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GENDER DIVERSITY AND FIRM PERFORMANCE: THE CASE OF PORTUGUESE MEDIUM FIRMS

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Abstract:

Gender diversity on Boards of Directors (BoD) has gained increasing prominence in the literature, particularly in the context of corporate governance and financial performance. The present study examines whether there is a relationship between gender diversity on BoD and the financial performance of medium-sized, unlisted Portuguese industrial companies. A quantitative approach was adopted using panel data from 298 companies over the period 2018 to 2023. The results reveal that the majority of companies in the sample would not meet the minimum threshold of 33.33% female representation on boards, as established by the European Directive on gender balance. The findings do not indicate a significant association between either the presence or proportion of women on boards of directors and the main financial indicators analysed. Similarly, no significant relationship was found between female firm leadership and firm performance. The limited presence of women in leadership positions observed in the companies analysed may explain the absence of the positive effects highlighted in the literature. Nevertheless, the results should not be interpreted as a denial of the relevance of female leadership, but rather as a reflection of persistent structural gender inequality in medium-sized Portuguese companies.

Key words: *gender diversity, financial performance, boards of directors, SMEs, critical mass theory*

1. Introduction

The business context is influenced by various economic, social, cultural, and political factors, which have a direct impact on corporate performance and outcomes. Among these factors, gender diversity on BoD has been gaining prominence in the literature.

The BoD plays a fundamental role in the structure and daily operations of companies, with key responsibilities that include defining strategy, ensuring compliance with legal standards, and safeguarding the proper functioning of the company and assuring business continuity. In this regard, it becomes relevant to understand whether more gender-diverse boards effectively contribute to better corporate results. Several studies highlight the potential of gender diversity to promote different perspectives, improve decision-making quality, and foster innovation within organizations. However, despite progress in women's access to education and professional training, female underrepresentation in leadership roles and at the highest decision-making levels persists (European Commission, 2025).

Considering that, in Portugal, most of the business fabric consists of unlisted small and medium-sized enterprises (SMEs), this study aims to examine whether there is a significant relationship between gender diversity on BoD and the financial performance of these companies, focusing in particular on medium-sized enterprises. This focus is especially relevant since gender diversity regulations are far less stringent for medium-sized firms than for large publicly listed companies.

To this end, the present research adopts a quantitative approach to relate gender diversity measures to selected financial performance indicators. This study distinguishes itself from existing literature by focusing on a less explored business segment - unlisted SMEs, specifically medium-sized enterprises - where this type of analysis remains relatively uncommon.

Thus, this work is divided and organized as follows: the next section provides a literature review. Section 3 describes the variables, data, and methodology used. Section 4 presents the main results of the study, which are discussed in Section 5. Finally, the last section concludes the article by outlining the study's main practical implications, its limitations, and suggestions for future research.

2. Literature review

2.1. Gender diversity in the Board of Directors

Gender diversity has increasingly been identified as a relevant factor associated with strengthening the effectiveness of Corporate Governance (Adams & Ferreira, 2009). The inclusion of diverse profiles on BoD has been recognized as one of the most significant contemporary developments in the field (Alvarado et al., 2017). Board diversity is understood as the combination of different attributes, characteristics, and competencies that individual members contribute to the board (Alvarado et al., 2017; Van der Walt & Ingley, 2003). The literature generally distinguishes between two types of diversity. The first relates to demographic diversity, based on observable and easily identifiable characteristics such as gender, ethnicity, and educational background. The second encompasses non-visible attributes, including knowledge, competencies, professional profiles, and individual abilities (Alvarado et al., 2017; Milliken & Martins, 1996; Pelled, 1996). Within this framework, the present study focuses on the first category, specifically gender diversity.

In recent years, academic interest has grown regarding the extent to which the presence of women in leadership positions and on BoD may influence firm value (Arvanitis et al., 2022). However, the debate remains ongoing, reflecting the complexity of the

phenomenon and the mixed empirical findings reported in the literature (Hussain et al., 2024). Accordingly, this study adopts an interdisciplinary approach grounded in the core principles of agency theory, resource dependence theory, social psychology and social identity theory, as well as tokenism and critical mass theory. By integrating these theoretical perspectives, this paper aims to deepen the analysis of the effects of gender diversity on corporate boards and to provide a more comprehensive and complete understanding of the topic.

2.1.1. Agency theory

According to Jensen and Meckling (1976), an agency relationship can be defined as a contract in which one or more individuals, referred to as the "principals", hire another individual or group of individuals, the "agents", to perform tasks or services on their behalf, delegating to them a certain degree of decision-making authority. However, the objectives and interests of these two parties are not always aligned, which may give rise to conflicts between them. This situation is commonly known as the "agency problem" (Eisenhardt, 1989; Jensen & Meckling, 1976; Ross, 1973).

Within the corporate context, agency theory assumes a fundamental conflict of interest between shareholders (the principals) and managers (the agents) (Arvanitis et al., 2022; Berle & Means, 1932). Its primary objective is therefore to identify, explain, and mitigate these conflicts (Fama & Jensen, 1983; Jensen & Meckling, 1976; Moreno-Gómez & Calleja-Blancon, 2018).

In this framework, the BoD plays a pivotal role in monitoring managerial actions and ensuring that decision-making aligns with shareholder interests. Without effective oversight, each party may prioritize its own objectives, potentially undermining the organization's long-term goals and performance (Fama & Jensen, 1983; Hart, 1995; Hernandez-Atienza et al., 2024; Jensen & Meckling, 1976; Panda & Leepsa, 2017).

The Board's essential function is thus to mitigate agency problems between managers and shareholders, and board independence constitutes a key factor in ensuring that this body acts in the best interests of shareholders (Carter et al., 2003; Fama & Jensen, 1983). For monitoring and control to be effective, it is also crucial that boards possess a high-quality composition and operate impartially (Alvarado et al., 2017; Moreno-Gómez & Calleja-Blancon, 2018).

The literature suggests that gender diversity may enhance board effectiveness by strengthening independence in judgment and decision-making (Adams et al., 2015; Adams & Ferreira, 2009; Hernandez-Atienza et al., 2024). Several studies document a positive association between the presence of women on boards and a more rigorous monitoring of management (Adams & Ferreira, 2009; Joecks et al., 2013; Moreno-Gómez & Calleja-Blancon, 2018). Female directors are often found to contribute additional competencies and diverse perspectives, potentially improving the quality of decisions, enhancing organizational performance, and creating value for a broader set of stakeholders (Carter et al., 2003; Moreno-Gómez & Calleja-Blancon, 2018; Singh & Vinnicombe, 2004).

Drawing on agency theory, Adams and Ferreira (2009) conclude that gender-diverse boards exhibit stronger monitoring capabilities and foster greater managerial accountability. The literature also suggests that female board members tend to evidence greater sensitivity

to ethical issues, lower levels of opportunistic behaviour, and a willingness to propose innovative approaches to complex organizational challenges (Arvanitis et al., 2022; Cumming et al., 2015; Francoeur et al., 2008; Jensen, 1993; Krishnan & Parsons, 2008). Similarly, authors such as Carter et al. (2003) argue that diversity enhances board independence. Consistent with this view, Adams and Ferreira (2009) find that women are more likely to serve as independent directors, which may improve the board's monitoring function (Liu et al., 2014; Marquez-Cardenas et al., 2022).

Nevertheless, Adams and Ferreira (2009) and Bøhren and Staubo (2016) caution that the effects of increased independence and enhanced monitoring are not uniformly beneficial across all organizations. Firms differ in their need for oversight, and a substantial increase in the number of directors, women or otherwise, who prioritize strict control may, in some contexts, hinder organizational performance by imposing levels of monitoring that exceed what is optimal (Adams & Ferreira, 2009; Bøhren & Staubo, 2016; Marquez-Cardenas et al., 2022).

