESG performance, which can be explained by communication costs, poor coordination, and the minority opinions are not given sufficient weight or consideration by the majority in the Social Identity Theory. However, interestingly, higher levels of female participation among independent directors help to improve a firm's ESG performance, especially in environmental performance. Furthermore, greater frequent attendance by female directors, longer tenure, and higher education levels also contribute to improving a firm's ESG performance. This indicates that gender diversity has a beneficial cost-effectiveness effect in the position of independent directors, and the appointment of female directors should consider their characteristics such as attendance, tenure, and education level.

Keywords: Female Director, ESG Performance

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1. Introduction

Board of directors is the highest governing institution of a corporation, responsible for exercising control and managing a firm's affairs while serving the rights of shareholders. Campbell and Mínguez-Vera (2008) proposed that the monitoring role of the board is a crucial element of corporate governance, especially in countries with underdeveloped external governance mechanisms. The gender composition of the board may have impacts on the quality of this monitoring role, consequently affecting the performance of various aspects of a corporation. In today's generation, there has been a rise in female empowerment, leading to a gradual reduction of stereotypes and constraints on women within the society. Traditional male-dominated corporate boards also have slowly embraced the inclusion of female member, and workplace restrictions on women have largely diminished, leading to an increasing presence of women in the top-tier in the business world. According to a report published by the Financial Supervisory Commission in Taiwan on gender norms for director in Asian countries, while most countries do not explicitly mandate gender ratio for director by law, they still promote gender diversity through corporate governance norms, indicating a global trend of valuing women. The World Bank's "2019 Women, Business and the Law" report surveyed 187 economies worldwide and assessed 8 indicators related to workplace gender protection laws. These indicators included freedom of movement, employment, wages, marriage, parenthood, starting a business, owning property, and retirement benefits. Taiwan ranked at the top in Asia, reflecting Taiwan's proactive commitment to gender equality.

The recognition of women's capabilities can be seen through the appointment of women to executive or board positions in corporations around the world. For example, in October 2014, the well-known American semiconductor manufacturer AMD appointed Ms. Lisa Su, as the President and CEO of AMD, making her the corporation's first female CEO. In September 2016, Ms. Pei-Chun Tsai, the CEO of Pou Chen Group, was ranked 37th on the *Fortune's* list of the world's top 50 female entrepreneurs, representing Taiwan as the only representative from the country. Additionally, in April of the same year, Ms. Pei-Chun Tsai was one of only two Taiwanese female entrepreneurs to be selected among the top 50 female powerhouses worldwide by the *Forbes*. The largest American confectionery manufacturer, Hershey's, welcomed its first female CEO, Ms. Michele Buck, in 2017. She had previously served as the General Manager at Kraft Foods, a chocolate manufacturer. During her time there, she faced a factory closure crisis, despite not having a background in factory operations. However, she focused on listening to the opinions of the manufacturing department's employees, identified areas for improvement, and ultimately saved the factory. Ms. Robyn Denholm assumed the role of director at the electric car manufacturer Tesla in 2014 and is one of only two women among the nine directors at Tesla. In 2018, she also became the chairperson of the corporation.

From the above, it can be seen that gender diversity among the corporate board and senior executives is one of the important recent trends in the economic and financial markets, and it is also a significant aspect of government regulatory policies regarding corporate governance. As businesses face various challenges, the diversity of board member enhances corporation's ability to adapt to a diverse environment. Daiwa Securities Inc. compared 565 companies in the Nikkei Index with female director accounting for over 10% of the total board members to the Nikkei Index. They found that during the period from 2012 to 2017, corporations with a higher proportion of female director formed an index with better stock performance and substantial operational results compared to the overall index. This demonstrates a strong positive relationship between a firm's stock market performance and the proportion of female director.

McLeod and Lobel (1992) noted that the diversity of organization member is sufficient to enhance the brainstorming process within a group by providing more thorough and thoughtful

insights. Boards with a high level of diversity, combining members with different intellectual, skill, background, and attributes, contribute to improving board functioning and efficiency, shaping better management decision, and enhancing firm value (Catalyst, 2004; Stephenson, 2004; Van der Walt and Ingley, 2003). From the perspective of agency theory (Jensen and Meckling, 1976), board diversity can increase the board independence and reduce the risk of collusion with the management. From a resource dependence viewpoint, Pfeffer and Salancik (1978) found that board diversity helps the board establish broader connection with external organizations and the environment. Brancato and Patterson (1999) mentioned that by increasing gender diversity, corporation gains deeper insight into various areas, such as legal, labor market, and product market aspects. Francoeur, Labelle and Sinclair-Desgagné (2008) suggested that in industries with high complexity, a higher proportion of female director helps maintain stable returns for the corporation.

However, from a cost perspective of board gender diversity, based on Social Identity Theory of Tajfel and Turner (1986) and the lingering gender stereotypes that persist in society, the opinions and perspectives of the female or minority board members may be marginalized, leading to their views not being taken into consideration by the majority of directors. Earley and Mosakowski (2000) suggest that board diversity can impact the efficiency of board functioning, delay decision-making, and reduce decision quality. Board diversity may exacerbate agency problem, further negatively affecting firm's operation and performance. Yu (2018) suggests that the appointment of female director in corporations may be done merely to comply with government regulation or to create a superficial image of board diversity for external perception. Kanter (2008) points out that having women on board may be more about showcasing gender diversity within the board rather than producing a significant improvement in decision-making and performance. Farrell and Hersch (2005), using the *Fortune's* top 500 U.S. corporations as a sample, found that the presence of female director did not elicit a significant response from investors in the market. Rose (2007), using a sample of Danish publicly-traded firms from 1998~2001, a country known for its high gender equality and a high female labor force participation rate, found no significant correlation between the proportion of female director and firm value proxied by the Tobin's q. Smith, Smith and Verner (2006) indicate that female director elected by employees have a positive impact on firm performance, whereas those appointed through other means may have negative consequences, possibly due to certain relational ties involved in the appointment. Nien, Chang and Hsu (2017) argue that the costs of board diversity include coordination and communication costs, as well as a reduction in efficiency due to a lack of expertise, which could potentially lead to a decline in firm performance and an increase in risk.

Women in the board of director not only have the potential to influence the corporation's operations but may also bring about changes in the corporation's operational models and considerations. Daily, Dalton and Cannella (2003) mentioned that a corporation's board of director, if composed of individuals with diverse perspectives and attributes, provide the corporation with a broader range of ideas, viewpoints, experiences, and considerations. People from different backgrounds and levels of expertise tend to have a wider scope of thorough thinking and considerations compared to individuals of a single type. The greater the diversity in levels and backgrounds of board members, the less likely the corporation is to make unethical decisions and actions that could harm its reputation (Arfken, Bellar and Helms, 2004). Board diversity contributes to the board's ability to question the management and effectively reduce incidents of corruption or shareholder wealth extraction within the corporation (Ramirez, 2003). Rosener (2003) and Konrad and Kramer (2006) found that firms with more female board members tend to have better corporate governance, consider the interests of various stakeholders, have robust mechanism and regulation to resolve conflicts of interests, and use

more non-financial performance indicators (such as social responsibility initiatives or innovation activities) to evaluate and form the corporation's operational consequence and strategies (Stephenson, 2004).

The characteristics of women in the board of director may lead the board to make operational decisions that better align with the interests of stakeholders or place a greater emphasis on corporate social responsibility (CSR). Eagly, Johannesen-Schmidt and van Engen (2003) found that, compared to men, women tend to exhibit qualities such as affectionate, kindful, helpful, sympathetic, interpersonally sensitive, nurturing, and caring about the well-being of others. Babcock (2012) provided survey results from New York experts, indicating that firms with a higher proportion of women in senior positions are more likely to implement CSR and sustainability strategies than other firms. Chang and Wang (2016) found that gender diversity in a board of directors or senior management encourages the corporation to prioritize the interests of stakeholders and allocate more resources to CSR. Similar findings have also been made by Setó-Pamies (2015), Hyun, Yang, Jung and Hong (2016), Zhou, Owusu-Ansah and Maggina (2018), Lim and Chung (2021), and Hyun, Kim, Han and Anderson (2021).

This study employs data from 1,590 non-financial industry listed firms on the Taiwan Stock Exchange and the Taipei Exchange between 2015~2020 to examine whether the presence of female director on corporate board influences its ESG performance. The potential contributions are following three folds. While existing research on board gender diversity and its impact on stakeholder-oriented CSR performance is well-documented, fewer studies have adopted a more specific evaluation framework on firm's ESG (Environmental, Social, Governance) performance, which is a contemporary approach for evaluating a firm's tangible commitment to the interests of various stakeholders. The ESG, was first introduced as a concept by the United Nations Global Compact in 2004 and is regarded as a more concrete set of indicators to assess a corporation's commitment to stakeholders' interests on various levels. A prominent business data company in Taiwan, Taiwan Economic Journal (TEJ), extensively evaluates publicly-traded firms in Taiwan, covering all the firm samples in the study, and derives specific numerical scores for multiple rating criteria for ESG performance. The advantage of using this rating system is that it allows for a more comprehensive and detailed examination of the overall ESG performance of boards with female member, as well as the performance on the individual E, S, and G dimensions, and rankings in different industry classification.

Secondly, this study takes a more nuanced approach by creating several variables that gauge the degree of board gender diversity. By observing the gender data of specific board members on an individual basis, this study constructs variables that measure whether a particular firm had female director, the number of female director, the percentage of female director among all board member, whether the chairman and vice-chairman are female, and the total number of female independent director—six variables in total. This approach provides a more comprehensive measure of the extent of female board member participation. Thirdly, this study further constructs non-gender characteristic variables for individual board members such as educational background, tenure, and board meeting attendance rate. This is done to examine whether these characteristics strengthen or weaken the relationship between board gender diversity and ESG performance, thus uncovering the mechanisms through which board gender diversity contributes to affect firm's ESG performance.

The next section is hypothesis development, followed by the third section on the introduction of variables, econometric models, firm samples, and data resource. The fourth section presents empirical result, and the final section concludes with recommendations.

2. Hypothesis Development

2.1 The Recent Development in Board Gender Diversity

In recent years, countries around the world have increasingly focused on promoting and implementing the concept of gender diversity in various fields, be it in politics or the economic and social spheres. Governments at various levels have actively pushed for the development of relevant laws and regulation to promote diversity among members of different types of organizations, including the corporate board of director, which is the subject of the study. Today, the global effort to promote women's participation on board is mainly be categorized into "quota system" and "disclosure-based system". Some countries, to enhance the effectiveness of regulation, have adopted both systems simultaneously.

Firstly, the primary aim of quota system is to ensure that the percentage of women on the board of corporation subject to regulation falls within the range of 30% to 50%. The European Economic Community (EEC) has been actively promoting gender equality legislation since 1957, with the Nordic countries making the fastest progress. The main countries and regions that have implemented gender quota systems include Norway, Iceland, France, Spain, Germany, the Netherlands, and the state of California in the U.S. Norway was the first country to legislate on this matter, requiring publicly traded corporations to have a minimum of 40% female director between 2003 and 2008. Iceland achieved its goal of having a 40% female board membership within five years by 2010. In 2011, France enacted legislation to address gender imbalances, mandating that at least 40% of female board member in listed corporations by 2016. Spain established regulation in 2015 requiring a 40% female board membership, and in 2016, Germany made it mandatory for publicly traded corporations to have a minimum of 30% female board members. The Netherlands legislated in 2020 that the boards of directors must have at least 30% of both male and female members (Tsai, 2016). In 2020, California passed a law that required corporations with five or more directors to have a minimum of two female directors, and for corporations with six or more directors, they needed at least three female directors (Chang, 2021).

Secondly, in the disclosure-based system for diversity policies, some countries have implemented more flexible regulation. Corporations in these countries are required to publicly disclose their diversity policy objectives, implementation progress, and other relevant information annually. These countries and regions include the United Kingdom, the United States, Hong Kong, and Singapore. When promoting board diversity in these regions, the focus extends beyond gender to include aspects such as race, age, and other backgrounds. In the United States, regulations enacted in 2009 require publicly traded corporations to disclose their corporate policies and progress in promoting board diversity. In the United Kingdom, regulations established in 2018 mandate that listed corporations consider diversity, including gender, race, and background, when appointing director. Starting in 2019, Singapore requires corporations to disclose their diversity policies and implementation progress in their annual reports. The Hong Kong Stock Exchange requires, as of 2019, that corporations develop diversity policies for their boards and outline how they intend to enhance the diversity of independent director. These policies and implementation progress must be disclosed in the corporate governance report and annual report (Chang, 2021).

In Taiwan, in accordance with the country's 2050 Net Zero Carbon Emissions roadmap, the Financial Supervisory Commission (FSC), Taiwan's securities regulator, issued the "Sustainable Development Roadmap for Listed and OTC Companies" on March 3, 2022. The aim of this initiative is to gradually encourage listed and OTC companies to disclose greenhouse gas information and enhance greenhouse gas verification. Building upon the foundation of corporate governance and sustainable development, the FSC established four

main pillars: "Governance", "Transparency", "Digital" and "Innovation". Using these pillars as a basis, they formulated five key directions to promote active engagement in sustainable development by businesses. Among these, "Deepening a Culture of Sustainable Governance" is aimed at strengthening sustainable governance, raising awareness of the importance of sustainability among corporation leadership, and promoting policy development and implementation.

