Unveiling the relationship between women on board and woman CEO selection: what is the role of sustainability governance?

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Abstract

Frame of the research: *Studies highlight challenges affecting woman CEO selection. However, the literature falls short in emphasizing proactive measures and supportive conditions crucial for women's success in organizational leadership.*

Purpose of the paper: *Several companies nowadays are committed to improving the presence of women at the corporate apex. However, little is known about the factors able to facilitate women's access to the CEO role. This paper relies on critical mass theory to investigate whether the presence of a critical mass of women on board facilitates the appointment of a woman CEO. Moreover, the paper investigates whether the presence of a sustainability committee on board strengthens the relationship between women on board and a woman CEO appointment. Lastly, the paper examines whether the presence of a sustainability-linked incentive system strengthens such a relationship.*

Methodology: *Analyses are performed on a sample of companies listed in the most important market of developed countries (S&P100, FTSE100, IBEX35, DAX30, CAC40, SMI). The time frame is about ten years (2010-2019). To test the hypothesis, we first ran a regression analysis. Later, we ran robustness tests adopting different matching techniques.*

Findings: *Results show a positive linkage between the presence of a critical mass of women on board and the presence of a woman CEO. In addition, results show that such a link is stronger when the company sets up a sustainability committee on board. Lastly, the results indicate that such a link is stronger when the company has a sustainability-linked incentive system for board members.*

Research limits: *Our study's sample is confined to particular businesses in developed nations, with a particular emphasis on the United States, the United Kingdom, Spain, Germany, France, and Switzerland. The concentration on these geographical regions prompts contemplation about the broader relevance of our results. Additionally, our sample consists solely of publicly traded companies, a deliberate choice aimed at guaranteeing the comprehensiveness of the data essential for our analyses.*

Practical implications: *The results must be taken with care as people belonging to different interests' groups or categories could interpret them differently. For women, our empirical results may seem like one more reason to break the glass ceiling and promote workplace inclusion at the top of companies. For men, this empirical evidence could instead be interpreted as a mechanism that rewards people based on whether or not they belong to a certain demographic group and not so much based on the skills and abilities they possess. In essence, men may perceive that as the critical mass of women on boards increases, so does the likelihood that men will be excluded from top positions.*

Originality of the paper: *This study investigates a phenomenon currently under-investigated in literature, namely the antecedents of having a woman CEO. In addition, the study investigates the possible role played by a company's effort toward sustainability in strengthening the relationship between women's presence on the board and a woman CEO selection.*

Key words: women on board; woman CEO; women at the top; sustainability committee; sustainability-linked incentive system

1. Introduction

Numerous companies have recently affirmed their steadfast commitment to advancing greater female participation within their organizational structure, particularly in elevating women to leadership positions. The motivations driving this commitment vary widely. On one hand, some argue that an increased presence of women within an organizational context can significantly enhance business decision-making, ultimately influencing organization-level outcomes (Arfken *et al.*, 2004; Lückerath-Rovers, 2013; Bart and McQueen, 2013; Post and Byron, 2015; Adams *et al.*, 2015; Chen *et al.*, 2019). Conversely, another perspective asserts that fostering a greater presence of women in the company is fundamentally the right thing to do, irrespective of its potential impact on organizational outcomes (Robinson and Dechant, 1997; Terjesen *et al.*, 2009; Ng and Wyrick, 2011).

Empirically, scholars have tested and confirmed a positive causal relationship between the presence of women in top leadership positions and corporate performance, as well as corporate innovation (Torchia *et al.*, 2011; Isidro and Sobral, 2015). However, despite the proven benefits of having women at the helm for corporate success, a stark gender disparity persists, with the number of women CEOs consistently lagging behind that of men (Singh and Vinnicombe, 2004; Liu, 2013; Smith and Parrotta, 2018). Despite the considerable body of research that has delved into the myriad barriers impeding women's progress in attaining top leadership positions, a critical void persists in our understanding of the positive factors that can actively facilitate and empower women to ascend to the coveted role of Chief Executive Officer (CEO).

While existing studies have diligently highlighted the challenges, ranging from gender biases to structural impediments, which hinder women's progression in corporate hierarchies (Eagly, 2004; Ryan and Haslam, 2005; Chizema *et al.*, 2015; Geletkanycz, 2020), there is a discernible gap in literature addressing the proactive mechanisms and supportive conditions essential for fostering women's successful journey to the pinnacle of organizational leadership.

As we navigate the intricate landscape of gender dynamics in the corporate world, understanding the barriers alone is insufficient. To effect meaningful change and promote gender equality in executive leadership, we must pivot our focus towards comprehending the catalysts that can propel capable women into CEO roles. By identifying and comprehensively analyzing these enabling factors, we can bridge the existing gap in knowledge while also contributing invaluable insights to organizations, policymakers, and scholars alike.

A significant gap in the existing literature exists due to the absence of a comprehensive theoretical model that substantiates how specific board-level constructs influence the decision-making process in appointing a woman as CEO. The factors that truly drive the appointment of a woman as CEO remain unclear, which underscores the need for thorough exploration and empirical scrutiny. This article aims to address this gap in the literature.