2.1.2. Resource dependence theory

Resource dependence theory provides a foundational framework for understanding the crucial role played by BoD, particularly in the context of gender diversity and its potential influence on firm performance (Marquez-Cardenas et al., 2022). According to this theory, companies operate within an open system in which the acquisition and exchange of essential resources are vital for organizational survival. As a result, firms inevitably become dependent on external actors and sources for access to these resources (Liu et al., 2014; Marquez-Cardenas et al., 2022; Pfeffer & Salancik, 1978). This dependence on external factors creates uncertainty, which translates into increased organizational risk (Liu et al., 2014).

Within this framework, resource dependence theory posits that a firm's success and long-term viability are fundamentally linked to its capacity to secure critical external resources (Arvanitis et al., 2022; Pfeffer & Salancik, 1978). The BoD, acting as an interface between the firm and its external environment, plays a central role in this process and is consequently a key determinant of organizational competitiveness and success (Arvanitis et al., 2022; Hillman et al., 2000; Moreno-Gómez & Calleja-Blancon, 2018; Pfeffer & Salancik, 1978).

The literature indicates that board members can provide substantial advantages to organizations, including access to valuable information through strategic advice and guidance. In addition, the Board can function as a communication channel between the firm and its external environment, facilitating access to privileged resources such as financing, strategic partnerships, and enhanced legitimacy among investors, clients, and other stakeholders (Alvarado et al., 2017; Isidro & Sobral, 2015; Moreno-Gómez & Calleja-Blancon, 2018).

Empirical studies grounded in resource dependence theory, such as Hillman et al. (2000), suggest that more diverse boards are more effective than homogeneous ones in securing and mobilizing key external resources (Arvanitis et al., 2022). The inclusion of directors of different genders broadens the range of perspectives, knowledge, and skills available to the Board, thereby strengthening its strategic decision-making capacity (Arvanitis et al., 2022). Consequently, gender-diverse boards enhance a firm's ability to

access valuable resources, which may contribute to improved organizational performance (Carter et al., 2003; Marquez-Cardenas et al., 2022).

With respect to strategic advice and decision-making, the literature further suggests that gender-diverse boards tend to be associated with higher-quality deliberations, particularly when addressing complex issues or matters involving key stakeholder groups such as employees, customers, and business partners (Arvanitis et al., 2022; Daily et al., 1999; Huse & Solberg, 2006; Kravitz, 2003; Liu et al., 2014). Moreover, resource dependence theory emphasizes that gender diversity enhances corporate legitimacy, promotes intercultural sensitivity, and supports firms' internationalization efforts (Carter et al., 2003; Hernandez-Atienza et al., 2024; Hillman et al., 2000; Marquez-Cardenas et al., 2022).

Overall, the presence of diversity on boards, by enabling organizations to access a broader array of resources, may help reduce environmental uncertainty and external dependence, while strengthening organizational reputation (Alvarado et al., 2017; Hillman & Dalziel, 2003; Moreno-Gómez & Calleja-Blancon, 2018).

Nevertheless, several studies present contrasting evidence, suggesting that diversity may, in certain contexts, create challenges for board cohesion (Hernandez-Atienza et al., 2024). Westphal and Milton (2000) argue that the interpersonal and social barriers often associated with diversity can reduce the likelihood that minority perspectives influence board decisions, thereby diminishing board effectiveness (Hernandez-Atienza et al., 2024). This line of reasoning aligns with Social Psychology and Social Identity theories, as well as the phenomenon of tokenism, presented below.

2.1.3. Identity and social psychology theories

In contrast to the previously discussed theoretical perspectives, both social identity theory and social psychology theory suggest that gender diversity on Boards of Directors may, under certain conditions, hinder board effectiveness and overall functioning (Arvanitis et al., 2022). According to social identity theory, individuals naturally categorize themselves into social groups based on psychological and demographic attributes such as gender, age, nationality, social class, or profession. This self-categorization process can lead to intergroup differentiation, fostering tensions, conflicts, and reduced cohesion among board members. Such dynamics may undermine communication and cooperation, ultimately affecting the quality and efficiency of board decision-making (Arvanitis et al., 2022; Tajfel, 1978).

Aligned with this view, Jehn et al. (1999) argue that diversity in social categories, such as gender and age, tends to increase relational conflict within work groups (Arvanitis et al., 2022). Carter et al. (2003) similarly note that increased gender diversity does not automatically translate into more effective board operations, as more heterogeneous boards may face a higher incidence of conflicts of interest among their members (Arvanitis et al., 2022; Goodstein et al., 1994).

Consistent with the principles of social identity theory, social psychology perspectives also recognize that diversity can influence board dynamics in both beneficial and detrimental ways (Arvanitis et al., 2022). Some scholars, including Westphal and Milton (2000), argue that minority members, by introducing distinct viewpoints, may disrupt established patterns

of group consensus. While this can reduce the risk of groupthink, it may simultaneously complicate deliberations and hinder the decision-making process (Arvanitis et al., 2022; Campbell & Mínguez-Vera, 2008).

2.1.4. Tokenism and the critical mass theory

Minority group members within larger groups may be marginalized or perceived as symbols rather than individuals, a phenomenon known as "tokenism" (Kanter, 1977; Torchia et al., 2011). In gender-imbalanced boards, women often face this token status, being viewed more as representatives of their gender than as individuals with unique skills (Liu et al., 2014). As gender diversity has gained visibility in organizational discussions, women in token roles experience heightened pressure to justify their presence and value, which can reinforce gender stereotypes and limit perceptions of their leadership abilities (Kanter, 1977; Lee & James, 2007; Torchia et al., 2011).

Tokenism can hinder women's influence in decision-making, by erecting barriers to accessing critical networks and information, particularly in senior leadership roles - a phenomenon known as the "glass ceiling" (Campbell & Mínguez-Vera, 2010; Oakley, 2000; Kotiranta et al., 2007). This invisible barrier is maintained through structural, cultural, and organizational practices, including promotion policies and male-dominated norms, which restrict career progression and limit women's real influence on boards (Krishnan & Park, 2005; Thams et al., 2018).

To overcome tokenism, a critical mass of women is needed to ensure their contributions are recognised and their influence is substantive (Kristie, 2011; Shrader et al., 1997). Applied to boards, critical mass theory suggests that "one is a token, two is a presence, and three is a voice" (Liu et al., 2014, p. 170). In other words, at least three women are needed for meaningful participation and impact (Arvanitis et al., 2022; Torchia et al., 2011; Kramer et al., 2007). Research suggests that achieving this threshold improves board functioning, enhances corporate innovation, and positively affects financial performance (Arvanitis et al., 2022; Brahma et al., 2020; Liu et al., 2014).

Empirical studies further suggest a U-shaped relationship between gender diversity and firm performance: initially, women's inclusion may negatively affect outcomes, but once approximately 30% female representation is achieved, boards experience improved effectiveness and financial results (Joecks et al., 2013). Despite these findings, additional empirical research is needed to refine the critical mass concept and validate its applicability across different corporate contexts (Torchia et al., 2011).

2.2. Gender diversity and firm financial performance

As previously mentioned, in recent years, gender diversity has become a topic of great importance in academic literature. Numerous studies have sought to examine whether the presence of gender diversity on BoD does or does not result in improved financial performance (Arvanitis et al., 2022). However, despite the large number of articles addressing this issue, the literature still does not present a consensual position due to the contradicting results obtained.

Erhardt et al. (2003) investigated the correlation between gender diversity on Boards and firms' financial performance, using ROA (Return on Assets) and ROI (Return on

Investment) as metrics. Based on data from the 127 largest U.S. companies, covering the period from 1993 to 1998, they concluded that gender diversity on Boards is significantly related to superior performance in both financial indicators examined.

Through their study, Campbell and Mínguez-Vera (2008) concluded that the presence of women on Boards does not directly affect firm value, but Board diversity, measured by the percentage of women and diversity indices, had a positive impact on firm value.

In contrast, Adams and Ferreira (2009) used U.S. companies from 1996 to 2003 and concluded that women have a significant impact on Boards and on firms' performance, although this impact is negative. Additionally, the study suggests that gender quotas may reduce firm value in companies with strong corporate governance.

In 2010, Campbell and Mínguez-Vera conducted another study, analysing the short- and long-term effects of including women on the Boards of Spanish companies between 1989 and 2001. Their results indicated that, in the short term, the stock market reacts positively to announcements of women joining Boards, suggesting that, on average, investors believe female presence adds value to the firm.