The FSC has mandated the enhancement of sustainable governance, including increasing gender diversity within board and contributing to ecological balance on Earth. As such, the FSC has set a requirement for listed and OTC companies to have female director by 2024, advocating for a female director proportion of no less than one-third, with disclosure of related details in their annual reports. The implementation timeline is as follows: In 2023, the FSC will amend the annual reporting guidelines, and the Taiwan Stock Exchange and the Taipei Exchange will modify the regulations for listed and OTC company boards. This will require applicants for listing to have at least one director of a different gender, and this director should still adhere to relevant points and review criteria. In 2024, when board of director for listed and OTC companies are re-elected, they must appoint at least one director of a different gender. In 2025, if the number of director of a certain gender on the board of a listed or OTC company does not reach one-third, the company must provide specific disclosure in their annual report regarding the reasons for not meeting the target and the improvement measures to be taken.

2.2 The Influence of Female Director on ESG Performance

Zhang, Zhu and Ding (2013) pointed out that female directors possess specific psychological traits that make them more willing to listen to the voices of different stakeholders. Kamarudin, Anuar, Ariff and Ismail (2022) found that companies with higher levels of gender diversity on their boards exhibit better corporate sustainability performance. With the increasing participation of women on boards, diversity has been notably enhanced, and because women possess certain traits, boards may be more aligned with the interests of stakeholders and prioritize CSR when formulating or advocating for business decisions. Eagly, Johannesen-Schmidt and van Engen (2003) discovered that, compared to men, women exhibit traits such as being affectionate, kindful, helpful, sympathetic, interpersonally sensitive, and nurturing, showing their inclination toward the welfare of others. Zhou, Owusu-Ansah and Maggina (2018) also indicated that female executives are more likely to promote CSR reporting, suggesting that their prioritization of the mechanisms behind CSR is driven by altruistic preferences rather than risk-averse preferences.

Hyun, Yang, Jung and Hong (2016) found a positive correlation between the number (or proportion) of female independent directors and firm's CSR rating. Ko and Feng (2019) also found a positive relationship between female director with accounting background and CSR performance. Empirical analysis of 2,166 U.S. companies by Lim and Chung (2021) showed that female CEOs significantly positively impact CSR engagement. Hyun, Kim, Han and Anderson (2022) and others have suggested that increased female participation leads to greater attention in addressing CSR issues. Furthermore, during periods of economic uncertainty following the global financial crisis, increased female participation increase the advantages of the new era of business that emphasizes CSR.

Overall, female director contribute to enhancing firm's ESG performance. Firstly, female director brings more diverse perspectives. They typically offer different viewpoints and experiences, enabling the board to consider ESG issues more comprehensively. Female directors may have a greater focus on social and environmental issues and can provide recommendations on how to improve the firm's social and environmental performance.

Secondly, female directors are often more sensitive to social responsibility issues, aiding the corporation in better fulfilling its social responsibilities. They may drive the corporation to engage in charity and community involvement programs, enhance labor and human rights standards, and reduce environmental footprint. Thirdly, female directors can help improve the governance structure. They often emphasize transparency and accountability, reducing corruption risks and elevating overall governance standards. Lastly, female directors tend to be more cautious, aiding in identifying and managing risks, particularly those related to ESG issues, thus reducing potential legal and reputational risks that the corporation might face. Based on the above arguments, this study proposes the first hypothesis as followed:

Hypothesis 1-A: *There is a positive relationship between the degree of female participation in the board of directors and the firm's ESG performance.*

However, board diversity is not without its costs. For various reasons such as societal norms or human factors (Westphal and Milton, 2000), female or minority ethnic director may be marginalized by the majority of directors, and their opinions may not be considered by the majority. Additionally, board diversity leads to reduced cohesion, increased communication time, lack of trust and cooperation among directors, and communication and coordination challenges. Sometimes, corporation may consider director candidates for the sake of superficial board diversity, but these candidates may not necessarily possess the required level of managerial expertise. Furthermore, conflicts of interest may arise among directors. For these reasons, a diverse board may lead to decreased board efficiency, longer decision-making process, or reduced decision quality, exacerbating agency problems (Earley and Mosakowski, 2000; Williams and O' Reilly, 1998; Lau and Murnighan, 1998). Jehn, Northcraft and Neale (1999) have proposed that diversity among team members results in poorer overall performance in decision-making, organizational commitment, and performance.

Jianakoplos and Bernasek (1998) suggested that female director may make erroneous decisions due to their gender-specific risk-averse tendency, resulting in reduced company performance. Adams and Ferreira (2009) argued that a higher proportion of female director in a corporation might lead to "over-monitoring" by the board, potentially decreasing firm performance. Cox and Blake (1991) posited that increasing the ratio of female executives could raise firm costs due to increased turnover of senior management, negatively impacting firm performance. Richard, Barnett, Dwyer and Chadwick (2004) found that increasing the proportion of female director could heighten dissent caused by gender differences, thereby increasing board controversies during the decision-making process. Additionally, some studies provide evidence that female director is more likely to be seen as symbolic member of the board (Zelechowski and Bilimoria, 2004) and are appointed in large numbers to match the demographics of employees, meet societal expectations, or comply with legal mandates (Farrell and Hersch, 2005). The direct consequence of this symbolism is that female director may only play a superficial institutional role, while having little actual benefits to the board (Zelechowski and Bilimoria, 2004). Kanter (2003) also mentioned that board gender diversity might decrease firm performance or have no effect on firm performance because the appointment of female director may be driven solely by the symbolic image of board diversity that the firm wishes to portray.

Overall, female director may potentially lower firm's ESG performance by following points. First, gender diversity may lead to conflicts of different viewpoints and values among directors, especially when board members fail to cooperate or communicate effectively. Such conflicts can hinder the board from reaching consensus and prevent the firm from effectively pursuing ESG goals. Second, cultural and institutional barriers may limit the participation and influence of female directors, reducing the benefits of gender diversity. These barriers

may include gender discrimination, limited promotion opportunities, and work-life balance issues. Third, symbolic female directors may be appointed by the firm to comply with regulations or image-establishing requirements, and female directors may not actively engage in board discussions and decision-making because they may feel that their opinions will not be taken seriously, lacking real influence or capabilities. In such cases, symbolic female directors may not significantly enhance ESG performance. Based on the above arguments, this study proposes an alternative hypothesis:

Hypothesis 1-B: *There is a negative relationship between the degree of female participation in the board of directors and the firm's ESG performance.*

3. Variable, Econometric Model, Samples and Data

3.1 Variable

3.1.1 Explained Variable-ESG Performance

Recently, an improved way to keep track and measure firm's CSR engagement is to consider firm's ESG (Environment, Social, and Governance) performance. These three tangible objective metrics represent a triple bottom line that a firm should take with respect to its stakeholders. The public can also use these figures to measure a firm's effort on CSR engagement.

The Taiwan Economic Journal (TEJ) database, developed by a well-known business database company in Taiwan, constructed and released the TESG sustainability development index (<https://tesg.tej.com.tw/>) for Taiwan's publicly traded firms in 2022. The "E" in TESG stands for environmental protection assessment, which mainly evaluates a firm's carbon emissions, waste management, and energy efficiency, to measure whether the firm has made efforts to maintain the environment and work towards environmental sustainability during its development process. The "S" in TESG stands for a firm's practice and protection of stakeholders' rights and interests in society, evaluating factors such as labor rights, social participation, and customer protection for consumers, and promoting the establishment of a good workplace environment and the implementation of social responsibility. The "G" in TESG stands for corporate governance, including a firm's compliance with government regulations at all levels, the relationship between the company's board of directors and senior management, supply chain management, and risk management, to evaluate the incentive mechanisms and efficiency of a firm's management in its operations.

The TESG sustainable development index has emerged multiple variables. First, while the TESG rating is divided into seven levels, including A+, A, B+, B, B-, C, and C-. Based on these seven levels, this study assigns discontinuous numerical values, ranging from 7 to 1 points. The higher the score, the better the TESG rating, and the better the firm's overall performance in ESG. Second, TESG scores, range from 0 to 100 points, with 0 being the worst and 100 being the best. Third, the ranking of the TESG score among all samples (*tesgwr*). For example, if a specific firm's TESG score in a particular year ranks second among 25 sample companies, the notation in the database is (2/25). This study converts this notation to $[100-(2/25)*100]=92$. The higher the converted value, the higher the firm's rank among all samples and the better its overall performance in TESG among all samples. Fourth, the ranking of TESG score in the samples of main-industry classification by SASB (Sustainability Accounting Standards Board) (*tesgmr*), which is similar to the conversion process of the previous variable. The higher the converted value, the better the firm's performance in the samples of main industry classification by SASB. Fifth, the ranking of TESG score in the samples of sub-industry classification by SASB (*tesgsr*). The higher the value, the better the firm's performance in the samples of sub-industry classification by SASB.

This study further considers the performance of three ESG dimensions in TESG evaluation, including the score of firm's performance on environmental aspect (*envscore*), the ranking of the score of environmental aspect in samples of SASB main industry classification (*envmr*) (using the same conversion method as before), the ranking of the score of environmental aspect in samples of SASB sub-industry classification (*envsr*), the score of firm's performance on social aspect (*socscore*), the ranking of the score of social aspect in samples of SASB main industry classification (*socmr*), the ranking of the score of social aspect in samples of SASB sub-industry classification (*socsr*), the score of firm's performance on corporate governance aspect (*govscore*), the ranking of the score of corporate governance aspect in samples of SASB main industry classification (*govmr*), the ranking of the score of corporate governance aspect in samples of SASB sub-industry classification (*govsr*). The higher the values of the above variables, the better the firm's performance in the individual aspect in ESG performance.

3.1.2 Main Explanatory Variable-Board Gender Diversity

This study aims to explore whether the presentation of female director on corporate board affects firm's performance on ESG. The main explanatory variable is the presentation of female director, which is measured by six variables: (1) a dummy variable indicating whether the firm has female director (*fdd*), with a value of 1 if the firm has at least one female director and 0 if it has none. (2) the number of female director (*fdn*). (3) female director ratio (*fdr*), defined as the proportion of female director to the total number of board member. (4) a dummy variable indicating whether the board chair is female (*fbcd*), with a value of 1 if the board chair is female and 0 if not. (5) a dummy variable indicating whether the vice board chair is female (*fvbcd*), with a value of 1 if the vice board chair is female and 0 if not, and (6) a dummy variable indicating whether the firm has female independent director (*fidd*), with a value of 1 if the firm has at least one female independent director and 0 if it has none. The higher the value of the above variables, the greater the degree of the presentation of female director on corporate board.

3.1.3 Control Variable

This study refers to Liang and Renneboog (2017), Shen and Chang (2009), El Ghouli, Guedhami, Kwok and Wang (2016), Dyck, Lins, Roth and Wagner (2019), Chen, Dong and Chen (2020), and Boubakri, El Ghouli, Guedhami and Wang (2021), and considers several control variables that may influence a firm's CSR and ESG performance. First, the total assets (*asset*) is used as a measure of firm size, defined as the natural logarithm of total assets. Second, the debt ratio (*debt*) is used as a measure of financial risk, defined as total liabilities divided by total assets. Third, firm's profitability, proxied by returns on assets (*roa*), defined as earnings before interest and tax and then divided by total asset. Fourth, board independence, proxied by independent director ratio (*idr*), defined as the number of independent director to the total number of director. Fifth, institutional investors' shareholdings (*insthold*), defined as the number of shares hold by institutional investors and divided by the number of shares outstanding. Table 1 reports the abbreviation and definition of variables of each variable.