First, drawing on the critical mass theory, we theorize that the presence of a critical mass of women on the board facilitates the appointment of a woman as CEO. Since the board is responsible for CEO appointments and women are typically a minority on the board, a critical mass of women should make it easier to appoint a woman as CEO. Second, we theorize that the presence of a sustainability committee within the board strengthens the relationship between women's presence on the board and the appointment of a woman as CEO. The existence of a sustainability committee has the potential to promote gender equality within the company and dispel gender stereotypes that often hinder women from reaching leadership positions. Third, we theorize that the presence of a sustainability-linked incentive system for board members strengthens the relationship between women's presence on the board and the selection of a woman as CEO. Including sustainability targets in the incentive system may support women directors' efforts to advance gender equality within the company.

To test our hypotheses, we examined a sample of publicly traded companies operating in developed countries, namely the United States, the United Kingdom, France, Germany, Spain, and Switzerland. The results reveal that the presence of a critical mass of women positively influences the likelihood of having a woman as CEO. Furthermore, the results indicate that this positive relationship is stronger when the company has a sustainability committee on the board. Lastly, the results suggest that this positive relationship is stronger when the company implements a sustainability-linked incentive system for board members.

Our empirical findings contribute to various research streams. First, we contribute to the literature on women on boards by demonstrating that their presence is not only beneficial for corporate performance and innovation but also for facilitating women's access to the CEO role. Second, we contribute to the limited literature on women CEOs by identifying factors that can facilitate their access to top positions. Third, we contribute to the literature on sustainable corporate governance by showing that specific sustainability mechanisms can lower barriers that often hinder women from reaching top positions within a company.

The remainder of the paper is organized as follows. First, we provide an overview of the theoretical background and develop our hypotheses. Next, we outline the data, constructs, and methods employed. Later, we present the empirical results. Finally, we discuss the results, practical implications, and limitations, offering recommendations for future research.

2. Theoretical background

Several academics have confirmed that people prefer to work with people who are demographically similar to them (Useem and Karabel, 1986; Tajfel and Turner, 1986). In a similar vein, some researchers have found that people tend to favor people who are demographically similar to them when it comes to deciding whether to hire or promote someone (Latham *et al.*, 1975; Rand and Wexley, 1975; Zajac and Westphal, 1996). This phenomenon can also be observed when the board of directors is deciding who will be the next CEO. If this is the case, male directors should be more likely to support a male CEO candidate. Women directors, on the other hand, should be more likely to support a woman CEO's candidacy. What happens when there is only one woman on board? Is the latter able to influence board decisions and ultimately lead to the appointment of a woman CEO? It is an established fact that although the number of women at the top is constantly increasing, women on board turn out to be a "minority group" (Torchia *et al.*, 2011; Jia and Zhang, 2013). However, the status of the "minority group" that characterizes women on board could change when the number of women exceeds a certain threshold value, the so-called "critical mass". Critical mass theory posits that as the number of individuals in a minority group increase, there is a significant transformation in power dynamics between the minority and majority (Granovetter, 1978; Kanter, 1977). When the size of the minority group surpasses a particular threshold, the influence that the minority group holds over the majority group experiences a notable surge. The attainment of this threshold is often viewed as a point of no return, signifying a critical juncture capable of instigating genuine change. According to Gladwell (2006), reaching this threshold is akin to a "magic moment" when a social behavior starts spreading rapidly. It is important to note, however, that critical mass theory doesn't precisely specify a value-specific threshold; rather, it asserts that when the size of the minority group surpasses a certain point, the power dynamics between the minority and majority groups undergo a significant shift (Joecks *et al.*, 2013). Empirical studies conducted thus far on women's ability to influence boardroom decisions have revealed that the presence of a single woman, as well as the presence of two women, is insufficient to change boardroom dynamics (Loyd *et al.*, 2008; Chang *et al.*, 2019). Certain studies have indicated that the "magic number" in critical mass theory is three—namely, the number that ensures the minority group wields a substantial level of influence over the majority group (Asch and Guetzkow, 1951; Konrad *et al.*, 2008). The consensus surrounding this threshold highlights its crucial role in triggering meaningful impact and cultivating increased influence for women within the boardroom. Consequently, the assertion is that the presence of a critical mass of women, specifically when there are at least three women on the board, should have a positive impact on the appointment of a woman as CEO.

Hypothesis 1: The presence of a critical mass of women directors on the board facilitates the appointment of a woman CEO.