According to Lückerath-Rovers (2011), gender diversity may lead to better decision-making; however, the author argued that its impact on financial performance is difficult to measure due to the complexity of the factors involved.

Regarding mandatory gender quota legislation, Matsa and Miller (2013) investigated the impact of such measures in Norway. They concluded that although the number of women on Boards increased significantly, firm profitability decreased in the short term. Thus, the authors reinforced that while quotas may increase gender diversity, they may also have adverse economic effects, particularly in the short run.

From a different perspective, Joecks et al. (2013) argued that the presence of women on Boards is positively correlated with firm performance, but only when a "critical mass" threshold of 30% female representation is reached. These results align with Critical Mass Theory, indicating that the influence of women on corporate decisions becomes evident only when they hold a significant proportion of Board seats.

More recent studies, such as Alvarado et al. (2017), analysed 125 non-financial companies listed on the Madrid Stock Exchange between 2005 and 2009 and found a positive relationship between gender diversity on Boards and firm performance. Their research suggests that the presence of women on Boards may bring new ideas, skills, and perspectives, which can add value to firms. According to Alvarado et al. (2017), Spain's "Equality Law," which introduced mandatory legislation to increase female representation on Boards, had a significant impact. Thus, the authors argue that mandatory regulation can be an effective mechanism for promoting gender diversity on Boards of Directors.

Focusing more specifically on the active participation of women in corporate decision-making, Green and Homroy (2018) showed that female presence on key governance committees, such as audit, nomination, and compensation committees, results in a significant positive impact on firm performance. These results highlight the importance of ensuring that women hold effective decision-making roles rather than merely symbolic positions, an idea linked to the Tokenism Theory discussed earlier.

Other authors, such as Bennouri et al. (2018), examined the relationship between gender diversity on Boards and financial performance in a sample of 394 French companies

between 2001 and 2010. Their results indicated that female presence on Boards is associated with increases in indicators such as ROA and ROE (Return on Equity), but also revealed a negative impact on market performance, measured by Tobin's Q. This suggests that although gender diversity may have positive effects on firm performance, the impact on market value may be more complex.

Pacheco et al. (2020), using balanced panel data from 4,806 Portuguese SMEs for the period 2010–2019, found no broad significant relationship between women's leadership and performance, although there was slight evidence of a negative relationship moderated by firm age and presence in certain activity sectors.

More recently, Arvanitis et al. (2022) investigated the impact of gender diversity on firm performance and concluded that gender diversity on Boards promotes a positive effect on corporate performance. The authors suggest that diversity enhances legitimacy, monitoring, decision-making, and access to external resources, which may lead to superior financial performance. This idea aligns with agency theory and resource dependence theory. However, they also observed an inverted U-shaped relationship between the percentage of women on Boards and firms' financial performance, since after a critical point of 33%, the positive effect reverses, suggesting that excessive diversity may harm performance. To a certain extent, this contradicts the results of Joecks et al. (2013) and the "Critical Mass Theory," which argue that women only exert a positive influence on performance once they reach a significant number on the Board.

Recently, in a systematic literature review, Hazaea et al. (2023) highlighted mixed conclusions across studies examining the relationship between gender diversity and financial performance. According to the authors, most research has prioritised firm-level control variables over those relating to employees or contextual variables. At the same time, their analysis indicates a broad reliance on established theoretical frameworks, alongside the emergence of new theories, reflecting the expansion of the field.

2.3. Mandatory gender quotas in companies

In recent years, the balanced representation of genders on BoD has been a widely debated topic, contributing to the development of policies, regarding the implementation of gender quotas in various decision-making bodies of listed companies (Adams, 2016; Falconieri & Akter, 2023; Schwartz-Ziv, 2017).

Despite significant progress in recent decades in women's participation in the labour market and in education levels, gender disparities remain a reality, with women still underrepresented in leadership positions, particularly on BoD and in top executive roles within organizations (European Commission, 2025).

The growing awareness of this underrepresentation has led many organizations to reassess their policies and practices concerning gender diversity (Oakley, 2000). Accordingly, in recent years, several countries have implemented recommendations and/or mandatory laws aimed at promoting greater female presence on corporate Boards. However, despite some progress, women's participation in these bodies continues to fall short of desired targets (Alvarado et al., 2017; European Commission, 2025).

Thus, legislative proposals have clearly emphasized the importance of gender diversity within organizations, and companies have been facing increasing pressure from regulatory authorities to strengthen this diversity on their BoD (Liu et al., 2014).

At the European level, the European Union (EU) has implemented concrete measures to promote gender equality, especially the equitable presence of women in leadership roles. Since 2010, gender equality has been a priority in EU policies, reflected in a range of legislative initiatives aimed at ensuring equal opportunities for women at the highest levels of political, economic, and public decision-making (Landini & Ferrannini, 2022; Pistoresi et al., 2024; Sapala, 2021). One of the main strategies adopted to achieve this objective was the EU Gender Equality Strategy, which identifies as key goals the increase of female representation on corporate Boards and the promotion of gender equality in leadership positions (European Commission, 2025).

Despite their capabilities and achievements in education, women remain significantly underrepresented compared with men in corporate decision-making bodies across the EU. To address this disparity, a Directive aimed at promoting gender balance on BoD entered into force in December 2022[1]. This directive requires listed companies to ensure that at least 40% of non-executive board members of each gender are represented, or 33% of all board members (European Commission, 2025). Similar rules currently apply in public administration and state-owned enterprises.

The most recent data from the European Institute for Gender Equality (EIGE) indicate a slight increase in female representation on the Boards of the largest listed companies (European Commission, 2025). In 2024, women accounted for 34.7% of board members, reaching a historic high compared with 33.8% in 2023. To date, 12 Member States have achieved the target of at least 33% female representation among all board members, with Portugal standing out at 34.7%. Conversely, there are still five Member States where gender balance remains highly unequal, with women representing less than one-fifth (between 10.2% and 18.5%) of board members in the largest listed companies (European Commission, 2025).

Moreover, the proportion of women in non-executive roles in the two main decision-making bodies of major listed EU companies stands at approximately 37.2%, with Portugal again notable at 44.2%. However, when observing the proportion of women in executive roles, the percentage is significantly lower (around 23.3%), with Portugal falling below this average at only 17.4%. This disparity (fewer women in executive than in non-executive roles) is present in most EU Member States, specifically in 22 out of 27 (European Commission, 2025).

Despite the progress in gender balance on Boards, largely driven by legislative efforts in certain Member States, only a very small number of women reach top leadership positions in listed companies. Although women currently represent more than 30% of board members, their presence in chair positions (8.1%) or as CEOs (7.8%) remains extremely low. It is also notable that in some countries, the number of women in these roles has been declining (European Commission, 2025).

[1] Directive (EU) 2022/2381 of the European Parliament and of the Council of 23 November 2022 on improving the gender balance among directors of listed companies and related measures. Available at: https://eur-lex.europa.eu/eli/dir/2022/2381/oj/eng.

Overall, while the presence of women in management positions in major European companies has evolved positively, substantial disparities persist between countries, and gender balance remains far from reality in many corporate contexts. However, resistance to the implementation of quotas and concerns about ensuring a sufficient pool of qualified candidates for leadership roles remain central issues in contemporary debates (Falconieri & Akter, 2023).

Although such regulatory initiatives contribute to advancing gender equality on Boards, some authors argue that they may also produce disadvantages. The imposition of gender quotas may compromise the true integration of women in these bodies, as it does not ensure that they effectively participate in corporate decision-making processes (Green & Homroy, 2018). Nevertheless, while gender equality may be regarded as an important goal for companies its adoption ultimately depends on its relationship with the organization's financial performance (Kotiranta et al., 2007).

2.4. Research hypotheses

Considering the various themes and theories discussed in the Literature Review, the present study conducts an empirical analysis based on several research hypotheses to examine whether, in medium-sized Portuguese non-listed companies, greater gender diversity on BoD has a significant impact on firms' financial performance. Thus, the hypotheses examined are as follows:

H1: Medium-sized Portuguese companies (non-listed) comply with the gender balance Directive for BoD applicable to listed companies.