Table 1 The Abbreviation and Definition of Variables

| Variable | Abbreviation | Definition |
|---|-------------------|---|
| Explained Variable - ESG performance | | |
| TESG ratings | <i>tesgrating</i> | TESG ratings is divided into 7 levels, including A+, A, B+, B, B-, C, and C-. Assigning an integer value of 7, 6,...1 to the seven TEGS levels, respectively, and a higher score indicates a better TEGS rating |
| TESG score | <i>tesgscore</i> | The TEGS score is ranged from 0 to 100 points, with 0 being the worst and 100 being the best |
| The rank of TEGS score in full samples | <i>tesgwr</i> | If a specific firm's TEGS score in a particular year is ranked 2nd |

| | | |
|--|-----------------|---|
| | | out of 25 firms in the full sample, the notation in the database is (2/25). This notation can be converted to $[100 - (2/25)*100] = 92$, where a higher value indicates that the firm has a higher ranking and better performance in the full sample |
| The rank of TESG score in SASB main industry classification | <i>tesgmr</i> | If a specific firm's TESG score in a particular year is ranked 2nd out of 25 firms in the SASB main industry classification, the notation in the database is (2/25). This notation can be converted to $[100 - (2/25)*100] = 92$, where a higher value indicates that the firm has a higher ranking and better performance in the SASB main industry classification. |
| The rank of TESG score in SASB sub- industry classification | <i>tesgsr</i> | If a specific firm's TESG score in a particular year is ranked 2nd out of 25 firms in the SASB sub-industry classification, the notation in the database is (2/25). This notation can be converted to $[100 - (2/25)*100] = 92$, where a higher value indicates that the firm has a higher ranking and better performance in the SASB sub-industry classification. |
| TESG environment score | <i>envscore</i> | The TESG environment score is ranged from 0 to 100 points, with 0 being the worst and 100 being the best |
| The rank of TESG environment score in SASB main industry classification | <i>envmr</i> | The ranking of a specific firm's TESG environmental score in the SASB main industry samples in a particular year. |
| The rank of TESG environment score in SASB sub- industry classification | <i>envsr</i> | The ranking of a specific firm's TESG environmental score in the SASB sub-industry samples in a particular year. |
| TESG social score | <i>socscore</i> | The TESG social score is ranged from 0 to 100 points, with 0 being the worst and 100 being the best |
| The rank of TESG social score in SASB main industry classification | <i>socmr</i> | The ranking of a specific firm's TESG social score in the SASB main industry samples in a particular year. |
| The rank of TESG social score in SASB sub- industry classification | <i>socsr</i> | The ranking of a specific firm's TESG social score in the SASB sub-industry samples in a particular year. |
| TESG corporate governance score | <i>govscore</i> | The TESG corporate governance score is ranged from 0 to 100 points, with 0 being the worst and 100 being the best |
| The rank of TESG corporate governance score in SASB main industry classification | <i>govmr</i> | The ranking of a specific firm's TESG corporate governance score in the SASB main industry samples in a particular year. |
| The rank of TESG corporate governance score in SASB sub- industry classification | <i>govsr</i> | The ranking of a specific firm's TESG corporate governance score in the SASB sub-industry samples in a particular year. |
| Main Explanatory Variable - Board Gender Diversity | | |
| Female director dummy | <i>fdd</i> | A dummy variable indicating whether a firm has female director, with a value of 1 if a firm has at least one female director and 0 if it has none |
| The number of female director | <i>fdn</i> | The number of female director |
| Female director ratio | <i>fdr</i> | The proportion of female directors to the total number of board members |
| Female board chair dummy | <i>fidd</i> | A dummy variable indicating whether a firm has female independent directors, with a value of 1 if a firm has at least one female independent director and 0 if it has none |
| Dummy of female board vice chair | <i>fidd</i> | A dummy variable indicating whether a firm has female independent directors, with a value of 1 if a firm has at least one female independent director and 0 if it has none |
| Dummy of female independent director | <i>fidd</i> | A dummy variable indicating whether a firm has female independent directors, with a value of 1 if a firm has at least one female independent director and 0 if it has none |
| Control variable | | |
| Firm size | <i>asset</i> | The total assets and then takes the natural logarithm |
| Debt ratio | <i>debtr</i> | (Total liabilities divided by total assets)×100% |

| | | |
|--|----------------|--|
| Returns on assets | <i>roa</i> | Earnings before interest and tax / total asset |
| Independent director ratio | <i>idr</i> | The number of independent director to the total number of director |
| Institutional investors' shareholdings | <i>insthod</i> | (number of shares hold by institutional investors / number of shares outstanding) * 100% |

Note: this table reports the abbreviations and definitions of the variables. The variable definitions are based on the Taiwan Economic Journal (TEJ) database and the author's own definitions.

3.2 Econometric Model

This study employs multiple regression to estimate how the presentation of female director affects ESG performance. The regression equation is:

$$\text{ESG}_{i,t} = \beta_0 + \beta_1 \cdot \text{FEMALEDIR}_{i,t} + \beta_2 \cdot \text{asset}_{i,t} + \beta_3 \cdot \text{debt}_{i,t} + \beta_4 \cdot \text{roa}_{i,t} + \beta_5 \cdot \text{idr}_{i,t} + \beta_6 \cdot \text{insthold}_{i,t} + \varepsilon_{i,t} \quad (1)$$

where the subscripts i and t represent the firm i in year t , respectively. **ESG** is the vector of ESG performance variables, including TESG ratings (*tesgrating*), TESG score (*tesgscore*), the ranking of TESG score in full samples (*tesgwr*), the rank of TESG score in SASB main industry classification (*tesgmr*), the rank of TESG score in SASB sub-industry classification (*tesgsr*), TESG environment score (*envscore*), the rank of TESG environment score in SASB main industry classification (*envmr*), the rank of TESG environment score in SASB sub-industry classification (*envsr*), TESG social score (*socscore*), the rank of TESG social score in SASB main industry classification (*socmr*), the rank of TESG social score in SASB sub-industry classification (*socsr*), TESG corporate governance score (*govscore*), the rank of TESG corporate governance score in SASB main industry classification (*govmr*), the rank of TESG corporate governance score in SASB sub-industry classification (*govsr*). **FEMALEDIR** is the vector of the variables measuring the female participation on board, including the dummy of having female director (*fdd*), the number of female director (*fdn*), female director ratio (*fdr*), the dummy of having female board chair (*fidd*), the dummy of having female board vice chair (*fidd*) and the dummy of having female independent director (*fidd*). Regression controls include firm size (*asset*), debt ratio (*debtr*), returns on assets (*roa*), independent director ratio (*idr*) and institutional investors' shareholdings (*insthod*). The regression equation is pooled-OLS estimated.

3.3 Sample and Data

This study employs non-financial industry listed firms on the Taiwan Stock Exchange (TWSE) and the Taipei Exchange (TPEX) (excluding the firms of banking, insurance, billing, securities, and financial holdings companies) as the research samples, with a total of 1,590 firms. The data is yearly ranged from 2015 to 2020. The data of board member's gender and characteristics, the data of firm's financial characteristics, governance variables and ESG performance variables is collected from the Taiwan Economic Journal (TEJ) database. The data of quantitative variables used for subsequent analysis is 5% winsorized.

4. Empirical Evidence

4.1 Summary Statistics and Correlation Analysis

This sub-section reports the descriptive statistics of the sample and the results of correlation analysis. Table 2 reports the descriptive statistics of various variables, including the number of observations, mean, standard deviation, maximum, and minimum values. Panel A shows the results for the full sample, panel B for firms with female director ($fdd=1$), and panel C for firms without female directors ($fdd=0$). Comparing the results between panel B and panel C reveals that, in firms with female director, the average TESG rating level is 3.9032, while in firms

without female directors, the average TESG rating level is 3.9617. The mean difference *t*-test in the rightmost column indicates that the former (group of samples with *fdd*=1) is significantly lower than the latter (group of samples with *fdd*=0). This suggests that, on average, firms with female directors have worse TESG ratings. This finding aligns with Hypothesis 1B of the study. Upon observing the TESG scores, the ranking of TESG scores within the entire sample, the ranking of TESG score within SASB main industry classification, and the ranking of TESG score within SASB sub-industry classification for firms with female director, it is evident that all of these values are lower compared to firms without female director (the mean differences are negative in both cases). However, these differences do not reach statistical significance.

Furthermore, we observed the differences in average scores for environmental aspects, as well as the rankings of environmental scores within SASB main and sub-industry classification, between the two sample groups. It is evident that firms with female director have higher average score than firms without female director. However, there is no significant difference between the two groups of samples in these three variables. Similarly, when observing the scores related to social aspect and the ranking of score of social aspect within SASB main and sub-industries, it is found that, on average, firms with female director have slightly lower score than firms without female director. Yet, there is still no significant difference between the two groups in these three variables. However, when examining the three variables related to corporate governance score, the evidence shows that, on average, firms with female director significantly score lower than those without female director. Firms with female director exhibit relatively lower performance in corporate governance aspect.

Through testing the mean differences in various ESG performance variables between the two groups of sample, principal outcome shows that while there is some evidence that firms with female director perform worse in terms of overall ESG performance, the two groups do not exhibit significant differences in the environmental and social aspects. However, there is a significant decline in performance for firms with female director in the aspect of corporate governance.

Finally, when observing the differences in various control variables between the two sample groups, it can be noted that firms with female director tend to be smaller in size (the mean difference in *asset* between the two groups is significantly negative). Additionally, firms with female director tend to have higher returns on assets and a higher institutional investors' shareholdings. However, there are no significant differences between the two groups in terms of debt ratio and the ratio of independent director.

Table 2 Summary Statistics

| Variable | Panel A. Full samples | | | | | Panel B. Samples of firms with <i>fdd</i> =1 | | | | | Samples of firms with <i>fdd</i> =0 | | | | | Difference in mean |
|-------------------|-----------------------|--------|-----------|---------|--------|--|--------|-----------|---------|--------|-------------------------------------|--------|-----------|---------|--------|--------------------|
| | Num. of obs. | Mean | Std. Dev. | Min | Max | Num. of obs. | Mean | Std. Dev. | Min | Max | Num. of obs. | Mean | Std. Dev. | Min | Max | |
| <i>fdd</i> | 9,289 | 0.6286 | 0.4832 | 0.0000 | 1.0000 | 5,839 | 1.0000 | 0.0000 | 1.0000 | 1.0000 | 3,450 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 1.0000 |
| <i>fdn</i> | 9,289 | 0.9783 | 0.9981 | 0.0000 | 6.0000 | 5,839 | 1.5563 | 0.8279 | 1.0000 | 6.0000 | 3,450 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 1.5563*** |
| <i>fdr</i> | 9,289 | 13.017 | 13.2058 | 0.0000 | 55.556 | 5,839 | 20.708 | 10.8698 | 5.2632 | 55.556 | 3,450 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 20.708*** |
| <i>fbcd</i> | 9,289 | 0.0652 | 0.2470 | 0.0000 | 1.0000 | 5,839 | 0.1038 | 0.3050 | 0.0000 | 1.0000 | 3,450 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.1038*** |
| <i>fvbcd</i> | 9,289 | 0.0212 | 0.1441 | 0.0000 | 1.0000 | 5,839 | 0.0337 | 0.1806 | 0.0000 | 1.0000 | 3,450 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0337*** |
| <i>fidd</i> | 9,289 | 0.2512 | 0.4337 | 0.0000 | 1.0000 | 5,839 | 0.3996 | 0.4898 | 0.0000 | 1.0000 | 3,450 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.3996*** |
| <i>tesgrating</i> | 9,315 | 3.9249 | 1.5183 | 1.0000 | 7.0000 | 5,865 | 3.9032 | 1.5092 | 1.0000 | 7.0000 | 3,450 | 3.9617 | 1.5331 | 1.0000 | 7.0000 | -0.0586* |
| <i>tesgscore</i> | 9,315 | 54.599 | 7.6290 | 32.930 | 83.730 | 5,865 | 54.509 | 7.5943 | 32.930 | 83.730 | 3,450 | 54.753 | 7.6863 | 34.810 | 80.340 | -0.2441 |
| <i>tesgwr</i> | 9,315 | 56.342 | 28.523 | 0.0000 | 99.956 | 5,865 | 56.015 | 28.400 | 0.0000 | 99.956 | 3,450 | 56.898 | 28.728 | 0.0000 | 99.956 | -0.8828 |
| <i>tesgmr</i> | 9,315 | 56.205 | 28.316 | 0.0000 | 99.878 | 5,865 | 55.950 | 28.232 | 0.0000 | 99.877 | 3,450 | 56.637 | 28.456 | 0.0000 | 99.878 | -0.6864 |
| <i>tesgsr</i> | 9,315 | 54.694 | 28.393 | 0.0000 | 99.762 | 5,865 | 54.340 | 28.434 | 0.0000 | 99.757 | 3,450 | 55.295 | 28.318 | 0.0000 | 99.762 | -0.9551 |
| <i>envscore</i> | 9,315 | 54.759 | 10.728 | 25.350 | 90.350 | 5,865 | 54.759 | 10.710 | 25.350 | 90.350 | 3,450 | 54.759 | 10.759 | 28.280 | 89.310 | 0.0001 |
| <i>envmr</i> | 9,315 | 54.847 | 27.965 | 0.0000 | 99.878 | 5,865 | 54.925 | 27.989 | 0.0000 | 99.874 | 3,450 | 54.716 | 27.926 | 0.0000 | 99.878 | 0.2091 |
| <i>envsr</i> | 9,315 | 53.667 | 27.602 | 0.0000 | 99.762 | 5,865 | 53.676 | 27.682 | 0.0000 | 99.754 | 3,450 | 53.653 | 27.470 | 0.0000 | 99.762 | 0.0232 |
| <i>socscore</i> | 9,315 | 55.161 | 10.088 | 28.550 | 91.000 | 5,865 | 55.137 | 10.178 | 28.550 | 91.000 | 3,450 | 55.201 | 9.9352 | 31.140 | 90.030 | -0.0634 |
| <i>socmr</i> | 9,315 | 56.276 | 28.141 | 0.0000 | 99.878 | 5,865 | 56.177 | 28.114 | 0.0000 | 99.878 | 3,450 | 56.444 | 28.190 | 0.0000 | 99.755 | -0.2670 |
| <i>socsr</i> | 9,315 | 54.853 | 28.268 | 0.0000 | 99.762 | 5,865 | 54.751 | 28.454 | 0.0000 | 99.757 | 3,450 | 55.028 | 27.952 | 0.0000 | 99.762 | -0.2774 |
| <i>govscore</i> | 9,315 | 53.967 | 10.776 | 19.650 | 84.410 | 5,865 | 53.753 | 10.752 | 19.650 | 81.540 | 3,450 | 54.331 | 10.808 | 22.140 | 84.410 | -0.5785** |
| <i>govmr</i> | 9,315 | 52.330 | 29.321 | 0.0000 | 99.878 | 5,865 | 51.838 | 29.298 | 0.0000 | 99.875 | 3,450 | 53.166 | 29.347 | 0.0000 | 99.878 | -1.3280** |
| <i>govsr</i> | 9,315 | 51.118 | 29.282 | 0.0000 | 99.757 | 5,865 | 50.455 | 29.160 | 0.0000 | 99.752 | 3,450 | 52.246 | 29.456 | 0.0000 | 99.757 | -1.7900*** |
| <i>asset</i> | 9,505 | 15.142 | 1.3953 | 11.996 | 19.479 | 6,055 | 15.124 | 1.4039 | 11.996 | 19.479 | 3,450 | 15.173 | 1.3796 | 11.996 | 19.479 | -0.0489* |
| <i>debt</i> | 9,505 | 36.150 | 17.987 | 2.4870 | 83.883 | 6,055 | 36.292 | 17.898 | 2.4870 | 83.883 | 3,450 | 35.901 | 18.142 | 2.4870 | 83.883 | 0.3909 |
| <i>roa</i> | 9,473 | 7.0261 | 9.9250 | -27.707 | 35.870 | 6,023 | 7.2418 | 9.9568 | -27.707 | 35.870 | 3,450 | 6.6496 | 9.8595 | -27.707 | 35.870 | 0.5922*** |
| <i>idr</i> | 9,309 | 33.051 | 11.436 | 0.0000 | 60.000 | 5,859 | 32.995 | 11.240 | 0.0000 | 60.000 | 3,450 | 33.144 | 11.762 | 0.0000 | 60.000 | -0.1485 |
| <i>insthold</i> | 9,301 | 41.129 | 22.600 | 1.0089 | 92.171 | 5,853 | 41.771 | 22.719 | 1.0089 | 92.171 | 3,448 | 40.039 | 22.357 | 1.0089 | 92.171 | 1.7320*** |