The company's broader dedication to promulgating gender equality may act as a contributing factor in shaping this dynamic relationship. The specific conditions that could strengthen the linkage between the presence of women on the board and the appointment of a woman as CEO remain ambiguous (You, 2021). In an environment that is less adversarial towards women, it is plausible that this could intensify the positive correlation between the presence of women on the board and the likelihood of selecting a woman as CEO. A workplace culture actively endorsing gender diversity, fostering inclusiveness, and ensuring equal opportunities for women might contribute to a more conducive environment for appointing women to senior leadership roles (Shore *et al.*, 2018). The extent to which an organization actively fosters a non-hostile and supportive environment for women emerges as a potential catalyst, strengthening the connection between a critical mass of women on the board and the elevation of a woman to the CEO role. This alignment could be particularly conspicuous in companies overseeing sustainability issues, as they are likely to prioritize not only environmental conservation but also engage actively in initiatives promoting gender equality and women's inclusion in the workplace (Razavi, 2016; Esquivel and Sweetman, 2016). Indeed, among the various objectives of the United Nations 2030 Agenda, or the Sustainable Development Goals, are not only concerns about preserving natural resources and addressing global warming but also ensuring women's full participation in the labor force, encompassing leadership positions (Grosser, 2009; Koehler, 2016; García-Sánchez *et al.*, 2023). Notably, the creation of a decision-making body responsible for directing and monitoring the company's social and environmental efforts is one of the ways through which companies are trying to contribute to these objectives. Such a governance body is commonly defined as a "sustainability committee" (Valle *et al.*, 2019; Minciullo *et al.*, 2022). The establishment of a sustainability committee is a voluntary decision, in contrast to other governing bodies, such as the audit and compensation committees (Endrikat *et al.*, 2020) to actively promote a corporation's positive impact on the natural environment and society as a whole. Beyond promoting responsible behavior in favor of the natural environment, the presence of a sustainability committee could also be able to promote gender equality within the organization and break down all the gender stereotypes that often prevent women's access to leadership positions. For instance, in a company where there is a sustainability committee on board, the cultural barriers that often characterize board meetings when choosing the next CEO could disappear. Therefore, we posit the following hypothesis:

Hypothesis 2: If the company has a sustainability committee on board, the effect of the presence of a critical mass of women on board on the appointment of a woman CEO will be stronger.

A growing number of companies are adopting comprehensive strategies to integrate sustainability into their corporate governance frameworks. In addition to establishing sustainability committees responsible for overseeing management's sustainability efforts, there is a rising trend of incorporating sustainability targets into the remuneration systems of board directors (Maas and Rosendaal, 2016). This multifaceted approach aims not only to monitor sustainability practices but also to align the interests of the board with those of various stakeholders, including the natural environment, civil society, suppliers, and customers (Hartikainen *et al.*, 2021; Minciullo *et al.*, 2022). This innovative solution not only promotes responsible corporate behavior but also acts as a catalyst for achieving sustainability objectives, covering environmental concerns such as CO_2 emissions and energy consumption, as well as social issues like gender parity and addressing the gender pay gap (Esquivel and Sweetman, 2016). While the direct impact of sustainability targets on promoting gender equality within organizations is yet to be empirically demonstrated, the inclusion of such targets in the incentive systems of directors may empower women directors (Minciullo *et al.*, 2022). This empowerment could be reflected in heightened efforts to advocate for gender equality and challenge prevailing stereotypes that often hinder women's access to leadership positions. Conversely, in companies lacking a sustainability-linked incentive system, the motivation for women directors to champion gender equality within the organization might be diminished. For this reason, we posit the following hypothesis:

Hypothesis 3: If the company has a sustainability-linked incentive system for board members, the effect of the presence of a critical mass of women on board on the appointment of a woman CEO will be stronger.

3. Methodology

3.1 Sample

To comprehend the subject under investigation, a decision was made to analyze a sample of companies possessing specific characteristics. Firstly, it was decided to focus exclusively on publicly traded companies. This selection is driven by the imperative to amass a sufficiently robust dataset devoid of missing values, facilitating the execution of comprehensive regression analyses on an extensive sample. Given that publicly traded companies are obligated to disclose both economic data and details about the composition of their board of directors, it was deemed reasonable to center the investigation around this category of enterprises. Secondly, the decision was taken to exclusively examine companies listed on the stock exchanges of developed nations, particularly in the United States and Europe. This choice emanates from the necessity to garner an ample number of observations featuring a woman CEO, thereby enabling the execution of rigorous regression analyses. In the United States, as delineated in a World Economic Forum article, merely 15% of Fortune-listed companies are led by a woman CEO. In Europe, as elucidated in a study presented by European Women on Boards, a mere 7% of companies boast a woman CEO. In scrutinizing Europe, specific attention was directed towards nations where women wield a conspicuous presence on corporate boards, including Spain, Germany, the United Kingdom, France, and Switzerland. Therefore, the sample under investigation comprises companies belonging to the following stock indexes: S&P100, FTSE100, IBEX 35, DAX30, CAC40, and SMI. The S&P100 index includes 100 large-cap firms in the United States, whereas the FTSE100 index includes 100 large-cap companies in the United Kingdom. IBEX35 is made up of 35 large-cap Spanish companies, DAX30 consists of thirty large-cap German companies, CAC40 is made up of forty large-cap French companies, and SMI comprises twenty large-cap Swiss companies. Our sample reflects the largest publicly traded companies, thereby offering a comprehensive representation of major players in the corporate landscape. Overall, our sample comprises 325 firm-year observations.

The period taken into consideration is ten years (2010-2019). This decision derives from the need to avoid the years of the financial crisis (2007-2008) and the years immediately following (2009) from the analysis. Data collection for this study relied on the Bloomberg database, a widely recognized and reliable source for financial and governance information.

3.2 Variables

Dependent variable. The dependent variable considered in this article is the appointment of a woman CEO. To measure this construct, a binary variable was created. This variable takes on the value "1" if the CEO in office in a given year is a woman and "0" if the CEO is a man (Knippen, *et al.*, 2018; You, 2021).