H2: The presence and relative weight of women on Boards has a positive impact on profitability.

H3: Companies led by women exhibit higher profitability.

This study also examines whether certain firm characteristics moderate the relationship between board gender diversity and firm performance. To this extent, the control variables used in the analysis are presented in the following section.

3. Variables, data and methodology

3.1. Variables

The dependent variable used in this study is the financial performance of the firms. The literature on this topic presents a variety of indicators to measure this variable, ranging from firm value e.g. Tobin's Q (Carter et al., 2003; Adams & Ferreira, 2009), to accounting indicators such as ROA or ROI (Arvanitis et al., 2022; Joecks et al., 2013).

Based on data availability and practical relevance, the present study chooses to use the following ratios to assess firms' financial performance:

- EBIT / Total assets
- EBITDA / Total assets
- Return on Assets (ROA): (Net profit / Total assets)
- Profit Margin (Net profit / Turnover)

Regarding the independent variable, this investigation considers gender diversity. Given the complexity of this concept, previous studies have employed different ways to measure it. Among the most common approaches are: the use of dummy variables indicating the presence of at least one woman on the BoD or whether the Board is chaired by a woman (Adams & Ferreira, 2009); the proportion of women on the board; and diversity indices such as Blau or Shannon indices (Campbell & Mínguez-Vera, 2008; Arvanitis et al., 2022). Although diversity indices offer a more comprehensive and accurate measurement of the phenomenon, the limitation in data availability led to the adoption of a more pragmatic approach, opting for the use of dummy variables. In this context, gender diversity will be assessed using three distinct indicators:

- Presence of Women on the BoD: dummy variable equal to 1 when there is at least one woman on the Board and 0 otherwise;
- Percentage of Women on the BoD: calculated using the ratio between the number of women on the Board and the total number of Board members;
- Presence of Women in leadership roles on the Board (Chair or Vice-Chair): dummy variable equal to 1 when a woman occupies a leadership position and 0 otherwise.

In addition to the main variables, it is essential to consider potential moderating factors that may influence the strength or quality of the relationship between gender diversity and financial performance (Arvanitis et al., 2022; Pacheco et al., 2020). These control variables aim to capture structural characteristics of firms that may influence both financial performance and gender diversity, thus enabling a more rigorous and balanced analysis.

In this study, based on their theoretical relevance and empirical support, the following control variables were defined:

- Leverage: calculated as the ratio of liabilities to total assets, thus reflecting the firm's degree of financial leverage;
- Firm Size: measured using total assets, which reflects the entity's scale and operational capacity;
- Board Size: determined by the total number of members composing the BoD;
- Firm Age: calculated by subtracting the year of incorporation from 2023 (the last year analysed).

The variables used in this study are summarised in Table 1:

Table 1 – Selected variables for the analysis

Type of variable	*Ackronym*	*Meaning*	*Formula*
Dependent variable	REBIT	REBIT	EBIT / Total assets
	REBITDA	REBITDA	EBITDA / Total assets
	ROA	Return on Assets	Net profit / Total assets
	PM	Profit margin	Net profit / Turnover
Independent variable	PRESENCE	Presence of women on the BoD	Dummy variable equal to 1 when there is at least one woman on the Board and 0 otherwise
	PERCENT	Percentage of women on the BoD	Ratio between the number of women on the Board and the total number of Board members
	LEADER	Presence of women on leadership roles in the BoD	Dummy variable equal to 1 when a woman occupies a leadership position and 0 otherwise

Control variable	LEV	Leverage	Total liabilities / Total assets
	DIM	Firm size	Log of Total assets
	DIM_BOARD	Board size	Total number of members in the BoD
	AGE	Firm age	Log (Year of 2023 – Incorporation year)

Source: Own elaboration.

3.2. Data

The data were collected from ORBIS, for the period from 2018 to 2023. The criteria applied in constructing the sample were as follows:

1. Inclusion of only active companies headquartered in mainland Portugal;
2. Exclusion of companies with fewer than 51 employees or more than 250 employees, in accordance with the legal definition of medium-sized companies (Decree-Law No. 372/2007 of 6 November), thus focusing the analysis on medium-sized companies;
3. Exclusion of companies with a turnover exceeding 50 million euros, also considering one of the criteria defined in the aforementioned Decree-Law, thereby excluding large companies;
4. Selection of companies belonging to sectors with higher technological intensity, based on the Portuguese Classification of Economic Activities (CAE), specifically covering the "High Technology" or "Medium-High Technology" sectors (CAE 20 to 32).

By applying criteria 2 and 3, micro and small companies were excluded, whose reported information tends to be more variable and incomplete, ensuring greater robustness and reliability of the study. Large companies were also excluded, as the study aims to focus on medium-sized companies. The justification for criterion 4 lies in seeking a more homogeneous sample, focused on sectors where female participation in leadership positions is often perceived as relatively low (e.g., Newstead et al., 2023).

After applying all the selection criteria, the final sample consisted of 298 companies. Considering the six-year period under analysis, a total of 1,788 observations were obtained. This panel data sample enables the examination of both time-series and cross-sectional effects while ensuring alignment with the research objectives of the study.

3.3. Methodology

Considering the variables included and the nature of the sample data, a panel data regression models are the most appropriate methodology for addressing the research questions of this study. This methodology offers several advantages, including improved detection and measurement of effects, reduced sample biases, and greater control of individual heterogeneity (Gujarati & Porter, 2008).

Using STATA 18.5, twelve regression models are tested to relate each of the four possible dependent variables with each of the three possible independent variables. The different dependent variables are REBIT, REBITDA, Return on Assets (ROA), and Profit Margin (PM). The independent variables are the presence of women on the BoD (PRESENCE), the percentage of women on the BoD (PERCENT), and the presence of women in leadership positions on the BoD(LEADER). Additionally, the control variables

considered are leverage (LEV), firm size (SIZE), BoD size (BOARD_SIZE), and firm age (AGE).

It is important to highlight that, despite the several advantages associated with using panel data regression model, this methodology also presents significant challenges. The main issues include multicollinearity, heteroscedasticity, and autocorrelation, which are common in both cross-sectional and time-series data. Furthermore, cross-sectional correlation may exist among units within the same period, requiring the application of robust statistical techniques to ensure the validity of the inferences (Gujarati, 2003).

Prior to estimating the models, a preliminary analysis was conducted to detect potential multicollinearity among the explanatory variables. Two complementary methods were applied: Pearson correlation coefficients and the Variance Inflation Factor (VIF).

Regarding the Pearson correlation coefficients, these allowed the assessment of the existence and strength of the association between pairs of independent variables. According to the literature, absolute values close to 0.8 may indicate a high correlation, suggesting the presence of multicollinearity (Shrestha, 2020).

However, correlation coefficients alone are insufficient to rule out multicollinearity; therefore, the analysis is complemented by calculating the VIF. This indicator directly measures the increase in the variance of regression coefficients resulting from multicollinearity among explanatory variables. According to the literature, VIF values close to 1 indicate the absence of multicollinearity; values between 1 and 5 suggest moderate correlation; values between 5 and 10 raise concerns about the robustness of estimates; and values above 10 are considered indicative of severe multicollinearity, potentially requiring model adjustments, such as the exclusion of redundant variables (Gujarati, 2003; Shrestha, 2020).

Following the completion of the preliminary diagnostic tests, the regression coefficients were estimated. In panel data models, this estimation can be carried out using three main approaches: Pooled Ordinary Least Squares (POLS), Fixed Effects Model (FEM), and Random Effects Model (REM).

Among these options, the REM was chosen, as it assumes that individual effects are uncorrelated with the explanatory variables. When this condition holds, the random effects model can be more efficient than the fixed effects model, as it utilizes both temporal variation and variation between units, leading to more precise and efficient estimates.