Note: this table reports the basic summarize statistics of each variable, including the number of non-missing observations, mean, standard deviation, minimum and maximum of full samples (Panel A), samples of firm with female director (*fdd*=1) and samples of firm without female director *fdd*=0. The rightmost column reports the differences in means (and *t*-statistics) of each variable. The data period is from 2015 to 2020. *, ** and *** show that the differences in means reach 10%, 5% and 1% significant level, respectively.

Table 3 reports the pairwise Pearson correlation coefficients among various variables. First, when examining the relationship between TESG rating levels and six board gender diversity variables, it is evident that firms with female director, more female director, a higher female director ratio, and having female chairperson tend to have lower TESG rating levels (all pairwise correlations are negative and significant). However, firms with female independent director have higher TESG rating level (all pairwise correlations are positive and significant). This suggests that while the first four gender diversity variables on the board have a negative impact on ESG performance, having female independent director corresponds to higher TESG rating levels. The empirical results partially support Hypothesis 1B, and Hypothesis 1A is only supported when the gender diversity variable is female independent director.

Additionally, when observing the other TESG variables and the performance of individual ESG aspects, it can be seen that most TESG variables are negatively correlated with the first four board gender diversity variables, indicating that increasing the degree of board gender diversity reduces the overall TESG performance and performance in three individual aspects. Interestingly, having female independent director is found to enhance the score of environment aspect and corporate governance aspect, while it significantly lowers the performance of social aspect.

Overall, the results of *t*-test of mean difference in board gender diversity variables between firms with female director versus without female director direct and correlation analysis indicate that, when not distinguishing between non-independent director and independent director, an increase in board gender diversity tends to lower ESG performance. However, when considering only the gender diversity of independent director, it can be observed that having female independent director is conducive to enhancing the overall ESG performance. Nevertheless, this enhancement is reflected in distinct patterns across different ESG dimensions. Gender diversity in the level of independent director leads to improved environmental and corporate governance performance but still has a noticeable negative impact on social performance.

4.2 Regression Result

Table 4 reports the regression estimation result on how board gender diversity, as measured by the dummy variable indicating the presence of female director (*fdd*), affects the firm's overall ESG performance and performance on three individual ESG aspects. Firstly, it is observed that in panel A, estimated coefficients on *fdd* are negative for all five ESG overall scores. These coefficients reach statistical significance of 10% level in model (1), (2), (3), and (5). This suggests that firms with female director tend to have worse ESG rating, lower ESG score, and be weaker in ranking within their counterparts in SASB industry classifications. The empirical finding tends to support Hypothesis 1B of the study. Having female director may lead to conflicts of different perspectives and values among board members, reducing the likelihood of reaching a consensus toward firm's strategies or policies. Furthermore, certain cultural and institutional inertia within the board may limit the active participation and influence of female director. In some cases, if female director are symbolic in nature, their involvement and influence may be even significantly reduced. In these situations, the presence of such kind of female director adversely impacts the firm's ESG performance.

Table 3 Correlation Coefficients

| variable | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) | (12) | (13) | (14) | (15) | (16) | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 |
|-------------------|----------|----------|----------|----------|----------|----------|---------|---------|---------|---------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|---------|---------|--------|
| <i>fdd</i> | 1.0000 | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>fdn</i> | 0.7534* | 1.0000 | | | | | | | | | | | | | | | | | | | | | | | |
| <i>fdr</i> | 0.7577* | 0.9380* | 1.0000 | | | | | | | | | | | | | | | | | | | | | | |
| <i>fbcd</i> | 0.2031* | 0.2700* | 0.2829* | 1.0000 | | | | | | | | | | | | | | | | | | | | | |
| <i>fvbcd</i> | 0.1131* | 0.1192* | 0.1162* | -0.0117 | 1.0000 | | | | | | | | | | | | | | | | | | | | |
| <i>fidd</i> | 0.4452* | 0.5327* | 0.5399* | 0.0470* | -0.0025 | 1.0000 | | | | | | | | | | | | | | | | | | | |
| <i>tesgrating</i> | -0.0187* | -0.0188* | -0.0776* | -0.0191* | -0.0153 | 0.0182* | 1.0000 | | | | | | | | | | | | | | | | | | |
| <i>tesgscore</i> | -0.0155 | -0.0160 | -0.0769* | -0.0214* | -0.0079 | 0.0226* | 0.9725* | 1.0000 | | | | | | | | | | | | | | | | | |
| <i>tesgwr</i> | -0.0150 | -0.0145 | -0.0716* | -0.0162 | -0.0113 | 0.0171* | 0.9679* | 0.9632* | 1.0000 | | | | | | | | | | | | | | | | |
| <i>tesgmr</i> | -0.0118 | -0.0103 | -0.0668* | -0.0129 | -0.0109 | 0.0214* | 0.9610* | 0.9569* | 0.9927* | 1.0000 | | | | | | | | | | | | | | | |
| <i>tesgsr</i> | -0.0161 | -0.0134 | -0.0668* | -0.0195* | -0.0037 | 0.0173* | 0.9146* | 0.9101* | 0.9457* | 0.9525* | 1.0000 | | | | | | | | | | | | | | |
| <i>envscore</i> | 0.0001 | -0.0105 | -0.0582* | -0.0136 | 0.0190* | 0.0175* | 0.6730* | 0.7027* | 0.6500* | 0.6385* | 0.6206* | 1.0000 | | | | | | | | | | | | | |
| <i>envmr</i> | 0.0035 | -0.0080 | -0.0516* | -0.0239* | 0.0238* | 0.0154 | 0.6461* | 0.6605* | 0.6425* | 0.6340* | 0.6141* | 0.9336* | 1.0000 | | | | | | | | | | | | |
| <i>envsr</i> | 0.0004 | -0.0090 | -0.0462* | -0.0258* | 0.0182* | 0.0166 | 0.6205* | 0.6329* | 0.6166* | 0.6100* | 0.6368* | 0.9003* | 0.9616* | 1.0000 | | | | | | | | | | | |
| <i>socscore</i> | -0.0031 | -0.0106 | -0.0786* | -0.0184* | 0.0040 | -0.0179* | 0.7312* | 0.7545* | 0.7181* | 0.7107* | 0.6572* | 0.4735* | 0.4421* | 0.4165* | 1.0000 | | | | | | | | | | |
| <i>socmr</i> | -0.0047 | -0.0153 | -0.0722* | -0.0202* | -0.0051 | -0.0220* | 0.7086* | 0.7162* | 0.7166* | 0.7184* | 0.6698* | 0.4389* | 0.4256* | 0.4068* | 0.9511* | 1.0000 | | | | | | | | | |
| <i>socsr</i> | -0.0047 | -0.0147 | -0.0695* | -0.0260* | 0.0070 | -0.0241* | 0.6686* | 0.6755* | 0.6758* | 0.6778* | 0.7111* | 0.4328* | 0.4185* | 0.4379* | 0.8836* | 0.9350* | 1.0000 | | | | | | | | |
| <i>govscore</i> | -0.0260* | -0.0152 | -0.0373* | -0.0139 | -0.0310* | 0.0456* | 0.6938* | 0.7036* | 0.7028* | 0.7056* | 0.6775* | 0.2116* | 0.2092* | 0.2012* | 0.2017* | 0.1866* | 0.1751* | 1.0000 | | | | | | | |
| <i>govmr</i> | -0.0220* | -0.0111 | -0.0321* | -0.0100 | -0.0236* | 0.0468* | 0.6861* | 0.6873* | 0.7019* | 0.7066* | 0.6784* | 0.2086* | 0.2063* | 0.1992* | 0.2000* | 0.1846* | 0.1723* | 0.9739* | 1.0000 | | | | | | |
| <i>govsr</i> | -0.0295* | -0.0218* | -0.0378* | -0.0157 | -0.0182* | 0.0436* | 0.6591* | 0.6599* | 0.6758* | 0.6804* | 0.7009* | 0.2069* | 0.2046* | 0.2176* | 0.1810* | 0.1691* | 0.1925* | 0.9378* | 0.9623* | 1.0000 | | | | | |
| <i>asset</i> | -0.0009 | 0.0203* | -0.0751* | -0.0043 | 0.0119 | -0.0218* | 0.4200* | 0.4404* | 0.4042* | 0.3957* | 0.3670* | 0.4033* | 0.3756* | 0.3424* | 0.4839* | 0.4272* | 0.3970* | 0.1416* | 0.1294* | 0.1153* | 1.0000 | | | | |
| <i>debt</i> | 0.0078 | 0.0270* | 0.0299* | -0.0197* | 0.0192* | -0.0028 | 0.0077 | 0.0117 | -0.0005 | -0.0052 | -0.0196* | 0.0555* | 0.0480* | 0.0307* | 0.0339* | 0.0179* | -0.0071 | -0.0366* | -0.0382* | -0.0513* | 0.2230* | 1.0000 | | | |
| <i>roa</i> | 0.0189* | 0.0191* | -0.0030 | -0.0117 | 0.0008 | 0.0353* | 0.2600* | 0.2674* | 0.2659* | 0.2686* | 0.2464* | 0.1512* | 0.1526* | 0.1436* | 0.2099* | 0.2149* | 0.1931* | 0.2101* | 0.2013* | 0.1863* | 0.1880* | -0.0937* | 1.0000 | | |
| <i>idr</i> | -0.0064 | -0.0237* | 0.0364* | 0.0210* | 0.0037 | 0.1993* | 0.0152 | 0.0164 | 0.0188* | 0.0255* | 0.0289* | -0.0468* | -0.0583* | -0.0480* | -0.0741* | -0.0641* | -0.0624* | 0.1247* | 0.1342* | 0.1380* | -0.1002* | -0.0166 | 0.0322* | 1.0000 | |
| <i>insthold</i> | 0.0373* | 0.0564* | 0.0036 | 0.0286* | -0.0124 | 0.0453* | 0.2136* | 0.2297* | 0.1967* | 0.1922* | 0.1725* | 0.1678* | 0.1398* | 0.1288* | 0.2295* | 0.1889* | 0.1678* | 0.1259* | 0.1139* | 0.0898* | 0.4101* | 0.0420* | 0.2244* | -0.0098 | 1.0000 |

Note: this table reports the pairwise Pearson correlation coefficients among variables. The data period is from 2015 to 2020. The asterisk mark means that a correlation coefficient reaches a significance level of 5%. Please refer to Table 1 for the definitions of variables.