Independent variable. The focal independent variable in this article is the presence of a critical mass of women on the board. In the realm of gender-based studies, the concept of women on the board entails a comprehensive exploration of the representation, influence, and impact of women within corporate governance structures. It pertains to the inclusion of women serving on the boards of directors of organizations, a pivotal aspect of contemporary discussions on gender diversity and equality in the corporate sphere. Our analysis revolves around the disclosure of information by companies, as the perceived identity of board members is not within our purview. As expounded in the theoretical background section, a critical mass of women is defined as the presence of three or more women on the board. To quantify this construct, a binary variable was created, taking the value "1" if there are at least three women on the board and "0" if the number of women is less than three (Torchia *et al.*, 2011).

Moderating variables. Two moderating variables were considered in this study. The first one pertains to the presence or absence of a sustainability committee within the board. To gauge this construct, a binary variable was formulated. This variable assumes the value "1" if the company has a sustainability committee on the board in a given year and "0" otherwise (Minciullo *et al.*, 2022). The second one concerns the presence or absence of a sustainability-linked incentive system for board members. This variable takes on the value "1" if the company has a sustainability-linked incentive system for board members in a given year and "0" otherwise (Minciullo *et al.*, 2022).

Control variables. Several control variables were introduced in the analyses as multiple factors could affect the appointment of a woman CEO. First, it was decided to consider four organizational variables: firm size, firm performance, financial leverage, and growth opportunities. Firm size was measured using the natural logarithm of total assets as a proxy. Logarithm transformation was chosen to address potential skewness in the distribution of firm size values, ensuring a more statistically sound analysis. Firm performance was assessed using return on assets, as outlined by Abernethy *et al.* (2019). To bolster robustness, additional analyses were conducted, incorporating return on equity and, alternatively, return on investment as performance metrics. Financial leverage was quantified using the debt-to-equity capital ratio, as per Mishra *et al.* (2020). Growth opportunities were gauged by considering the ratio between market value and the book value of shareholders' equity, following the approach of Thams *et al.* (2020). Two governance variables were included in the analysis: board size and board independence, as defined by Abernethy *et al.* (2019). Board size was measured using the total number of boardroom directors as a proxy.

Board independence was measured by determining the percentage of independent directors out of the total. Furthermore, a decision was made to incorporate a dummy variable to account for the effects stemming from ownership structure characteristics, in line with Hambrick and Finkelstein (1995). To measure ownership structure, a binary dummy variable was constructed, assuming values of "1" or "0" based on the identity of the owner with the majority shareholding, commonly known as the top owner. The dummy variable takes the value of "1" when the ownership structure falls into specific categories based on the identity of the top owner: banks, corporations, family offices, foundations, governments, holding companies, individuals, investment advisors, private equity, and trusts. Additionally, dummy variables were added to consider year effects, country effects, and industry effects. Finally, a dummy variable was introduced, assuming the value of "1" or "0" based on the presence of a binding gender quota in the country where the company is listed, following the study by Casaca *et al.* (2022). The complete list of variables considered, along with their descriptions, is provided in the Appendix.

3.3 Analyses

Descriptive statistical analyses were first carried out. A Pearson correlation matrix was created in a subsequent step to confirm the presence of a correlation between the independent variable and the dependent variable. In the third step, regression analysis was utilized to test the hypothesis. Panel data analyses were employed to investigate dynamics over time, utilizing statistical methods that consider both cross-sectional and time-series variations. This approach facilitates a thorough exploration of the interactions between variables across diverse entities and time periods, thereby enhancing the depth and precision of the study's findings. Given the binary nature of the dependent variable, it was decided to perform a regression analysis using the Logit model and, subsequently, a regression analysis using the Probit model. The utilization of the Probit model is particularly fitting for our study, given its appropriateness for binary outcomes, providing an effective framework for assessing the probability of a woman being appointed as CEO. The Logit model contributes to the robustness of our analysis by adeptly handling nonlinear relationships, allowing us to capture the nuanced and intricate dynamics that may impact the outcome variable. This methodological choice ensures a comprehensive and rigorous examination of the factors impacting the appointment of women CEOs in our study. The STATA statistical package, specifically utilizing the xtprobit and xtlogit commands, was employed to execute our statistical analyses.

4. Findings

Table 1 shows the results derived from the descriptive statistical analyses (mean, standard deviation, minimum and maximum). Table 2, on the other hand, displays the results derived from the correlation analysis. The correlation coefficient between having a critical mass of women on the board and the selection of a woman as CEO is positively aligned, albeit relatively small, yet statistically significant (correlation coefficient = 0.10, p-value < 0.05). This finding is consistent with our initial hypothesis, although it does not assure the existence of a causal relationship between the independent and dependent variables. Additionally, it is notable that the correlation coefficient between firm size and the appointment of a woman as CEO is positive and statistically significant (correlation coefficient = 0.04, p-value < 0.05).