To support this choice, the Hausman test failed to reject the null hypothesis ($\chi^2(3) = 2.87$; $p = 0.412$), indicating that the random effects specification is consistent and therefore preferred over the fixed effects model. Additionally, a Breusch-Pagan test was applied, which allows the comparison of the POLS model with the REM, as well as the assessment of heteroscedasticity. The test is based on the resulting p-value: if it is below a predefined significance level (usually 0.05), the null hypothesis of homoscedasticity is rejected, indicating the presence of heteroscedasticity. In all tested equations, p-values were below 0.05, confirming heteroscedasticity and additionally justifying the preference for the random effects model over the POLS model.

Despite the justified selection of the REM, it is important to recognize that this model may be sensitive to endogeneity, i.e., situations where explanatory variables are correlated

with the error term. This problem naturally compromises the validity of estimates, requiring careful interpretation of results.

Additionally, after selecting the REM, the Wooldridge test was conducted to assess the presence of first-order autocorrelation in the residuals. This test checks whether the errors are correlated over time, which can indicate non-independence of observations, a common issue in panel data models. When the p-value is below a predefined significance level (usually 0.05), the null hypothesis of no autocorrelation is rejected, indicating the presence of serial correlation in the errors. This situation can compromise the validity of estimators, requiring specific corrections, such as the use of robust standard errors. In all tested equations, p-values were below 0.05, confirming the presence of autocorrelation.

Since the Breusch-Pagan and Wooldridge tests indicated the presence of heteroscedasticity and autocorrelation, respectively, it was necessary to correct these issues. Therefore, for each specified equation, regressions with heteroskedasticity- and autocorrelation-consistent (HAC) robust standard errors clustered at the firm level were employed, thus yielding more reliable and robust estimates.

4. Results

4.1. Descriptive statistics

Table 2 presents the descriptive statistics of the variables used in the study, including the mean, standard deviation (SD), and the Pearson correlation coefficients for each variable.

The performance-related variables exhibit average values ranging from 5.00% (ROA) to 11.1%, with profit margin (PM) showing the highest variability. Regarding gender diversity on Boards of Directors, the mean value of the PRESENCE variable - indicating the presence of at least one woman - shows that approximately 52.7% of the companies studied had at least one female board member in at least one of the years analysed. The PERCENT variable - representing the proportion of women on the Board - has a mean value of 22.6%, ranging from 0% to 100%, indicating substantial heterogeneity in female representation on Boards. The LEADER variable, which captures the presence of women in leadership positions on the Board, has a mean value of 17.1%, reflecting a lower female presence in top-level roles.

Among the remaining independent variables, leverage (LEV) displays considerable variation across companies, while DIM suggests a relatively homogeneous sample in terms of firm size. The size of the BoD (DIM_BOARD) ranges from 1 to 19 members, with a mean of 3.91, indicating that most companies maintain relatively small Boards. Finally, the AGE variable, representing firm age (also presented in logarithmic form), has a mean of 3.40 (approximately 30 years), although the sample includes companies with widely varying levels of maturity.

Table 2 – Mean values, standard deviation and Pearson correlation matrix

	Mean	s.d.	PRESENCE	PERCENT	LEADER	LEV	DIM	DIM_BOARD	AGE
REBIT	0.066	0.093							
REBITDA	0.111	0.094							
ROA	0.050	0.083							
PM	0.058	0.101							
PRESENCE	0.527	0.499	1.000						
PERCENT	0.226	0.270	-	1.000					
LEADER	0.171	0.377	-	-	1.000				
LEV	0.527	0.269	-0.0820 (***)	-0.1262 (***)	-0.130 (***)	1.000			
DIM	16.242	0.764	0.2162 (***)	0.1363 (***)	0.088 (***)	-0.131 (***)	1.000		
DIM_BOARD	3.909	2.956	0.3576 (***)	0.0647 (***)	0.014	0.027	0.224 (***)	1.000	
AGE	3.401	0.601	0.1259 (***)	0.0499 (**)	-0.041 (*)	-0.162 (***)	0.093 (***)	0.149 (***)	1.000

Notes: ***p < 0.01; **p < 0.05; *p < 0.1. See Table 1 for variables definition.
Source: Own elaboration.

Table 2 also presents the Pearson correlation matrix for the independent variables. Overall, no strong correlations are observed, as none of the coefficients exceed the critical threshold of 0.8. According to Shresta (2020), this indicates the absence of significant statistical distortions due to multicollinearity. The highest correlation is observed between PRESENCE and DIM_BOARD (r = 0.3576), representing a moderate association between these variables. These results indicate that the independent variables are statistically distinct, and that none need to be excluded from the proposed regression model. To further confirm the absence of multicollinearity, Variance Inflation Factors (VIFs) were calculated. All VIF values remain well below the commonly accepted threshold in the literature, presenting a mean value of 1.1, thus confirming that multicollinearity is not a concern. Consequently, the estimated coefficients are unlikely to be affected by redundancy among the independent variables.

4.2. Regression results

The analysis was conducted using a random effects model, with robust standard errors employed to correct for heteroscedasticity and autocorrelation.

Tables 3 to 5 present the estimated regression coefficients for the independent variables PRESENCE, PERCENT, and LEADER, along with control variables.

Regression results for the main independent variables - PRESENCE, PERCENT, and LEADER - show that none are statistically significant in any model, suggesting no robust evidence of their impact on financial performance indicators (REBIT, REBITDA, ROA, and PM).

Among the control variables, LEV consistently exhibits negative and highly significant coefficients across all models, confirming an inverse relationship between leverage and

financial performance. This finding reinforces the interpretation that higher levels of debt are associated with poorer financial outcomes. DIM shows positive coefficients, with statistical significance observed only in models using ROA and PM as dependent variables, suggesting that firm size may positively influence financial performance, particularly when measured by PM. DIM_BOARD displays negative coefficients but is generally not statistically significant, except in the model with PM as the dependent variable. This may indicate a potential inverse relationship between Board size and net profit margin, although there is no strong evidence for the other performance measures. Finally, AGE displays a negative relationship across all models, and is weakly significant only in the REBITDA and PM specifications, suggesting that older firms may perform slightly worse financially. These results are broadly consistent with previous studies (e.g., Coad et al., 2013; Pacheco, 2020, among others).

Overall, the models exhibit modest explanatory power, with R^2 and adjusted R^2 values ranging from 0.123 to 0.223; nevertheless, findings are consistent across specifications. The analysis indicates that, although gender diversity on Boards does not appear to have a significant effect on financial performance, leverage, firm size, and, to a limited extent, Board characteristics and firm age, are associated with variations in financial outcomes.

5. Discussion

This section interprets the empirical findings in relation to the research hypotheses and situates them within the broader literature on gender diversity and corporate governance. The results provide limited evidence that gender diversity on boards is associated with financial performance in the sample of Portuguese medium-sized firms analysed. Instead, the findings point primarily to structural patterns of female underrepresentation and to the contextual factors that may constrain the potential influence of gender diversity within corporate governance structures.

The results do not support Hypothesis 1, as the majority of companies analysed (187 out of 298) do not meet the European Directive requiring at least 33.33% female representation on Boards. To this extent, the findings underscore the persistent underrepresentation of women on BoD in Portuguese medium-sized firms, despite legislative progress at both national and European levels. As highlighted in the literature, promoting gender equality on Boards has been a central focus of corporate and public policy (Adams, 2016; Falconieri & Akter, 2023). This discourse has led to the adoption of several legislative initiatives, including Portugal's Law No. 62/2017[1] and, more recently, the 2022 European Directive, both aimed at reducing gender disparities. Both measures represent significant legal milestones, establishing mandatory gender quotas on the BoD of public and listed companies.

However, the evidence indicates that Portuguese medium-sized firms remain well below the levels of female representation already observed in listed companies. This

[1] Law n.º 62/2017, from August 1st: It establishes the regime of balanced representation between women and men on the boards of management and supervisory bodies of public sector enterprises and listed companies. *Diário da República*, 1st series, n.º 147, 2017.

disparity can be partly attributed to the exclusion of SMEs from the legislative measures discussed, as these requirements are not mandatory for such entities.