Table 4 Regression Result of the Effects of Board Gender Diversity (*fdd*) on Overall and Individual ESG Score

| Explanatory Variable | Explained Variable (Overall and Individual ESG Score) | | | | | | | | | | | | | |
|----------------------|---|-----------------------|-----------------------|----------------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|---------------------------|-----------------------|-----------------------|-----------------------|
| | Panel A. TESG Ratings and Total Score | | | Panel B. Environment Score | | | | Panel C. Social Score | | | Panel D. Governance Score | | | |
| | <i>tesgrating</i> | <i>tesgscore</i> | <i>tesgwr</i> | <i>tesgmr</i> | <i>tesgsr</i> | <i>envscore</i> | <i>envmr</i> | <i>envsr</i> | <i>socscore</i> | <i>socmr</i> | <i>socsr</i> | <i>govscore</i> | <i>govmr</i> | <i>govsr</i> |
| (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) | (12) | (13) | (14) | |
| <i>fdd</i> | -0.0674** (-2.33) | -0.291** (-2.03) | -1.022* (-1.87) | -0.817 (-1.50) | -1.040* (-1.87) | -0.00594 (-0.03) | 0.211 (0.38) | 0.0307 (0.06) | -0.108 (-0.58) | -0.373 (-0.69) | -0.323 (-0.59) | -0.661*** (-2.96) | -1.526** (-2.51) | -1.908*** (-3.13) |
| <i>asset</i> | 0.437*** (37.66) | 2.290*** (39.72) | 7.993*** (36.42) | 7.788*** (35.65) | 7.403*** (33.25) | 3.096*** (36.65) | 7.610*** (34.16) | 6.903*** (30.95) | 3.397*** (45.08) | 8.452*** (38.99) | 8.117*** (36.70) | 0.857*** (9.58) | 2.189*** (8.97) | 2.172*** (8.89) |
| <i>debt</i> | -0.00562*** (-6.94) | -0.0283*** (-7.04) | -0.112*** (-7.34) | -0.116*** (-7.59) | -0.134*** (-8.66) | -0.0174*** (-2.95) | -0.0461*** (-2.97) | -0.0625*** (-4.02) | -0.0357*** (-6.80) | -0.101*** (-6.71) | -0.138*** (-8.96) | -0.0268*** (-4.29) | -0.0735*** (-4.32) | -0.0952*** (-5.59) |
| <i>roa</i> | 0.0258*** (17.25) | 0.131*** (17.65) | 0.516*** (18.28) | 0.524*** (18.66) | 0.475*** (16.59) | 0.0750*** (6.90) | 0.228*** (7.98) | 0.212*** (7.40) | 0.108*** (11.17) | 0.363*** (13.02) | 0.311*** (10.95) | 0.185*** (16.07) | 0.485*** (15.45) | 0.451*** (14.35) |
| <i>idr</i> | 0.00651*** (5.28) | 0.0348*** (5.68) | 0.127*** (5.45) | 0.141*** (6.09) | 0.145*** (6.13) | -0.00754 (-0.84) | -0.0547** (-2.31) | -0.0371 (-1.57) | -0.0277*** (-3.46) | -0.0670*** (-2.91) | -0.0684*** (-2.91) | 0.122*** (12.86) | 0.355*** (13.71) | 0.362*** (13.93) |
| <i>insthold</i> | 0.00115* (1.67) | 0.00870** (2.55) | 0.00268 (0.21) | -0.000348 (-0.03) | -0.00915 (-0.70) | -0.00470 (-0.94) | -0.0390*** (-2.96) | -0.0346*** (-2.62) | 0.00791* (1.77) | -0.00836 (-0.65) | -0.0191 (-1.46) | 0.0224*** (4.24) | 0.0508*** (3.52) | 0.0243* (1.68) |
| constant | -2.905*** (-16.86) | 18.66*** (21.81) | -68.08*** (-20.91) | -65.51*** (-20.21) | -59.78*** (-18.10) | 8.350*** (6.66) | -57.22*** (-17.32) | -47.62*** (-14.40) | 4.825*** (4.32) | -68.00*** (-21.15) | -62.18*** (-18.95) | 36.12*** (27.22) | 5.571 (1.54) | 6.753* (1.86) |
| Num. of obs. | 9,281 | 9,281 | 9,281 | 9,281 | 9,281 | 9,281 | 9,281 | 9,281 | 9,281 | 9,281 | 9,281 | 9,281 | 9,281 | 9,281 |
| Adj. R-square | 0.215 | 0.234 | 0.205 | 0.201 | 0.175 | 0.168 | 0.149 | 0.125 | 0.252 | 0.204 | 0.178 | 0.075 | 0.071 | 0.064 |
| Prob. of F-stat. | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |

Note: This table reports the regression estimates of the effects of corporate board gender diversity (the dummy of whether a firm has female director: *fdd*) on firm's overall and individual ESG score. The measurement of overall and individual ESG score include TEGS rating (*tesgrating*), TEGS score (*tesgscore*), the rank of TEGS score in full samples (*tesgwr*), the rank of TEGS score in SASB main industry classification (*tesgmr*), the rank of TEGS score in SASB sub-industry classification (*tesgsr*), TEGS environmental score (*envscore*), the rank of TEGS environmental score in SASB main industry classification (*envmr*), the rank of TEGS environmental score in SASB sub-industry classification (*envsr*), TEGS environmental social score (*socscore*), the rank of TEGS social score in SASB main industry classification (*socmr*), the rank of TEGS social score in SASB sub-industry classification (*socsr*), TEGS corporate governance score (*govscore*), the rank of TEGS corporate governance score in SASB main industry classification (*govmr*), the rank of TEGS corporate governance score in SASB sub-industry classification (*govsr*). Control variables include firm size (*asset*), debt ratio (*debt*), returns on assets (*roa*), independent director ratio (*idr*) and institutional investors' shareholdings (*insthold*). The data period is from 2015 to 2020. The *t*-values of the estimated coefficients are shown in parentheses, and *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

In panel B and panel C, it is evident that the dummy variable indicating the presence of female director does not reach statistically significance level of at least 10% for the coefficients influencing the variables related to the environmental aspect and social aspect. This suggests that having female director does not impact the firm's performance in terms of environmental and social dimensions. However, in panel D, it becomes apparent that the presence of female director has a negative impact on the three variables related to corporate governance. The coefficients on corporate governance score and rankings within both the SASB main industry and sub-industry classifications are negative and statistically significant at a level of at least 10%. This indicates that firms with female director tend to exhibit poorer corporate governance performance. Hence, it can be inferred that the predominantly negative impact of female director on overall ESG performance can largely be explained by their association with reduced performance on corporate governance.

Observing the coefficients of the various control variables from panel A to panel D, it is evident that the coefficients on firm scale (*asset*) are positive and statistically significant. The coefficients on debt ratio (*debt*) are almost significantly negative, while the coefficients on returns on assets (*roa*) are nearly positive and significant. The majority of coefficients on institutional investors' shareholdings (*insthold*) is significantly positive. This indicates that firms with larger scale, lower leverage, greater profitability, and higher institutional investors' shareholdings tend to have better overall ESG performance. Furthermore, these firms also exhibit relatively better performance on environmental, social, and corporate governance aspect.

Table 5 reports the regression estimation result of board gender diversity (measured by the number of female director, *fdn*), affects the firm's overall ESG performance and individual ESG aspects. Upon examining the estimated coefficients of the main explanatory variables in panel A to D, it is apparent that the majority of them are negative and statistically significant. This implies that as the number of female director increases, the firm's ESG rating level is decreasing, ESG score are lower, and the rankings in ESG scores within SASB industry classification are further behind. Furthermore, as the number of female director increases, the rating in environmental, social, and corporate governance aspect is lower, and the rankings within these three aspects within SASB industry classification also lag behind. Overall, the empirical result supports Hypothesis 1B of the study, indicating that board gender diversity diminishes ESG performance.

Table 6 presents the regression estimation result on whether board gender diversity (measured by the ratio of female directors, *fdr*), affects overall ESG performance and performance across three individual ESG aspect. Upon examining the estimated coefficients of the main explanatory variables in panel A to D, it is evident that the majority of them are negative and statistically significant. This indicates that as the ratio of female director increases, firm's ESG rating levels are unfavorable, ESG score, as well as scores across three individual ESG aspects, are also lower. Furthermore, the overall ESG score and scores in the three ESG aspect further behind counterparts within SASB industry classification. The empirical results are similar to those presented in Table 5.

Table 5 Regression Result of the Effects of Board Gender Diversity (*fdn*) on Overall and Individual ESG Score

| Explanatory Variable | Explained Variable (Overall and Individual ESG Score) | | | | | | | | | | | | | |
|----------------------|---|-----------------------|-----------------------|-----------------------|-----------------------|----------------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|---------------------------|-----------------------|-----------------------|
| | Panel A. TESG Ratings and Total Score | | | | | Panel B. Environment Score | | | Panel C. Social Score | | | Panel D. Governance Score | | |
| | <i>tesgrating</i> | <i>tesgscore</i> | <i>tesgwr</i> | <i>tesgmr</i> | <i>tesgsr</i> | <i>envscore</i> | <i>envmr</i> | <i>envsr</i> | <i>socscore</i> | <i>socmr</i> | <i>socsr</i> | <i>govscore</i> | <i>govmr</i> | <i>govsr</i> |
| (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) | (12) | (13) | (14) | |
| <i>fdn</i> | -0.0426*** (-3.04) | -0.198*** (-2.84) | -0.647** (-2.44) | -0.511* (-1.94) | -0.561** (-2.09) | -0.200** (-1.97) | -0.422 (-1.57) | -0.420 (-1.56) | -0.223** (-2.46) | -0.697*** (-2.67) | -0.634** (-2.37) | -0.204* (-1.89) | -0.407 (-1.38) | -0.668** (-2.26) |
| <i>asset</i> | 0.438*** (37.69) | 2.290*** (39.74) | 7.995*** (36.44) | 7.789*** (35.66) | 7.406*** (33.27) | 3.094*** (36.63) | 7.603*** (34.14) | 6.898*** (30.94) | 3.396*** (45.08) | 8.448*** (38.99) | 8.112*** (36.69) | 0.860*** (9.62) | 2.198*** (9.01) | 2.182*** (8.92) |
| <i>debt</i> | -0.00557*** (-6.88) | -0.0281*** (-6.99) | -0.112*** (-7.29) | -0.115*** (-7.55) | -0.134*** (-8.62) | -0.0171*** (-2.90) | -0.0453*** (-2.92) | -0.0618*** (-3.97) | -0.0354*** (-6.73) | -0.100*** (-6.64) | -0.137*** (-8.90) | -0.0267*** (-4.27) | -0.0734*** (-4.31) | -0.0948*** (-5.56) |
| <i>roa</i> | 0.0258*** (17.26) | 0.131*** (17.66) | 0.516*** (18.29) | 0.524*** (18.66) | 0.475*** (16.59) | 0.0752*** (6.93) | 0.229*** (8.01) | 0.213*** (7.43) | 0.108*** (11.19) | 0.363*** (13.04) | 0.312*** (10.97) | 0.185*** (16.04) | 0.484*** (15.42) | 0.450*** (14.33) |
| <i>idr</i> | 0.00644*** (5.22) | 0.0345*** (5.63) | 0.126*** (5.41) | 0.140*** (6.05) | 0.144*** (6.09) | -0.00798 (-0.89) | -0.0557** (-2.36) | -0.0381 (-1.61) | -0.0282*** (-3.52) | -0.0684*** (-2.97) | -0.0696*** (-2.96) | 0.122*** (12.83) | 0.355*** (13.69) | 0.361*** (13.89) |
| <i>insthold</i> | 0.00119* (1.74) | 0.00894*** (2.62) | 0.00340 (0.26) | 0.000210 (0.02) | -0.00867 (-0.66) | -0.00419 (-0.84) | -0.0377*** (-2.86) | -0.0335** (-2.54) | 0.00838* (1.88) | -0.00691 (-0.54) | -0.0178 (-1.36) | 0.0223*** (4.22) | 0.0505*** (3.50) | 0.0242* (1.67) |
| constant | -2.909*** (-16.95) | 18.66*** (21.90) | -68.14*** (-21.01) | -65.56*** (-20.31) | -59.94*** (-18.22) | 8.557*** (6.85) | -56.63*** (-17.20) | -47.16*** (-14.31) | 4.982*** (4.47) | -67.54*** (-21.09) | -61.75*** (-18.90) | 35.86*** (27.12) | 4.896 (1.36) | 6.077* (1.68) |
| Num. of obs. | 9,281 | 9,281 | 9,281 | 9,281 | 9,281 | 9,281 | 9,281 | 9,281 | 9,281 | 9,281 | 9,281 | 9,281 | 9,281 | 9,281 |
| Adj. R-square | 0.215 | 0.234 | 0.206 | 0.201 | 0.175 | 0.169 | 0.149 | 0.125 | 0.252 | 0.205 | 0.179 | 0.074 | 0.070 | 0.064 |
| Prob. of F-stat. | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |

Note: This table reports the regression estimates of the effects of corporate board gender diversity (the number of female director: *fdn*) on firm's overall and individual ESG score. The measurement of overall and individual ESG score include TESG rating (*tesgrating*), TESG score (*tesgscore*), the rank of TESG score in full samples (*tesgwr*), the rank of TESG score in SASB main industry classification (*tesgmr*), the rank of TESG score in SASB sub-industry classification (*tesgsr*), TESG environmental score (*envscore*), the rank of TESG environmental score in SASB main industry classification (*envmr*), the rank of TESG environmental score in SASB sub-industry classification (*envsr*), TESG environmental social score (*socscore*), the rank of TESG social score in SASB main industry classification (*socmr*), the rank of TESG social score in SASB sub-industry classification (*socsr*), TESG corporate governance score (*govscore*), the rank of TESG corporate governance score in SASB main industry classification (*govmr*), the rank of TESG corporate governance score in SASB sub-industry classification (*govsr*). Control variables include firm size (*asset*), debt ratio (*debt*), returns on assets (*roa*), independent director ratio (*idr*) and institutional investors' shareholdings (*insthold*). The data period is from 2015 to 2020. The *t*-values of the estimated coefficients are shown in parentheses, and *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