Tab. 1: Descriptive statistics

Variables	Mean	Standard Deviation	Minimum	Maximum
Woman CEO	.037	.189	0	1
Critical Mass WOB	.52	.5	0	1
Sustainability Committee	.373	.484	0	1
Sustainability-linked incentives	.322	.467	0	1
Firm size	24.224	1.887	17.467	28.622
Firm performance	6.46	12.823	-59.76	236.78
Financial leverage	157.664	900.078	-109.391	38429.412
Growth opportunities	6.294	34.836	.005	895.232
Board size	12.063	3.224	3	23
Board independence	71.368	18.707	0	100

Source: our elaboration

Tab. 2: Correlation matrix

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
(1) Woman CEO	1.00									
(2) Critical Mass WOB	0.10*	1.00								
(3) Sustainability Committee	0.07*	0.21*	1.00							
(4) Sustainability-linked incentives	0.02	0.12*	0.30*	1.00						
(5) Firm size	0.04*	0.27*	0.22*	0.15*	1.00					
(6) Firm performance	-0.01	-0.02	-0.07*	-0.05*	-0.22*	1.00				
(7) Financial leverage	0.01	0.01	-0.01	0.00	0.01	0.00	1.00			
(8) Growth opportunities	-0.01	0.01	-0.03	-0.04*	-0.12*	0.55*	0.56*	1.00		
(9) Board size	-0.03	0.39*	0.07*	0.08*	0.46*	-0.16*	-0.01	-0.07*	1.00	
(10) Board independence	0.03	0.14*	0.07*	0.08*	0.32*	0.04*	0.03	0.04*	-0.06*	1.00

** p<0.01, * p<0.05, + p<0.1

Source: our elaboration

Table 3 shows the results derived from the regression analysis with a logit model. In model 1, regression analyses were performed by entering only the control variables. The values reveal the existence of a statistically positive influence of firm size on the dependent variable (b = 0.303; p-value <0.01). This implies that as the size of the company increases, the likelihood of having a woman CEO also increases. Moreover, the findings indicate a negative and statistically significant impact of board size on the dependent variable. (b = -0.126; p-value<0.01). This means that the larger the size of the boardroom the lower the probability of having a woman CEO. In model 2, alongside the entry of control variables, the independent variable under scrutiny was entered as well. The outcomes demonstrate a positive and statistically significant impact of having a critical mass of women on the board on the dependent variable (b = 1.528; p-value<0.01). This means that the presence of a critical mass of women on board facilitates the appointment of a woman CEO.

Therefore, the first hypothesis developed in this article is verified. In model 3, in addition to entering the control variables and the independent variable, we entered the variable related to the presence or not of a sustainability committee on board. According to the findings, such a governance feature does not directly influence the appointment of a woman CEO (b = 0.117; p-value>0.05). In model 4, we added the variable related to the presence or not of a sustainability-linked incentive system for board members. Even in this case, the results indicate that such a governance feature does not directly affect the dependent variable. In model 5, we tested whether the presence of a sustainability committee on board strengthens the relationship between the presence of a critical mass of women on board and a woman CEO selection. The beta coefficient related to the interaction term is positive and significant (b = 0.324; p-value<0.01). Therefore, the second hypothesis developed in this paper is verified. Lastly, in model 6, we tested whether the presence of a sustainability-linked incentive system for board members strengthens the relationship between the presence of a critical mass of women on board and a woman CEO selection. Even in this case, the beta coefficient is positive and significant (b = 0.127; p-value<0.01), which verifies the third hypothesis. Overall, the beta coefficient related to the influence of a critical mass of women on a woman CEO appointment is positive and significant in all the regression models. Although not very high, the R squared increases when passing from model 1 to model 6. After the regression analyses, VIF tests were conducted to verify the presence of multicollinearity. All VIF values were found to be below the cutoff value of 10.

Tab. 3: Regressions with a logit model

	(1) Woman CEO	(2) Woman CEO	(3) Woman CEO	(4) Woman CEO	(5) Woman CEO	(6) Woman CEO
Firm size	0.303** (0.088)	0.284** (0.090)	0.292** (0.091)	0.285** (0.090)	0.301** (0.093)	0.283** (0.091)
Firm performance	-0.013 (0.017)	-0.019 (0.017)	-0.019 (0.017)	-0.019 (0.017)	-0.018 (0.017)	-0.019 (0.017)
Firm leverage	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)
Growth opportunities	-0.016 (0.020)	-0.015 (0.020)	-0.015 (0.020)	-0.015 (0.020)	-0.015 (0.020)	-0.015 (0.020)
Board size	-0.126** (0.047)	-0.223** (0.053)	-0.223** (0.053)	-0.223** (0.053)	-0.226** (0.054)	-0.222** (0.054)
Board independence	-0.001 (0.007)	-0.009 (0.008)	-0.009 (0.008)	-0.009 (0.008)	-0.009 (0.008)	-0.009 (0.008)
CMWOB		1.528** (0.296)	1.540** (0.298)	1.528** (0.296)	1.418** (0.360)	1.569** (0.345)
Sustainability Committee			0.117 (0.244)		0.374 (0.505)	
Sustainability-linked incentives				0.014 (0.239)		0.085 (0.479)
CMWOB X Sustainability Committee					0.324** (0.551)	
CMWOB X Sustainability-linked incentives						0.127** (0.532)
Constant	-8.118** (2.027)	-6.458** (2.080)	-6.604** (2.105)	-6.471** (2.092)	-6.719** (2.117)	-6.469** (2.093)
Ownership structure	Yes	Yes	Yes	Yes	Yes	Yes
Year	Yes	Yes	Yes	Yes	Yes	Yes
Country	Yes	Yes	Yes	Yes	Yes	Yes
Industry	Yes	Yes	Yes	Yes	Yes	Yes
Binding gender quota	Yes	Yes	Yes	Yes	Yes	Yes
Pseudo R^2	0.142	0.179	0.180	0.180	0.190	0.190