Consequently, the results suggest that, in the absence of binding regulation, such as the gender balance directive applicable to listed firms, the advancement of female representation in Portuguese medium-sized companies tends to be slower and more limited. This pattern reflects the persistence of structural barriers to gender equality in this segment of the corporate landscape.

Table 3 – Random-effects model with robust standard errors (PRESENCE as independent variable)

	REBIT			REBITDA			ROA			PM		
	Coefficient	Sig	Standard-deviation	Coefficient	Sig	Standard-deviation	Coefficient	Sig	Standard-deviation	Coefficient	Sig	Standard-deviation
PRESENCE	-0.003		0.007	0.000		0.008	-0.003		0.006	0.004		0.008
LEV	-0.150	***	0.028	-0.142	***	0.027	-0.147	***	0.024	-0.169	***	0.029
DIM	0.007		0.005	-0.002		0.006	0.009	**	0.004	0.026	***	0.005
DIM_BOARD	-0.003		0.003	-0.003		0.003	-0.003		0.002	-0.004	**	0.002
AGE	-0.009		0.009	-0.017		0.009	-0.007		0.007	-0.010	*	0.006
constant	0.070		0.092	0.283	***	0.076	0.019		0.076	-0.227	***	0.082
	R^2 = 0.151 / adjusted R^2 = 0.149			R^2 = 0.126 / adjusted R^2 = 0.123			R^2 = 0.194 / adjusted R^2 = 0.192			R^2 = 0.223 / adjusted R^2 = 0.220		

Notes: ***p < 0.01; **p < 0.05; *p < 0.1. See Table 1 for variables definition. Source: Own elaboration

Table 4 - Random-effects model with robust standard errors (PERCENT as independent variable)

	REBIT			REBITDA			ROA			PM		
	Coefficient	Sig	Standard-deviation	Coefficient	Sig	Standard-deviation	Coefficient	Sig	Standard-deviation	Coefficient	Sig	Standard-deviation
PERCENT	-0.002		0.015	0.002		0.016	-0.002		0.012	0.005		0.015
LEV	-0.150	***	0.028	-0.142	***	0.027	-0.147	***	0.024	-0.169	***	0.029
DIM	0.007		0.005	-0.002		0.006	0.009	**	0.004	0.026	***	0.005
DIM_BOARD	-0.003		0.003	-0.003		0.003	-0.003		0.002	-0.004	*	0.002
AGE	-0.009		0.009	-0.017	*	0.009	-0.007		0.007	-0.010	*	0.006
constant	0.072		0.074	0.284	***	0.099	0.021		0.076	-0.229	*	0.082
	R^2 = 0.151 / adjusted R^2 = 0.149			R^2 = 0.126 / adjusted R^2 = 0.123			R^2 = 0.194 / adjusted R^2 = 0.192			R^2 = 0.222 / adjusted R^2 = 0.220		

Notes: ***p < 0.01; **p < 0.05; *p < 0.1. See Table 1 for variables definition. Source: Own elaboration

Table 5 - Random-effects model with robust standard errors (LEADER as independent variable)

	REBIT			REBITDA			ROA			PM		
	Coefficient	Sig	Standard-deviation	Coefficient	Sig	Standard-deviation	Coefficient	Sig	Standard-deviation	Coefficient	Sig	Standard-deviation
LEADER	0.001		0.011	0.002		0.012	-0.002		0.009	0.007		0.011
LEV	-0.150	***	0.028	-0.142	***	0.027	-0.147	***	0.024	-0.168	***	0.029
DIM	0.007		0.005	-0.002		0.006	0.009	**	0.004	0.026	***	0.005
DIM_BOARD	-0.003		0.003	-0.003		0.003	-0.003		0.002	-0.004	**	0.002
AGE	-0.009		0.009	-0.017	*	0.009	-0.007		0.007	-0.010	*	0.006
constant	0.073		0.092	0.284	***	0.100	0.022		0.076	-0.230	***	0.083
	R^2 = 0.151 / adjusted R^2 = 0.221			R^2 = 0.126 / adjusted R^2 = 0.123			R^2 = 0.194 / adjusted R^2 = 0.149			R^2 = 0.223 / adjusted R^2 = 0.192		

Notes: ***p < 0.01; **p < 0.05; *p < 0.1. See Table 1 for variables definition. Source: Own elaboration

Furthermore, the analysis revealed no statistically significant relationship between the presence or percentage of women on BoD (PRESENCE and PERCENT) and firm financial performance (REBITDA, REBIT, ROA, and PM). As such, Hypothesis 2, which posited a positive impact of Board-level gender diversity on financial performance, was not supported. Notably, Pacheco et al. (2020) reported similar results.

This lack of statistical significance can be better understood when examined in light of the findings from Hypothesis 1. Those results showed that most firms in the sample (187 out of 298) do not reach the threshold of 33.33% women on BoD, a value established by the European directive to ensure a more balanced gender representation. This point is particularly relevant, as the existing literature, notably Joecks et al. (2013), suggest that the impact of gender diversity on Boards tends to follow a U-shaped relationship with financial performance. In other words, when Boards exhibit very low levels of female representation, the effect may be neutral or even negative. Only when a critical mass of approximately 30% women is reached does the effect become positive.

In this context, the results related to Hypothesis 2 align with the assumptions of critical mass theory, widely discussed in the literature on gender diversity in BoD. According to this

theory, a merely symbolic or token presence of women, for instance, one or two female directors, is insufficient to generate structural change or significantly influence strategic decision-making. Only when a minimum proportion is achieved, typically operationalised as three women, do they cease to be perceived as isolated representatives and begin to have an active voice and real influence on internal Board dynamics, and, consequently, on financial performance (Torchia et al., 2011; Arvanitis et al., 2022).

It is also important to note that although several studies identify the absolute number of three women as the minimum threshold for critical mass (Torchia et al., 2011; Kramer et al., 2007), this definition depends heavily on the overall size of the Board. The 30% proportion therefore constitutes a more suitable metric for Boards of varying sizes, enabling more robust comparisons and aligning with both national and European guidelines.

Thus, the results obtained should not be interpreted as evidence that women's presence on Boards has no impact on financial performance, but rather as a reflection of the fact that female representation in the Portuguese medium-sized firms included in this sample remains below the threshold necessary for gender diversity to produce meaningful effects on corporate outcomes. As argued by Arvanitis et al. (2022), only when women achieve significant representation, both in number and influence, can they effectively contribute to strategy, innovation, and improved financial performance. Given that medium-sized firms constitute a substantial segment of the Portuguese business fabric, these findings underscore the importance of promoting greater female participation on Boards, not only as a matter of equity but also as a potential driver of organisational performance.

Regarding Hypothesis 3, the results did not reveal a statistically significant relationship between the presence of women in leadership positions (LEADER), namely, Board chair or vice-chair, and firm financial performance. Therefore, the hypothesis was not supported.

This finding contrasts with part of the existing literature, which highlights the crucial role of female leadership in fostering more inclusive governance practices, improving monitoring, and shaping distinct strategic approaches (Adams & Ferreira, 2009; Liu et al., 2014). However, the absence of statistical significance should not be interpreted as evidence against the relevance of female leadership. Instead, it should be considered in light of contextual and structural factors that may influence the impact of women in senior roles.

One such factor concerns the marked underrepresentation of women in leadership positions within the sample, which limits the statistical explanatory power of the variable. The number of firms with women serving as Board chair or vice-chair is extremely small, hindering an accurate assessment of their potential impact.

Furthermore, the literature suggests that the isolated presence of women in top positions, particularly in predominantly male environments, may lead them to be perceived as "tokens", meaning symbolic representatives of their gender rather than influential actors (Kanter, 1977; Torchia et al., 2011). In such circumstances, their leadership tends to be stigmatized and frequently associated with gender-stereotyped traits, which constrains their actions and limits their actual influence in Board decision-making processes (Lee & James, 2007; Liu et al., 2014).

This underrepresentation and stigmatization are often linked to the phenomenon of the glass ceiling, which describes the invisible barriers that hinder women's access to

leadership positions, even when they possess the necessary experience and competencies (Campbell & Mínguez-Vera, 2010). These barriers may be structural - such as a lack of transparency in promotion processes - or cultural, as leadership continues to be traditionally associated with masculinity (Oakley, 2000; Thams et al., 2018).