Table 6 Regression Result of the Effects of Board Gender Diversity (*fdr*) on Overall and Individual ESG Score

| Explanatory Variable | Explained Variable (Overall and Individual ESG Score) | | | | | | | | | | | | | |
|----------------------|---|-----------------------|-----------------------|----------------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|---------------------------|-----------------------|-----------------------|-----------------------|-----------------------|
| | Panel A. TESG Ratings and Total Score | | | Panel B. Environment Score | | | Panel C. Social Score | | | Panel D. Governance Score | | | | |
| | <i>tesgrating</i> | <i>tesgscore</i> | <i>tesgwr</i> | <i>tesgmr</i> | <i>tesgsr</i> | <i>envscore</i> | <i>envmr</i> | <i>envsr</i> | <i>socscore</i> | <i>socmr</i> | <i>socsr</i> | <i>govscore</i> | <i>govmr</i> | <i>govsr</i> |
| (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) | (12) | (13) | (14) | |
| <i>fdr</i> | -0.00543*** (-5.11) | -0.0262*** (-4.97) | -0.0904*** (-4.50) | -0.0807*** (-4.04) | -0.0834*** (-4.10) | -0.0218*** (-2.82) | -0.0451** (-2.21) | -0.0379* (-1.86) | -0.0310*** (-4.49) | -0.0809*** (-4.08) | -0.0770*** (-3.81) | -0.0262*** (-3.20) | -0.0613*** (-2.75) | -0.0734*** (-3.28) |
| <i>asset</i> | 0.433*** (37.14) | 2.266*** (39.19) | 7.912*** (35.94) | 7.714*** (35.20) | 7.329*** (32.81) | 3.074*** (36.26) | 7.563*** (33.82) | 6.865*** (30.67) | 3.367*** (44.55) | 8.374*** (38.51) | 8.042*** (36.24) | 0.836*** (9.31) | 2.141*** (8.74) | 2.116*** (8.62) |
| <i>debt</i> | -0.00542*** (-6.70) | -0.0274*** (-6.81) | -0.109*** (-7.12) | -0.113*** (-7.39) | -0.131*** (-8.46) | -0.0165*** (-2.80) | -0.0442*** (-2.84) | -0.0610*** (-3.92) | -0.0345*** (-6.57) | -0.0982*** (-6.50) | -0.135*** (-8.76) | -0.0260*** (-4.16) | -0.0716*** (-4.21) | -0.0930*** (-5.45) |
| <i>roa</i> | 0.0258*** (17.31) | 0.131*** (17.70) | 0.517*** (18.33) | 0.525*** (18.71) | 0.475*** (16.63) | 0.0754*** (6.95) | 0.230*** (8.02) | 0.213*** (7.43) | 0.109*** (11.23) | 0.364*** (13.07) | 0.313*** (11.00) | 0.185*** (16.07) | 0.484*** (15.45) | 0.451*** (14.35) |
| <i>idr</i> | 0.00670*** (5.44) | 0.0357*** (5.84) | 0.130*** (5.59) | 0.144*** (6.21) | 0.148*** (6.26) | -0.00688 (-0.77) | -0.0534** (-2.26) | -0.0360 (-1.52) | -0.0267*** (-3.34) | -0.0644*** (-2.80) | -0.0659*** (-2.81) | 0.123*** (12.96) | 0.358*** (13.80) | 0.365*** (14.04) |
| <i>insthold</i> | 0.00122* (1.77) | 0.00906*** (2.66) | 0.00392 (0.30) | 0.000846 (0.07) | -0.00810 (-0.62) | -0.00418 (-0.84) | -0.0377*** (-2.86) | -0.0336** (-2.55) | 0.00856* (1.92) | -0.00675 (-0.53) | -0.0175 (-1.34) | 0.0225*** (4.24) | 0.0509*** (3.53) | 0.0243* (1.68) |
| constant | -2.820*** (-16.32) | 19.09*** (22.26) | -66.59*** (-20.39) | -64.11*** (-19.71) | -58.47*** (-17.64) | 8.883*** (7.06) | -55.96*** (-16.87) | -46.67*** (-14.05) | 5.510*** (4.91) | -66.27*** (-20.54) | -60.52*** (-18.38) | 36.29*** (27.24) | 5.980* (1.65) | 7.183*** (1.97) |
| Num. of obs. | 9,281 | 9,281 | 9,281 | 9,281 | 9,281 | 9,281 | 9,281 | 9,281 | 9,281 | 9,281 | 9,281 | 9,281 | 9,281 | 9,281 |
| Adj. R-square | 0.217 | 0.236 | 0.207 | 0.202 | 0.176 | 0.169 | 0.149 | 0.125 | 0.253 | 0.205 | 0.179 | 0.075 | 0.071 | 0.064 |
| Prob. of F-stat. | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |

Note: This table reports the regression estimates of the effects of corporate board gender diversity (female director ratio: *fdr*) on firm's overall and individual ESG score. The measurement of overall and individual ESG score include TESG rating (*tesgrating*), TESG score (*tesgscore*), the rank of TESG score in full samples (*tesgwr*), the rank of TESG score in SASB main industry classification (*tesgmr*), the rank of TESG score in SASB sub-industry classification (*tesgsr*), TESG environmental score (*envscore*), the rank of TESG environmental score in SASB main industry classification (*envmr*), the rank of TESG environmental score in SASB sub-industry classification (*envsr*), TESG environmental social score (*socscore*), the rank of TESG social score in SASB main industry classification (*socmr*), the rank of TESG social score in SASB sub-industry classification (*socsr*), TESG corporate governance score (*govscore*), the rank of TESG corporate governance score in SASB main industry classification (*govmr*), the rank of TESG corporate governance score in SASB sub-industry classification (*govsr*). Control variables include firm size (*asset*), debt ratio (*debt*), returns on assets (*roa*), independent director ratio (*idr*) and institutional investors' shareholdings (*insthold*). The data period is from 2015 to 2020. The *t*-values of the estimated coefficients are shown in parentheses, and *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

Table 7 and Table 8 report the regression estimation results on whether board gender diversity (measured respectively by whether firm's board chairman is female (*fbcd*) and whether the firm's board vice-chairman is female (*fvbcd*), affects the firm's overall ESG performance and performance in the three individual ESG aspect. Observing the estimated coefficients of the main explanatory variables in panel A to D in Table 7, it is evident that most of them are negative and statistically significant. This suggests that when the board chairman is female, firm's ESG rating level is lower, ESG score, as well as ratings across individual ESG aspect, are also lower. Additionally, the firm's overall ESG rating and the scores of three ESG aspect rank further behind within SASB industry classification. The empirical result is similar to those presented in Table 5. Observing the estimated coefficients of the main explanatory variables in Table 8, it can be seen that in panel A and D, the majority of them are negative and statistically significant. This indicates that when the vice-chairman of the board is female, the firm's ESG rating level is lower, ESG score, and score related to corporate governance are lower. Furthermore, the firm's overall ESG rating and score in the corporate governance aspect rank further behind within counterparts within industry. However, in panel B, it is observed that the estimated coefficient for the dummy variable indicating whether the vice-chairman is female (*fvbcd*) is positive and statistically significant, suggesting that when the vice-chairman of the board is female, it contributes to improving the performance in the environmental aspect.

Table 9 reports the regression estimation result on board gender diversity (measured by the dummy variable of the presence of female independent director, *fidd*), affects the firm's overall ESG performance and performance across three individual ESG aspects. Upon observing Table 9, it is notable that when a firm has female independent director, the ESG rating level, ESG score, and ESG score ranking within the industry are not significantly lower as previously observed. Instead, the coefficients of *fidd* are positive (though still not statistically significant). This suggests that the presence of female independent director at least does not lower the firm's overall ESG performance. In contrast to the previous results, distinguishing between independent and non-independent director within the board, an increase in the overall gender diversity of the board corresponds to a decrease in ESG performance. However, when distinguishing between independent and non-independent director, an increase in the gender diversity of non-independent directors reduces ESG performance, whereas an increase in the gender diversity of independent director does not lower ESG performance. In fact, it may enhance firm's environmental performance. From the perspective of independent director, increasing gender diversity improves environmental performance and, at the very least, does not diminish overall ESG performance. These empirical results partially support Hypothesis 1A. As mentioned earlier, women may have a greater focus on social and environmental issues and contribute to improving corporate governance. When women serve as independent directors, their cautious and environmentally conscious characteristics enable them to monitor and advise the management to adopt more environmentally-friendly and focused strategies and actions, leading to better environmental performance. This translates to no significant decrease in overall ESG performance and performance in individual ESG aspect.

Table 7 Regression Result of the Effects of Board Gender Diversity (*fbcd*) on Overall and Individual ESG Score

| Explanatory Variable | Explained Variable (Overall and Individual ESG Score) | | | | | | | | | | | | | |
|----------------------|---|-----------------------|-----------------------|-----------------------|-----------------------|----------------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|---------------------------|-----------------------|-----------------------|
| | Panel A. TESG Ratings and Total Score | | | | | Panel B. Environment Score | | | Panel C. Social Score | | | Panel D. Governance Score | | |
| | <i>tesgrating</i> | <i>tesgscore</i> | <i>tesgwr</i> | <i>tesgmr</i> | <i>tesgsr</i> | <i>envscore</i> | <i>envmr</i> | <i>envsr</i> | <i>socscore</i> | <i>socmr</i> | <i>socsr</i> | <i>govscore</i> | <i>govmr</i> | <i>govsr</i> |
| (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) | (12) | (13) | (14) | |
| <i>fbcd</i> | -0.113** (-2.00) | -0.649** (-2.31) | -1.751 (-1.64) | -1.371 (-1.29) | -2.172** (-2.00) | -0.493 (-1.20) | -2.355** (-2.17) | -2.600** (-2.39) | -0.668* (-1.82) | -2.002* (-1.90) | -2.736** (-2.54) | -0.721* (-1.65) | -1.505 (-1.27) | -2.164* (-1.82) |
| <i>asset</i> | 0.438*** (37.71) | 2.292*** (39.76) | 8.000*** (36.46) | 7.793*** (35.68) | 7.409*** (33.29) | 3.095*** (36.65) | 7.604*** (34.15) | 6.899*** (30.95) | 3.397*** (45.10) | 8.453*** (39.01) | 8.115*** (36.71) | 0.862*** (9.63) | 2.200*** (9.02) | 2.187*** (8.94) |
| <i>debt</i> | -0.00568*** (-7.01) | -0.0286*** (-7.12) | -0.113*** (-7.39) | -0.116*** (-7.64) | -0.135*** (-8.72) | -0.0175*** (-2.98) | -0.0467*** (-3.01) | -0.0632*** (-4.07) | -0.0359*** (-6.84) | -0.102*** (-6.76) | -0.139*** (-9.02) | -0.0272*** (-4.36) | -0.0745*** (-4.38) | -0.0966*** (-5.66) |
| <i>roa</i> | 0.0256*** (17.17) | 0.130*** (17.57) | 0.514*** (18.22) | 0.523*** (18.61) | 0.473*** (16.52) | 0.0747*** (6.88) | 0.227*** (7.94) | 0.211*** (7.36) | 0.108*** (11.12) | 0.361*** (12.97) | 0.310*** (10.89) | 0.184*** (15.98) | 0.482*** (15.38) | 0.448*** (14.26) |
| <i>idr</i> | 0.00659*** (5.34) | 0.0352*** (5.75) | 0.128*** (5.50) | 0.142*** (6.12) | 0.146*** (6.19) | -0.00732 (-0.82) | -0.0538** (-2.27) | -0.0360 (-1.52) | -0.0274*** (-3.42) | -0.0659*** (-2.86) | -0.0670*** (-2.85) | 0.123*** (12.91) | 0.356*** (13.75) | 0.363*** (13.99) |
| <i>insthold</i> | 0.00113* (1.65) | 0.00870** (2.55) | 0.00246 (0.19) | -0.000541 (-0.04) | -0.00922 (-0.70) | -0.00450 (-0.90) | -0.0378*** (-2.87) | -0.0335** (-2.54) | 0.00808* (1.81) | -0.00788 (-0.61) | -0.0183 (-1.40) | 0.0221*** (4.18) | 0.0501*** (3.47) | 0.0234 (1.62) |
| constant | -2.946*** (-17.22) | 18.49*** (21.78) | -68.70*** (-21.25) | -66.00*** (-20.51) | -60.37*** (-18.41) | 8.381*** (6.74) | -56.90*** (-17.35) | -47.42*** (-14.44) | 4.794*** (4.32) | -68.13*** (-21.34) | -62.22*** (-19.11) | 35.70*** (27.09) | 4.574 (1.27) | 5.527 (1.53) |
| Num. of obs. | 9,281 | 9,281 | 9,281 | 9,281 | 9,281 | 9,281 | 9,281 | 9,281 | 9,281 | 9,281 | 9,281 | 9,281 | 9,281 | 9,281 |
| Adj. R-square | 0.215 | 0.234 | 0.205 | 0.201 | 0.175 | 0.168 | 0.149 | 0.125 | 0.252 | 0.204 | 0.179 | 0.074 | 0.070 | 0.064 |
| Prob. of F-stat. | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |

Note: This table reports the regression estimates of the effects of corporate board gender diversity (the dummy of whether a firm has female board chair: *fbcd*) on firm's overall and individual ESG score. The measurement of overall and individual ESG score include TESG rating (*tesgrating*), TESG score (*tesgscore*), the rank of TESG score in full samples (*tesgwr*), the rank of TESG score in SASB main industry classification (*tesgmr*), the rank of TESG score in SASB sub-industry classification (*tesgsr*), TESG environmental score (*envscore*), the rank of TESG environmental score in SASB main industry classification (*envmr*), the rank of TESG environmental score in SASB sub-industry classification (*envsr*), TESG environmental social score (*socscore*), the rank of TESG social score in SASB main industry classification (*socmr*), the rank of TESG social score in SASB sub-industry classification (*socsr*), TESG corporate governance score (*govscore*), the rank of TESG corporate governance score in SASB main industry classification (*govmr*), the rank of TESG corporate governance score in SASB sub-industry classification (*govsr*). Control variables include firm size (*asset*), debt ratio (*debt*), returns on assets (*roa*), independent director ratio (*idr*) and institutional investors' shareholdings (*insthold*). The data period is from 2015 to 2020. The *t*-values of the estimated coefficients are shown in parentheses, and *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

Table 8 Regression Result of the Effects of Board Gender Diversity (*fvbcd*) on Overall and Individual ESG Score

| Explained Variable (Overall and Individual ESG Score) | | | | | | | | | | | | | | |
|---|---------------------------------------|-----------------------|-----------------------|-----------------------|-----------------------|----------------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|---------------------------|-----------------------|-----------------------|
| Explanatory Variable | Panel A. TESG Ratings and Total Score | | | | | Panel B. Environment Score | | | Panel C. Social Score | | | Panel D. Governance Score | | |
| | <i>tesgrating</i> | <i>tesgscore</i> | <i>tesgwr</i> | <i>tesgmr</i> | <i>tesgsr</i> | <i>envscore</i> | <i>envmr</i> | <i>envsr</i> | <i>socscore</i> | <i>socmr</i> | <i>socsr</i> | <i>govscore</i> | <i>govmr</i> | <i>govsr</i> |
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) | (12) | (13) | (14) |
| <i>fvbcd</i> | -0.200** (-2.07) | -0.616 (-1.28) | -2.967 (-1.62) | -2.839 (-1.56) | -1.368 (-0.74) | 1.090 (1.55) | 3.775** (2.03) | 2.760 (1.48) | -0.00972 (-0.02) | -1.744 (-0.96) | 0.723 (0.39) | -2.359*** (-3.16) | -4.926** (-2.42) | -3.821* (-1.87) |
| <i>asset</i> | 0.438*** (37.75) | 2.294*** (39.78) | 8.008*** (36.49) | 7.800*** (35.71) | 7.415*** (33.31) | 3.094*** (36.64) | 7.602*** (34.13) | 6.898*** (30.94) | 3.398*** (45.10) | 8.459*** (39.03) | 8.118*** (36.71) | 0.867*** (9.69) | 2.211*** (9.06) | 2.196*** (8.98) |
| <i>debt</i> | -0.00561*** (-6.93) | -0.0283*** (-7.05) | -0.112*** (-7.33) | -0.116*** (-7.59) | -0.135*** (-8.67) | -0.0175*** (-2.98) | -0.0465*** (-2.99) | -0.0628*** (-4.04) | -0.0357*** (-6.80) | -0.101*** (-6.70) | -0.138*** (-8.97) | -0.0267*** (-4.28) | -0.0734*** (-4.32) | -0.0954*** (-5.60) |
| <i>roa</i> | 0.0257*** (17.22) | 0.131*** (17.62) | 0.515*** (18.26) | 0.524*** (18.65) | 0.474*** (16.56) | 0.0749*** (6.90) | 0.228*** (7.98) | 0.212*** (7.40) | 0.108*** (11.16) | 0.362*** (13.01) | 0.311*** (10.94) | 0.184*** (16.03) | 0.484*** (15.42) | 0.450*** (14.30) |
| <i>idr</i> | 0.00655*** (5.31) | 0.0349*** (5.71) | 0.128*** (5.48) | 0.142*** (6.11) | 0.145*** (6.15) | -0.00762 (-0.85) | -0.0551** (-2.33) | -0.0373 (-1.58) | -0.0277*** (-3.46) | -0.0667*** (-2.90) | -0.0683*** (-2.91) | 0.123*** (12.90) | 0.356*** (13.74) | 0.363*** (13.96) |
| <i>insthold</i> | 0.00106 (1.54) | 0.00835** (2.45) | 0.00134 (0.10) | -0.00148 (-0.11) | -0.0103 (-0.78) | -0.00456 (-0.91) | -0.0383*** (-2.91) | -0.0342*** (-2.59) | 0.00780* (1.75) | -0.00894 (-0.70) | -0.0193 (-1.48) | 0.0215*** (4.07) | 0.0488*** (3.38) | 0.0220 (1.52) |
| constant | -2.955*** (-17.28) | 18.44*** (21.72) | -68.84*** (-21.30) | -66.12*** (-20.55) | -60.54*** (-18.47) | 8.353*** (6.72) | -57.05*** (-17.39) | -47.58*** (-14.49) | 4.747*** (4.28) | -68.28*** (-21.39) | -62.41*** (-19.16) | 35.63*** (27.05) | 4.436 (1.23) | 5.349 (1.49) |
| Num. of obs. | 9,281 | 9,281 | 9,281 | 9,281 | 9,281 | 9,281 | 9,281 | 9,281 | 9,281 | 9,281 | 9,281 | 9,281 | 9,281 | 9,281 |
| Adj. R-square | 0.215 | 0.234 | 0.205 | 0.201 | 0.175 | 0.168 | 0.149 | 0.125 | 0.252 | 0.204 | 0.178 | 0.075 | 0.070 | 0.064 |
| Prob. of F-stat. | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |

Note: This table reports the regression estimates of the effects of corporate board gender diversity (the dummy of whether a firm has female vice board chair: *fvbcd*) on firm's overall and individual ESG score. The measurement of overall and individual ESG score include TESG rating (*tesgrating*), TESG score (*tesgscore*), the rank of TESG score in full samples (*tesgwr*), the rank of TESG score in SASB main industry classification (*tesgmr*), the rank of TESG score in SASB sub-industry classification (*tesgsr*), TESG environmental score (*envscore*), the rank of TESG environmental score in SASB main industry classification (*envmr*), the rank of TESG environmental score in SASB sub-industry classification (*envsr*), TESG environmental social score (*socscore*), the rank of TESG social score in SASB main industry classification (*socmr*), the rank of TESG social score in SASB sub-industry classification (*socsr*), TESG corporate governance score (*govscore*), the rank of TESG corporate governance score in SASB main industry classification (*govmr*), the rank of TESG corporate governance score in SASB sub-industry classification (*govsr*). Control variables include firm size (*asset*), debt ratio (*debt*), returns on assets (*roa*), independent director ratio (*idr*) and institutional investors' shareholdings (*insthold*). The data period is from 2015 to 2020. The *t*-values of the estimated coefficients are shown in parentheses, and *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

Table 9 Regression Result of the Effects of Board Gender Diversity (*fidd*) on Overall and Individual ESG Score

| Explained Variable (Overall and Individual ESG Score) | | | | | | | | | | | | | | |
|---|---------------------------------------|-----------------------|-----------------------|-----------------------|----------------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|---------------------------|-----------------------|-----------------------|-----------------------|
| Explanatory Variable | Panel A. TESG Ratings and Total Score | | | | Panel B. Environment Score | | | Panel C. Social Score | | | Panel D. Governance Score | | | |
| | <i>tesgrating</i> | <i>tesgscore</i> | <i>tesgwr</i> | <i>tesgmr</i> | <i>tesgsr</i> | <i>envscore</i> | <i>envmr</i> | <i>envsr</i> | <i>socscore</i> | <i>socmr</i> | <i>socsr</i> | <i>govscore</i> | <i>govmr</i> | <i>govsr</i> |
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) | (12) | (13) | (14) |
| <i>fidd</i> | 0.0388 (1.18) | 0.261 (1.60) | 0.623 (1.00) | 0.816 (1.32) | 0.553 (0.88) | 0.666*** (2.78) | 1.790*** (2.84) | 1.711*** (2.71) | -0.149 (-0.70) | -0.810 (-1.32) | -0.912 (-1.46) | 0.377 (1.49) | 1.013 (1.46) | 0.840 (1.21) |
| <i>asset</i> | 0.438*** (37.73) | 2.295*** (39.80) | 8.009*** (36.48) | 7.803*** (35.71) | 7.418*** (33.31) | 3.103*** (36.74) | 7.625*** (34.24) | 6.920*** (31.04) | 3.397*** (45.07) | 8.448*** (38.97) | 8.111*** (36.67) | 0.866*** (9.68) | 2.213*** (9.07) | 2.198*** (8.99) |
| <i>debt</i> | -0.00565*** (-6.98) | -0.0285*** (-7.08) | -0.113*** (-7.37) | -0.116*** (-7.62) | -0.135*** (-8.69) | -0.0175*** (-2.98) | -0.0463*** (-2.99) | -0.0628*** (-4.04) | -0.0357*** (-6.80) | -0.101*** (-6.71) | -0.138*** (-8.95) | -0.0271*** (-4.34) | -0.0743*** (-4.37) | -0.0961*** (-5.64) |
| <i>roa</i> | 0.0257*** (17.18) | 0.130*** (17.57) | 0.514*** (18.22) | 0.523*** (18.60) | 0.473*** (16.53) | 0.0742*** (6.84) | 0.227*** (7.92) | 0.210*** (7.34) | 0.108*** (11.17) | 0.363*** (13.04) | 0.312*** (10.98) | 0.184*** (15.98) | 0.482*** (15.37) | 0.449*** (14.26) |
| <i>idr</i> | 0.00625*** (4.97) | 0.0329*** (5.28) | 0.123*** (5.17) | 0.135*** (5.73) | 0.141*** (5.86) | -0.0125 (-1.37) | -0.0681*** (-2.83) | -0.0499** (-2.07) | -0.0266*** (-3.26) | -0.0608*** (-2.59) | -0.0614** (-2.57) | 0.120*** (12.34) | 0.348*** (13.18) | 0.356*** (13.45) |
| <i>insthold</i> | 0.00104 (1.52) | 0.00815** (2.39) | 0.00108 (0.08) | -0.00196 (-0.15) | -0.0107 (-0.81) | -0.00540 (-1.08) | -0.0406*** (-3.08) | -0.0363*** (-2.75) | 0.00796* (1.79) | -0.00787 (-0.61) | -0.0184 (-1.41) | 0.0214*** (4.05) | 0.0484*** (3.35) | 0.0216 (1.49) |
| constant | -2.958*** (-17.29) | 18.42*** (21.69) | -68.88*** (-21.31) | -66.18*** (-20.57) | -60.58*** (-18.48) | 8.282*** (6.66) | -57.24*** (-17.46) | -47.77*** (-14.55) | 4.761*** (4.29) | -68.19*** (-21.36) | -62.33*** (-19.14) | 35.61*** (27.02) | 4.371 (1.22) | 5.294 (1.47) |
| Num. of obs. | 9,281 | 9,281 | 9,281 | 9,281 | 9,281 | 9,281 | 9,281 | 9,281 | 9,281 | 9,281 | 9,281 | 9,281 | 9,281 | 9,281 |
| Adj. R-square | 0.215 | 0.234 | 0.205 | 0.201 | 0.175 | 0.169 | 0.150 | 0.125 | 0.252 | 0.204 | 0.178 | 0.074 | 0.070 | 0.063 |
| Prob. of F-stat. | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |

Note: This table reports the regression estimates of the effects of corporate board gender diversity (the dummy of whether a firm has female independent director: *fidd*) on firm's overall and individual ESG score. The measurement of overall and individual ESG score include TESG rating (*tesgrating*), TESG score (*tesgscore*), the rank of TESG score in full samples (*tesgwr*), the rank of TESG score in SASB main industry classification (*tesgmr*), the rank of TESG score in SASB sub-industry classification (*tesgsr*), TESG environmental score (*envscore*), the rank of TESG environmental score in SASB main industry classification (*envmr*), the rank of TESG environmental score in SASB sub-industry classification (*envsr*), TESG environmental social score (*socscore*), the rank of TESG social score in SASB main industry classification (*socmr*), the rank of TESG social score in SASB sub-industry classification (*socsr*), TESG corporate governance score (*govscore*), the rank of TESG corporate governance score in SASB main industry classification (*govmr*), the rank of TESG corporate governance score in SASB sub-industry classification (*govsr*). Control variables include firm size (*asset*), debt ratio (*debt*), returns on assets (*roa*), independent director ratio (*idr*) and institutional investors' shareholdings (*insthold*). The data period is from 2015 to 2020. The *t*-values of the estimated coefficients are shown in parentheses, and *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

Table 10 reports regression results about additional characteristics possessed by female director, including whether they hold a Ph.D. degree (*phd*), average tenure (*tenure*), and average attendance rate at board meetings. It examines whether these features strengthen or weaken the relationship between board gender diversity and ESG performance. Firstly, when we observe the coefficients of cross-product term in panel A~D for *fdd*phd*, we find that although most coefficients remain negative, they do not reach statistical significance. This indicates that when a firm has female director and at least one of female director has Ph.D. degree, the firm's overall ESG performance, including rating level, score, and industry rankings, does not significantly decrease as before. In contrast to previous result where the presence of female director tends to lower ESG performance, now having female director with Ph.D. qualification does not lead to a decrease in ESG performance. This suggests that female director with higher educational level mitigate the negative effect of gender diversity on ESG performance. Similarly, in panel B~D, evidence shows, although there is only one significant piece of evidence, in most cases, environmental scores, social score, corporate governance score, and corresponding rankings in SASB industry classification do not significantly decrease as a firm has female director with education level of Ph.D. degree. In other words, having female director with Ph.D. level mitigates the previously observed significant decreases the performance of three ESG aspects.