Standard errors are in parentheses; CMWOB stands for Critical Mass of Women on Board
** p<.01, * p<.05, + p<.1
Source: our elaboration

Further robustness tests were conducted to understand whether the results found were statistically robust. Firstly, regressions with a probit model were conducted. Results are reported in Table 4. In line with previous findings, the beta coefficient related to the presence of a critical mass of women is positive and significant in all the models. Furthermore, in model 5, we again tested whether the presence of a sustainability committee on board strengthens the relationship between the presence of a critical mass of women on board and a woman CEO selection. The beta coefficient related to the interaction term is positive and significant (b = 0.142; p-value<0.01). In model 6, we again tested whether the presence of a sustainability-linked incentive system for board members strengthens the relationship between the presence of a critical mass of women on board and a woman CEO selection. Even in this case, the beta coefficient is positive and significant (b = 0.078; p-value<0.01).

Tab. 4: Regressions with a probit model

	(1) Woman CEO	(2) Woman CEO	(3) Woman CEO	(4) Woman CEO	(5) Woman CEO	(6) Woman CEO
Firm size	0.151** (0.045)	0.150** (0.046)	0.152** (0.047)	0.150** (0.046)	0.156** (0.047)	0.149** (0.046)
Firm performance	-0.005 (0.008)	-0.008 (0.009)	-0.008 (0.009)	-0.008 (0.009)	-0.008 (0.009)	-0.009 (0.009)
Firm leverage	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)
Growth opportunities	-0.005 (0.008)	-0.006 (0.008)	-0.006 (0.008)	-0.006 (0.008)	-0.006 (0.008)	-0.006 (0.008)
Board size	-0.067** (0.024)	-0.118** (0.027)	-0.118** (0.027)	-0.118** (0.027)	-0.119** (0.027)	-0.117** (0.027)
Board independence	-0.002 (0.004)	-0.006 (0.004)	-0.006 (0.004)	-0.006 (0.004)	-0.006 (0.004)	-0.006 (0.004)
CMWOB		0.779** (0.144)	0.781** (0.145)	0.779** (0.144)	0.727** (0.175)	0.804** (0.167)
Sustainability Committee			0.026 (0.123)		0.133 (0.233)	
Sustainability-linked incentives				0.001 (0.124)		0.056 (0.224)
CMWOB X Sustainability Committee					0.142** (0.261)	
CMWOB X Sustainability-linked incentives						0.078** (0.254)
Constant	-4.064** (1.006)	-3.400** (1.036)	-3.429** (1.049)	-3.401** (1.042)	-3.490** (1.056)	-3.388** (1.042)
Ownership structure	Yes	Yes	Yes	Yes	Yes	Yes
Year	Yes	Yes	Yes	Yes	Yes	Yes
Country	Yes	Yes	Yes	Yes	Yes	Yes
Industry	Yes	Yes	Yes	Yes	Yes	Yes
Binding gender quota	Yes	Yes	Yes	Yes	Yes	Yes
Pseudo R^2	0.142	0.181	0.181	0.181	0.190	0.190

Standard errors are in parentheses; CMWOB stands for Critical Mass of Women on Board
** p<.01, * p<.05, + p<.1
Source: our elaboration

Similar to many studies in the realm of corporate governance, this investigation suffers from sample selection bias and endogeneity. Sample-selection bias entails the non-random selection of specific companies based on the availability of observable data, while endogeneity arises when the independent variable is correlated with other unobserved variables. To effectively counteract these inherent biases, the study employed both propensity score matching (PSM) and nearest neighbor matching (NNM) techniques. Propensity score matching and nearest neighbor matching are well-established methodologies frequently utilized in observational studies (Chatjuthamard *et al.*, 2022), particularly in situations where there are limited comparable observations in the control sample (comprising companies with a critical mass of women on the board) compared to the reference sample (comprising companies without a critical mass of women on the board). These techniques contribute to ensuring a more balanced and meaningful comparison, addressing the challenges posed by the distinct characteristics of the two groups and enhancing the reliability of the study's findings. The matching was performed considering all the control variables previously used in the regression analysis. The results are reported in Table 5. Overall, the empirical findings are in line with what was previously found.