To enhance the validity of our findings and to examine whether alternative methods reveal relationships not captured by the baseline parametric models, we conducted several robustness tests. First, a Mann–Whitney U test was performed to compare financial performance between firms below and above the 33.33% gender diversity threshold (critical mass benchmark). The results in Table 6 indicate a statistically significant difference in profit margins (PM) between firms below and above the 33.33% gender representation threshold ($Z = -2.818$, $p = 0.005$). However, no significant differences emerge for other accounting-based performance measures. While this suggests a potential distributional shift in profit margins at the threshold level, the absence of corresponding effects in regression models and non-linear specifications indicates limited structural evidence of a critical mass effect.

Table 6 - Mann–Whitney U test using as grouping variable the critical mass threshold (33.33%)

	REBIT	REBITDA	ROA	PM
Mann-Whitney U	366089.000	359052.000	358220.000	343884.000
Wilcoxon W	996092.000	989055.000	988223.000	973887.000
Z	-.714	-1.381	-1.460	-2.818
Sig. (2-tailed)				***

Notes: ***p < 0.01; **p < 0.05; *p < 0.1. See Table 1 for variables definition. Source: Own elaboration

Second, Spearman's rank correlation coefficients were computed to examine potential monotonic but non-linear relationships between the proportion of women on boards (PERCENT) and financial performance indicators. Table 7 shows that the correlations between board diversity and financial performance indicators are weak and statistically insignificant (except for profit margin), reinforcing the absence of systematic association detected in the parametric models.

Table 7 - Spearman's rank correlation coefficients between PERCENT and financial performance indicators

		PERCENT	REBIT	REBITDA	ROA	PM
PERCENT	Correlation Coefficient	1.000	.012	.006	.028	.069
	Sig.	.				***

Notes: ***p < 0.01; **p < 0.05; *p < 0.1. See Table 1 for variables definition. Source: Own elaboration

Third, to address concerns regarding governance heterogeneity within SMEs, firms were stratified into tertiles based on the firm-level average log of total assets (2018–2023). A chi-square test of independence was conducted, and its results (in Table 8) indicate a statistically significant but weak association between firm size tertiles and female leadership presence ($\chi^2 = 24.208$, $p < 0.01$; Cramer's $V = 0.116$). While this suggests limited structural

heterogeneity across size strata, the magnitude of the association is small, indicating modest practical relevance.

Table 8 - Chi-Square and Cramer's V tests of association between firm-size tertiles (small, medium and large) and female leadership

	Value	Sig.
Pearson Chi-Square	24.208	***
Cramer's V	.116	***

Notes: ***p < 0.01; **p < 0.05; *p < 0.1. Source: Own elaboration

Fourth, to address potential small-sample bias and distributional non-normality, all regression models were re-estimated using 5,000 bootstrap replications with bias-corrected and accelerated (BCa) confidence intervals (see Appendices 1–3). The bootstrapped estimates closely replicate the baseline results. Across all dependent variables (PM, REBIT, REBITDA, and ROA), the confidence intervals confirm that the main gender diversity measures (PRESENCE, PERCENT, and LEADER) remain statistically insignificant, while key control variables—particularly leverage and board size—retain their statistical significance. Overall, the bootstrap analysis reinforces the stability and robustness of the baseline findings.

Fifth, to assess whether the relationship between board gender diversity and firm performance reflects a potential critical mass effect, additional random-effects models including a squared diversity term (PERCENT²) were estimated. As reported in Appendix 4, the squared term is not statistically significant in most specifications and only marginally significant in the REBIT model. Overall, the results provide no consistent evidence of non-linearity, suggesting that the effect of board gender diversity does not depend on reaching specific diversity thresholds—such as the commonly discussed three-women critical mass—within the observed data range. These findings further support the robustness of the baseline results.

Finally, to examine whether the relationship between board gender diversity and firm performance varies with board size, additional random-effects models including the interaction term PERCENT × BOARD_DIM were estimated. In these models, both the diversity and board-dimension variables were mean-centered to mitigate multicollinearity and facilitate interpretation of the interaction effect. As reported in Appendix 5, the interaction term is statistically significant for REBIT, REBITDA, and ROA, but not for PM. This suggests that the contribution of women on boards may depend partly on the structural context of the board, with board size potentially shaping how diversity translates into performance outcomes. At the same time, the absence of a significant interaction in the PM specification indicates that this moderating effect is not uniform across all performance measures.

Taken together, these additional analyses—including non-parametric tests, correlation analysis, governance heterogeneity checks, bootstrap estimation, non-linearity tests, and interaction specifications—consistently confirm the stability of the baseline regression results reported in Tables 3–5. In particular, the bootstrap estimations replicate the absence of statistically significant effects for the main gender diversity variables (PRESENCE, PERCENT, and LEADER), while the key control variables—especially leverage—remain robustly associated with firm performance. Likewise, the non-linear and

interaction specifications provide only limited additional evidence, suggesting that the lack of significant relationships is not driven by unmodelled threshold effects or functional misspecification.

Overall, these findings reinforce the interpretation developed in the main results section: within the sample of Portuguese medium-sized firms analysed, gender diversity on Boards does not exhibit a statistically detectable impact on financial performance indicators. Importantly, however, this result should be interpreted in light of the descriptive evidence showing that most firms remain far below the representation levels often associated with meaningful influence in board dynamics. In other words, the empirical results appear to reflect the structural underrepresentation of women on Boards, rather than the absence of potential governance benefits associated with gender diversity.

Consistent with the arguments derived from critical mass theory and the broader corporate governance literature, the results therefore suggest that the very limited representation of women in leadership roles within the analysed firms may be insufficient to generate measurable performance effects. Rather than contradicting the relevance of female leadership emphasized in previous research, the findings point to the persistence of structural constraints affecting gender representation in Portuguese medium-sized companies. These results highlight the importance not only of increasing women's access to board positions, but also of ensuring that their participation reaches levels that enable effective influence on board deliberations and strategic decision-making.

6. Conclusion

In a corporate context where diversity and equality have become increasingly central to governance debates, understanding the relationship between gender representation on Boards of Directors and firm performance remains an important research question. While much of the existing literature focuses on publicly listed companies, this study examines this relationship within a less explored context: medium-sized, non-listed Portuguese firms.

Using panel data from 298 firms operating in technology-intensive sectors between 2018 and 2023, the analysis shows that most companies do not meet the 33.33% female representation threshold established by the European Directive on gender balance for listed companies. This finding highlights the persistence of gender disparities in the governance structures of Portuguese medium-sized enterprises and suggests that, in the absence of binding regulation, progress in gender diversity may remain slow and uneven.

Regarding the relationship between gender diversity and financial performance, no statistically significant association was identified between the presence or proportion of women on Boards of Directors and the key financial indicators examined. This lack of statistical relevance should be interpreted in light of critical mass theory. Because most companies in the sample fall below the 30% threshold, female representation is likely to remain residual and largely symbolic, and therefore may remain insufficient to produce a measurable impact on organisational outcomes.

Similarly, the study did not confirm the existence of a relationship between female leadership, defined as the presence of women serving as Chair or Vice-Chair of the Board, and financial performance. This absence of association may be linked to the very small

number of women actually occupying these top positions, which limits the statistical robustness of the variable. Moreover, in traditionally male-dominated environments such as the corporate sector, female leaders may be perceived as "tokens", that is, symbolic representatives of their gender with constrained influence over strategic decision-making processes.

From a policy perspective, the findings suggest that the absence of mandatory regulatory requirements for SMEs may contribute to the persistent gender gap observed in medium-sized firms, in contrast with the progress achieved among listed companies subject to binding quotas. While the results do not allow for a direct causal inference, they are consistent with the view that regulatory asymmetry plays a role in shaping board composition. This raises important policy considerations. Rather than imposing immediate quota-based obligations, policymakers could consider phased targets, enhanced disclosure requirements, or "comply or explain" mechanisms tailored to the structural characteristics of SMEs. Complementary measures, such as leadership development programs, governance training, and incentive-based schemes, may also support a gradual and sustainable increase in female representation in non-listed firms.