Observing the coefficients in Table 10 for the coefficients of cross-product term in panel A~D for *fdd*tunure*, it is shown that the majority of coefficients are still not statistically significant. This suggests that female director with longer tenure do not significantly decrease the overall ESG rating and performance of individual ESG aspects. In contrast to previous estimation that considered only the presence of female director, the evidence indicates that having female director tends to lower ESG performance. However, when considering female director with longer tenure, the evidence suggests that the presence of female director does not result in a deterioration of overall ESG performance and three individual performance on ESG aspects. In fact, there is some evidence that female director with longer tenure may even contribute to an improvement in the performance on environmental. Observing the coefficients in Table 10 for the coefficients of cross-product term in panel A~D for *fdd*attend*, it is shown that the majority of these coefficients are positive and reach statistical significance levels of up to 10%. This indicates that female director with higher board meetings attendance rates not only do not lower overall ESG ratings and performance on three individual aspects but actually contribute to performance enhancement. This suggests that board meetings attendance rates are a key factor for female director in promoting ESG performance.

Looking at these three non-gender characteristics of female directors, including education level, tenure, and board meetings attendance rate, all contribute to mitigating the role of female director in decreasing ESG performance. These three non-gender characteristics represent essential qualities through which board members functioning within the board, beyond just the gender. Signaling Theory of Spence (1973) suggests that education level serves as an outward indicator of job quality, and director with higher education or specialized knowledge are better equipped to apply their expertise to firm's strategic decision-making, leading to improved firm performance. Director with higher educational backgrounds are known to enhance board effectiveness (Fairchild and Li, 2005; Nicholson and Kiel, 2004). Director with higher education levels can leverage their acquired professional knowledge to provide the company with more professional advice and assistance. A director with a high level of education is more likely to possess more specialized knowledge and analytical skills, allowing them to focus on understanding and analyzing firm's operational prospects, governance, and the input, strategies, and actions required or possessed in the face of current environmental changes. Therefore, female director with higher education levels are capable of helping the board strengthen its monitoring and advising function, thereby enhancing the firm's engagement in ESG issues.

Table 10 Regression Result of the Effects of Female Director with Greater Level of Education, Tenure and Board Meetings Attendance

| Explanatory Variable | Explained Variable (Overall and Individual ESG Score) | | | | | | | | | | | | | |
|----------------------|---|------------------|---------------|---------------|---------------|----------------------------|--------------|--------------|-----------------------|--------------|--------------|---------------------------|--------------|--------------|
| | Panel A. TEGS Ratings and Total Score | | | | | Panel B. Environment Score | | | Panel C. Social Score | | | Panel D. Governance Score | | |
| | <i>tesgrating</i> | <i>tesgscore</i> | <i>tesgwr</i> | <i>tesgmr</i> | <i>tesgsr</i> | <i>envscore</i> | <i>envmr</i> | <i>envsr</i> | <i>socscore</i> | <i>socmr</i> | <i>socsr</i> | <i>govscore</i> | <i>govmr</i> | <i>govsr</i> |
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) | (12) | (13) | (14) |
| <i>fdd*phd</i> | -0.0460 | -0.238 | -0.872 | -0.765 | -0.633 | -0.309 | -0.542 | -0.547 | -0.408* | -1.036 | -0.844 | -0.118 | -0.219 | -0.542 |
| | (-1.35) | (-1.41) | (-1.35) | (-1.20) | (-0.97) | (-1.25) | (-0.83) | (-0.84) | (-1.85) | (-1.63) | (-1.30) | (-0.45) | (-0.31) | (-0.76) |
| <i>fdd*tenure</i> | -0.000184 | 0.00660 | -0.00156 | -0.0133 | -0.0131 | 0.0321* | 0.0777* | 0.0541 | 0.0119 | 0.0154 | -0.0169 | -0.0164 | -0.0491 | -0.0137 |
| | (-0.08) | (0.54) | (-0.03) | (-0.29) | (-0.28) | (1.78) | (1.67) | (1.15) | (0.72) | (0.34) | (-0.36) | (-0.88) | (-0.98) | (-0.27) |
| <i>fdd*attend</i> | 0.00622*** | 0.0351*** | 0.117*** | 0.122*** | 0.109*** | 0.0362*** | 0.0695*** | 0.0725*** | 0.00235 | 0.0152 | 0.0133 | 0.0626*** | 0.164*** | 0.157*** |
| | (4.75) | (5.31) | (4.76) | (5.00) | (4.34) | (3.71) | (2.77) | (2.85) | (0.26) | (0.62) | (0.52) | (6.33) | (6.11) | (5.79) |
| CONTROLS | included | included | included | included | included | included | included | included | included | included | included | included | included | included |
| constant | included | included | included | included | included | included | included | included | included | included | included | included | included | included |

Note: This table reports the regression estimates of the effects of female director with greater level of education (the cross product term of dummy of female director and whether female director has Ph.D degree: *fdd*phd*), female directors with longer tenure (cross-product term of the dummy of female director and average tenure of female director: *fdd*tenure*) and female directors with greater level of board meetings attendance (cross-product term of the dummy of female director and female director's average board meeting attendance rate: *fdd*attend*) on firm's overall ESG performance and individual ESG score. The measurement of overall and individual ESG score include TEGS rating (*tesgrating*), TEGS score (*tesgscore*), the rank of TEGS score in full samples (*tesgwr*), the rank of TEGS score in SASB main industry classification (*tesgmr*), the rank of TEGS score in SASB sub-industry classification (*tesgsr*), TEGS environmental score (*envscore*), the rank of TEGS environmental score in SASB main industry classification (*envmr*), the rank of TEGS environmental score in SASB sub-industry classification (*envsr*), TEGS environmental social score (*socscore*), the rank of TEGS social score in SASB main industry classification (*socmr*), the rank of TEGS social score in SASB sub-industry classification (*socsr*), TEGS corporate governance score (*govscore*), the rank of TEGS corporate governance score in SASB main industry classification (*govmr*), the rank of TEGS corporate governance score in SASB sub-industry classification (*govsr*). Control variables include firm size (*asset*), debt ratio (*debt*), returns on assets (*roa*), independent director ratio (*idr*) and institutional investors' shareholdings (*insthold*). The data period is from 2015 to 2020. The *t*-values of the estimated coefficients are shown in parentheses, and *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

Vafeas (2003) noted that director with longer tenure have more opportunities to become familiar with crucial knowledge and the industry environment, which equips them with better experience, commitment, and competence. They also tend to have greater confidence in carrying out their responsibilities. Celikyurt, Sevilir and Shivdasani (2012) found that as board members accumulate management experience and networks, those with longer tenure are better able to fulfill their advising role. Consequently, director with longer tenure possess more industry experience, understand the specialized knowledge and details required for a corporation's sustainable operation, and are more aware the needs to invest more resources and efforts in sustainability, particularly in the face of environmental changes. This, in turn, contributes to enhancing the firm's ESG engagement.

Lastly, Beasley (1996) and Fama and Jensen (1983) argued that when outside director hold multiple positions, driven by a concern for their own reputations, they are more inclined to effectively oversee the corporation to maintain their good standing. Director holding multiple positions can expand their social networks and increase opportunities for connecting with other organizations, making it easier to help the corporation acquire significant tangible and intangible resources. Board meeting attendance is the most concrete and fundamental way a director can fulfill their monitoring and advising function. If a director has low attendance rate at board meetings, it becomes challenging to gain a deep understanding of the execution of managerial decisions and determine whether they are beneficial or detrimental to the corporation. In this context, especially with the gender traits mentioned in this research, directors' characteristics will not effectively operate and exert influence in the practical operation of the board. The board meetings attendance rate is crucial for female directors to exert their influence in steering the decision-making and execution of management towards a greater focus on stakeholders' interests through their distinctive qualities. A higher board meetings attendance rate provides more opportunities and a greater impact in this regard.

5. Conclusion and Suggestion

This study employs the data from 1,590 non-financial industry listed firms on the Taiwan Stock Exchange and the Taipei Exchange to examine the effects of board gender on firm's ESG performance. Existing literature suggests that female director possess certain qualities relative to male counterparts that can lead firms to place a greater emphasis on stakeholder interests. As a result, female directors, through increasing monitoring and advising functioning within the board, promote the performance on ESG and other CSR strategies. However, part of literature also points out that if female director merely serve as figureheads, this can lead to increased communication and coordination barriers within the board. Issues related to social identification and the perpetuation of gender stereotypes also lead to the marginalization of the opinions of female directors, potentially hindering the formation and focus of the firm's ESG policies and ultimately leading to a decline in the ESG performance.

This study collected gender-related data for every firm samples annually, such as the number of female director, the number of female independent director, and whether the chairman and vice-chairman are female, to construct a more comprehensive measure of board gender diversity. Simultaneously, it utilized data from the database of TEJ to assess the overall and three aspects of ESG performance as well as corresponding rankings in SASB industry classification for Taiwanese publicly traded firms, providing a comprehensive evaluation of a firm's ESG performance. Through correlation analysis and regression estimates, empirical result indicates that, when considering the entire board, an increase in the degree of gender diversity is detrimental to ESG performance. This not only results in lower ESG rating but also leads to lower ESG scores and rankings in SASB industry classification.

An interesting finding emerges when distinguishing directors between independent directors versus non-independent directors, an increase in gender diversity among non-independent directors is detrimental to ESG performance, whereas an increase in gender diversity among independent directors does not negatively impact ESG performance, instead, it contributes to enhancing firm's environmental performance. A second intriguing finding is that highly educated and experienced female director mitigate the negative influence of board gender diversity on ESG performance. Additionally, female directors with a high attendance rate improve ESG performance. This suggests that other characteristics of female directors moderate the extent of impact of board gender diversity on ESG performance.

The empirical findings of the study provide insights and implications for regulatory authorities, suggesting that there may not be an immediate need to raise the standard of gender diversity or to follow the levels established by other well-developed countries in the context of publicly-traded firms. Encouraging or mandating gender quotas for boards or other governing bodies may not be the best approach. When a firm cannot identify suitable female board members, such policy regulations can negatively impact the efficiency of board operations or a firm's decision-making regarding ESG policies. For corporations themselves, when appointing female directors, it is crucial to carefully consider other non-gender characteristics such as education, working experience, and active participation in board meetings. This ensures that appointed female directors genuinely understand the importance of a firm's ESG policies and can exert a significant influence in forming ESG strategies. Investors should also be aware that higher levels of gender diversity on the board do not necessarily indicate a more attractive investment opportunity. Instead, investors should focus on understanding the specific qualifications and attributes of female directors on the board. Further analysis is needed to determine what additional governance-related qualities and characteristics these female directors possess that contribute to a firm's commitment to sustainability. This approach allows for a more comprehensive assessment of the role of board gender diversity in the selection of investment targets.

Regarding recommendations for future research, firstly, the current focus of gender diversity measurement is primarily on the board level. Subsequent research can explore and investigate the gender diversity within subsidiary organizations of the board, such as audit committees, compensation committees, corporate governance committees, and nomination committees. This expansion of the analysis will enable a more comprehensive assessment of the broader impact of gender diversity within the senior organizational structures of a firm. Additionally, if the access to board meeting data or records of individual board meetings becomes available in the future, further analysis can be conducted to ascertain whether significant decisions or ESG policies were proposed, seconded, rejected, or otherwise influenced by female directors. This would provide more concrete evidence to gain a clearer understanding of the specific impact of board gender diversity on firm's ESG policies.

Third, the measurement of firm's ESG performance can encompass instances of corporate misconduct, negative news or events, and the fines imposed by regulatory authorities. If an increase in board gender diversity genuinely changes the frequency of corporate misconduct, negative events, or misbehaviors, the evidence of the impact of board gender diversity on a firm's sustainability efforts will become more comprehensive. Finally, the level of board gender diversity may suffer from serious sample selection issues. In other words, certain characteristics, governance factors, and ownership structures may influence the likelihood of appointing female directors, and these pre-determined factors of board gender diversity can affect a firm's ESG performance. Therefore, future research could consider correcting for the sample selection issue in the context of board gender diversity. This correction could be achieved through methods like two-stage estimation of Heckman (1979) or propensity score matching method of

Rosenbaum and Rubin (1983, 1985a, b).

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