Tab. 5: Propensity score matching and nearest neighbor matching

	(1) PSM	(2) NNM	(3) PSM	(4) NNM	(5) PSM	(6) NNM
CMWOB	.072** (.011)	.060** (.011)				
CMWOB X Sustainability Committee			.051** (.016)	.056** (.015)		
CMWOB X Sustainability-linked incentives					.052** (.014)	.034** (.013)
Firm size	Yes	Yes	Yes	Yes	Yes	Yes
Firm performance	Yes	Yes	Yes	Yes	Yes	Yes
Firm leverage	Yes	Yes	Yes	Yes	Yes	Yes
Growth opportunities	Yes	Yes	Yes	Yes	Yes	Yes
Board size	Yes	Yes	Yes	Yes	Yes	Yes
Board independence	Yes	Yes	Yes	Yes	Yes	Yes
Ownership structure	Yes	Yes	Yes	Yes	Yes	Yes
Year	Yes	Yes	Yes	Yes	Yes	Yes
Country	Yes	Yes	Yes	Yes	Yes	Yes
Industry	Yes	Yes	Yes	Yes	Yes	Yes
Binding gender quota	Yes	Yes	Yes	Yes	Yes	Yes

Standard errors are in parentheses; CMWOB stands for Critical Mass of Women on Board
** p<.01, * p<.05, + p<.1
Source: our elaboration

5. Discussions and conclusions

Since the 1990s, a growing body of research has extensively examined the intricate relationship between the representation of women on corporate boards and organizational performance. Central to this discourse is the "business case" advocating for women's presence at the corporate summit, asserting that an increased representation of women in top leadership is not only a moral imperative but also a strategic advantage benefiting businesses (Hoobler *et al.*, 2018). Despite the recognized benefits of having women in leadership roles, a persistent gender disparity is evident, particularly in the scarcity of women CEOs compared to their male counterparts (Singh and Vinnicombe, 2004; Liu, 2013; Smith and Parrotta, 2018).

Exploring the factors influencing the appointment of women CEOs reveals a nuanced and evolving landscape. While the existing literature is rich, it lacks a comprehensive theoretical model capable of unraveling the intricate web of board-level constructs influencing decisions about appointing a woman CEO (Eagly, 2004; Ryan and Haslam, 2005; Chizema *et al.*, 2015; Geletkanycz, 2020). This paper addresses this gap by subjecting a sample of companies listed in the main markets of advanced economies to rigorous analysis, examining whether the presence of a critical mass of women on boards facilitates the appointment of a woman CEO. Additionally, we explore the moderating role of sustainable governance.

The empirical results affirm a positive and statistically significant impact of a critical mass of women on the appointment of a woman CEO, aligning with critical mass theory, which suggests that as the number of individuals from a minority group increases, so does their influence over the majority group (Granovetter, 1978; Kanter, 1977). Furthermore, our results align with previous organizational studies indicating a bias favoring individuals with similar demographic characteristics in hiring decisions (Latham *et al.*, 1975; Rand and Wexley, 1975; Zajac and Westphal, 1996).

Beyond confirming existing theories, this manuscript introduces novel theoretical insights by exploring the intersection of sustainability-related governance mechanisms and the relationship between women on boards and the selection of a woman CEO. The analyses reveal that the presence of a sustainability committee within the board reinforces the connection between women's board representation and the appointment of a woman CEO. Additionally, the analyses highlight that this causal link is more robust when the company implements a sustainability-linked incentive system. This nuanced exploration enhances our understanding of the dynamics at play and provides valuable considerations for advancing gender equality and sustainable governance practices within corporate leadership structures.

Our research findings intricately intersect with several distinct scholarly inquiries. Firstly, our study contributes to the existing literature on women on boards by illustrating that their presence not only positively influences corporate performance and innovation (Torchia *et al.*, 2011; Isidro and Sobral, 2015) but also plays a crucial role in fostering greater gender diversity within the executive suite, particularly in the journey to the CEO role. By unraveling the interconnectedness of women's presence on boards with their access to top leadership positions, we contribute to a more holistic understanding of the multifaceted implications of gender diversity in corporate governance.

Furthermore, our study makes a notable contribution to the relatively sparse literature on women CEOs. While women currently constitute a minority in CEO roles, our research sheds light on crucial factors that can facilitate their trajectory to these upper echelons of leadership. This nuanced perspective challenges preconceived notions and highlights that, despite being underrepresented, women can overcome barriers with the right conditions and support systems.

In a distinctive vein, our investigation addresses a long-standing and underexplored research question: the governance features that either amplify or diminish the influence of a critical mass of women on board in the selection of a woman CEO. Recent scholarly distinctions between generic corporate governance mechanisms and sustainability-related corporate governance mechanisms (Minciullo *et al.*, 2022) provide a conceptual framework for our analysis. Sustainability-related mechanisms are purposefully designed to integrate socio-environmental issues into decision-making processes, aiming to bring these critical matters to the forefront of board discussions. Generic mechanisms, in contrast, are broad governance tools that enhance overall corporate governance, impacting various facets of the firm.

Our study significantly advances the discourse on sustainability-related corporate governance mechanisms by revealing their role in dismantling barriers that often impede women from attaining top leadership positions. By showcasing the distinct impact of sustainability-focused governance measures, we contribute not only to the board gender diversity conversation but also to the evolving understanding of the broader role of sustainability practices in reshaping corporate leadership dynamics.

One significant ramification of our findings is that an increase in the number of women on the board, surpassing a specific threshold, correlates with an amplified influence on the selection of a woman CEO. However, the interpretation of this result may vary among different interest groups. For women, it could be perceived as an additional motivation to shatter the glass ceiling and advocate for workplace inclusivity at the upper echelons of companies. Conversely, men might interpret this empirical evidence as a mechanism that favors individuals based on demographic criteria rather than skills and abilities, potentially raising concerns about exclusion from top positions as the critical mass of women on boards grows. A foreseeable challenge is that companies might introduce tools for selecting top management figures, such as CEOs, that mitigate cognitive biases inherent in human decision-making.