Several limitations of the present research must, however, be acknowledged. While the use of accounting data enhances the objectivity and comparability of the analysis, it does not capture qualitative factors that may influence the effectiveness of women's presence on Boards, such as leadership style, organisational culture, or the extent to which women participate meaningfully in strategic decisions. In addition, the low variability in gender-diversity measures and the scarce presence of women in top leadership roles may have constrained the results, limiting the statistical significance of the tested relationships. A further limitation concerns data constraints, which prevented the inclusion of additional governance dimensions such as board independence, the distinction between executive and non-executive directors, and differences between family and non-family firms. Future research could address these aspects in order to provide a more comprehensive assessment of governance heterogeneity in SME contexts.

These limitations open avenues for future research. It would be valuable, for instance, to expand the sample to include companies from different sectors or conducting more extensive longitudinal analyses could provide a more comprehensive and robust understanding of how gender representation evolves within medium-sized Portuguese firms and how those firms are influenced by non-mandatory regulatory measures already adopted by listed firms.

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Appendix 1 – Bootstrapped model with bias corrected and accelerated confidence intervals (PRESENCE as independent variable)

	REBIT			REBITDA			ROA			PM		
	Coefficient	Sig	Standard-deviation	Coefficient	Sig	Standard-deviation	Coefficient	Sig	Standard-deviation	Coefficient	Sig	Standard-deviation
PRESENCE	-0.001		0.004	0.001		0.004	-0.001		0.004	0.005		0.005
LEV	-0.130	***	0.015	-0.118	***	0.014	-0.131	***	0.014	-0.156	***	0.016
DIM	0.004		0.003	-0.002		0.003	0.005	*	0.003	0.021	***	0.003
DIM_BOARD	-0.003	**	0.001	-0.003	**	0.001	-0.003	***	0.001	-0.004	***	0.001
AGE	-0.007		0.004	-0.016	***	0.004	-0.005		0.004	-0.003		0.004
constant	0.111	**	0.051	0.266	***	0.053	0.068		0.076	-0.176	***	0.051
	R^2 = 0.152 / adjusted R^2 = 0.149			R^2 = 0.126 / adjusted R^2 = 0.124			R^2 = 0.195 / adjusted R^2 = 0.192			R^2 = 0.225 / adjusted R^2 = 0.222		

Notes: ***p < 0.01; **p < 0.05; *p < 0.1. Results for 5.000 bootstrap replications. See Table 1 for variables definition. Source: Own elaboration

Appendix 2 - Bootstrapped model with bias corrected and accelerated confidence intervals (PERCENT as independent variable)

	REBIT			REBITDA			ROA			PM		
	Coefficient	Sig	Standard-deviation	Coefficient	Sig	Standard-deviation	Coefficient	Sig	Standard-deviation	Coefficient	Sig	Standard-deviation
PERCENT	0.002		0.008	0.005		0.008	0.001		0.007	0.008		0.008
LEV	-0.129	***	0.015	-.118	***	0.014	-.131	***	0.014	-0.156	***	0.016
DIM	0.004		0.003	-0.002		0.003	0.005	*	0.003	0.021	***	0.003
DIM_BOARD	-0.003	**	0.001	-0.003	**	0.001	-0.003	***	0.001	-0.004	***	0.001
AGE	-0.007		0.004	-0.016	***	0.005	-0.005		0.004	-0.002		0.004
constant	0.113	**	0.052	0.267	***	0.053	0.021		0.045	-0.179	***	0.050
	R^2 = 0.152 / adjusted R^2 = 0.149			R^2 = 0.126 / adjusted R^2 = 0.124			R^2 = 0.195 / adjusted R^2 = 0.192			R^2 = 0.224 / adjusted R^2 = 0.222		

Notes: ***p < 0.01; **p < 0.05; *p < 0.1. Results for 5.000 bootstrap replications. See Table 1 for variables definition. Source: Own elaboration

Appendix 3 - Bootstrapped model with bias corrected and accelerated confidence intervals (LEADER as independent variable)

	REBIT			REBITDA			ROA			PM		
	Coefficient	Sig	Standard-deviation	Coefficient	Sig	Standard-deviation	Coefficient	Sig	Standard-deviation	Coefficient	Sig	Standard-deviation
LEADER	0.004		0.006	0.004		0.006	0.001		0.005	0.009		0.006
LEV	-0.129	***	0.015	-.117	***	0.014	-0.131	***	0.014	-0.155	***	0.016
DIM	0.003		0.003	-0.002		0.003	0.005	*	0.003	0.021	***	0.003
DIM_BOARD	-0.003	**	0.001	-0.003	**	0.001	-0.003	***	0.001	-0.004	***	0.001
AGE	-0.007		0.004	-0.016	***	0.005	-0.005		0.004	-0.002		0.004
constant	0.112	**	0.052	0.266	***	0.054	0.070		0.046	-0.180	***	0.051
	R^2 = 0.152 / adjusted R^2 = 0.150			R^2 = 0.126 / adjusted R^2 = 0.124			R^2 = 0.195 / adjusted R^2 =0.192			R^2 = 0.225 / adjusted R^2 = 0.223		

Notes: ***p < 0.01; **p < 0.05; *p < 0.1. Results for 5.000 bootstrap replications. See Table 1 for variables definition. Source: Own elaboration

Appendix 4 - Random-effects model for the non-linearity specification (board gender diversity)

	REBIT			REBITDA			ROA			PM		
	Coefficient	Sig.	Standard-deviation	Coefficient	Sig.	Standard-deviation	Coefficient	Sig.	Standard-deviation	Coefficient	Sig.	Standard-deviation
PERCENT	-0.034		0.021	-0.010		0.021	-0.022		0.018	0.009		0.022
PERCENT2	0.048	*	0.026	0.019		0.027	0.031		0.023	-0.001		0.027
LEV	-0.131	***	0.008	-0.119	***	0.008	-0.131	***	0.007	-0.153	***	0.008
DIM	0.003		0.003	-0.002		0.003	0.004	*	0.002	0.022	***	0.003
DIM_BOARD	-0.002	***	0.001	-0.003	***	0.001	-0.003	***	0.001	-0.004	***	0.001
AGE	-0.006	*	0.004	-0.016	***	0.004	-0.005		0.003	-0.003		0.004
Constant	0.115		0.076	0.271	**	0.078	0.074		0.066	-0.188	**	0.079
Random intercept variance	0.004			0.004			0.003			0.004		

Notes: *** p < 0.01; ** p < 0.05; * p < 0.1. PERCENT2 represents the squared term used to test the potential non-linear relationship between board gender diversity and firm performance. Standard-deviation reports the standard error.

Appendix 5 - Random-effects model for the combined effect of Board dimension and gender diversity

	REBIT			REBITDA			ROA			PM		
	Coefficient	Sig.	Standard-deviation	Coefficient	Sig.	Standard-deviation	Coefficient	Sig.	Standard-deviation	Coefficient	Sig.	Standard-deviation
PERCENT_BOARD	0.008	**	0.003	0.013	***	0.003	0.007	**	0.003	0.003		0.003
PERCENT_C	0.009		0.008	0.017	**	0.008	0.007		0.007	0.011		0.008
DIM_BOARD_C	-0.003	***	0.001	-0.002	***	0.001	-0.003	***	0.001	-0.004	***	0.001
LEV	-0.131	***	0.008	-0.119	***	0.008	-0.132	***	0.007	-0.153	***	0.008
DIM	0.004		0.003	-0.001		0.003	0.005	**	0.002	0.022	***	0.003
AGE	-0.008	**	0.003	-0.017	***	0.004	-0.006	**	0.003	-0.003		0.004
Constant	0.101		0.076	0.245	**	0.078	0.058		0.067	-0.206	***	0.079
Random intercept variance	0.004			0.004			0.003			0.004		

Notes: ***p < 0.01; **p < 0.05; *p < 0.1. PERCENT_C and DIM_BOARD_C are centred variables used to mitigate multicollinearity in the interaction specification. Standard-deviation reports the standard error.