A second key implication is that a company's commitment to sustainability appears to diminish the unseen barriers preventing women from attaining top leadership positions. It is crucial to approach this result with caution, as the findings don't establish a direct relationship between the presence of a sustainability committee and the appointment of a woman CEO. Instead, the results indicate a moderating relationship - when there is a sustainability committee on the board, the connection between women on the board and the selection of a woman CEO becomes stronger. This suggests that companies aspiring to genuine inclusivity for women can enhance their efforts by establishing governance bodies dedicated to pursuing social and environmental sustainability goals. Similarly, incentivizing sustainability objectives within incentive systems can be a strategic move for companies aiming to foster a truly inclusive environment for women.

Recognizing the potential for future exploration, it is imperative to address the inherent limitations in this study, as they influence both the theoretical and practical implications of our findings. A primary limitation revolves around the scope of our sample, prompting questions about the generalizability of our results to the broader global landscape of companies. To bolster the robustness of our conclusions, future research should broaden its horizons by incorporating data from additional nations and regions worldwide. Exploring companies in diverse developed economies, such as Japan, South Korea, and Australia, would yield a more comprehensive understanding of the nuanced dynamics at play.

A second limitation arises from the decision to exclusively focus on listed companies. While this choice was driven by the need for a comprehensive sample in our analyses, it prompts contemplation about whether the relationship between the critical mass of women on boards and the appointment of a woman CEO holds true across different types of companies, including non-listed entities. Subsequent research, facilitated by data availability, could delve into this aspect, uncovering whether this correlation transcends the listing status of a company.

Furthermore, a constraint in our empirical method is the inability to directly analyze the underlying behavior of women directors. This limitation is a common challenge in board studies due to the notorious difficulty in obtaining original board data. To enhance the depth and reliability of insights, future research, particularly qualitative in nature, could illuminate micro-behavioral mechanisms within the boardroom. Qualitative investigations can unveil specific dynamics, offering a more nuanced understanding of the interactions and decision-making processes among women directors.

In charting the course for future research, an intriguing direction lies in dissecting the impact of context-level differences. A focused exploration into the dynamics within women-dominated industries, for example, could yield valuable insights into how the critical mass of women on boards shapes the appointment of a woman CEO within specific organizational contexts.

Furthermore, we urge scholars to transcend the confines of critical mass theory and embrace a diverse array of theoretical frameworks, moving beyond traditional sociological and management paradigms. This expanded theoretical approach holds the promise of enriching our understanding of the entire phenomenon, contributing to a more holistic comprehension of the intricate interplay between women on boards and the selection of women CEOs. By incorporating varied theoretical perspectives, future research has the potential to unveil new dimensions, enabling a more nuanced exploration of the complex dynamics at the intersection of gender, governance, and leadership.

Our research not only highlights the positive influence of a critical mass of women on the board on the selection of a woman CEO but also emphasizes the pivotal role of sustainability governance in amplifying this effect. Specifically, our findings reveal that the presence of a sustainability committee within the board serves as a potent catalyst, further increasing the likelihood of appointing a woman as CEO. Furthermore, our results demonstrate that sustainability-linked incentive systems also act as influential catalysts. Overall, the synergistic interplay of gender diversity and sustainability initiatives within the governance framework emerges as a crucial driver for fostering inclusive leadership, offering valuable insights for organizations aiming to create more equitable and sustainable corporate environments.

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Appendix

N.	Variable	Source	Description
1	Woman CEO	Bloomberg	Binary variable that takes the value "1" if the individual is a woman and "0" if the individual is a man
2	Critical Mass WOB	Bloomberg	Binary variable that takes the value "1" if there are at least three women in the board of directors and "0" otherwise
3	Sustainability Committee	Bloomberg	Binary variable that takes the value "1" if there is a sustainability committee within the board and "0" otherwise
4	Sustainability-linked incentives	Bloomberg	Binary variable that takes the value "1" if there are sustainability targets within the incentive system and "0" otherwise
5	Firm size	Bloomberg	Natural logarithm of total assets
6	Firm performance	Bloomberg	Return on assets; Return on equity; Return on investment
7	Firm leverage	Bloomberg	Ratio between debt capital and equity capital
8	Growth opportunities	Bloomberg	Ratio between market value and book value of equity
9	Board size	Bloomberg	Number of directors present in the board of directors
10	Board independence	Bloomberg	Percentage of independent directors out of the total number of directors present in the board
11	Ownership structure	Bloomberg	Variable that takes the value "1" based on the identity of the majority shareholder
12	Year	Bloomberg	Variable that takes the value "1" based on the year to which the collected data refer
13	Country	Bloomberg	Variable that takes the value "1" based on the country to which the collected data refer
14	Industry	Bloomberg	Variable that takes the value "1" based on the industry to which the company belongs
15	Binding gender quota	Bloomberg	Binary variable that takes the value "1" if there is a binding gender quota in force in the country where the company operates, with consideration to the current year

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