Do Executive and Non-Executive Female Members Curb Investment Inefficiency for European Firms?

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Abstract

This study examines the influence of women in top management positions (Chairperson, CEO, and CFO) on investment efficiency in European listed companies. Findings suggest that the presence of women as Chairperson is associated with reduced investment efficiency. However, in executive roles, women enhance investment efficiency, mitigating both overinvestment and underinvestment. In instances of inefficient investment, female Chairperson tend to overinvest. Additional analyses indicate that changes in the gender of the Chairperson negatively impact investment efficiency and overinvestment situations. This research enriches the investment literature and contributes to the limited knowledge of the impact of women in top management on investment efficiency in listed European companies.

JEL Classification: G32; J16; M14; M21

Keywords: investment efficiency; overinvestment; underinvestment; gender; top management.

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1. Introduction

Competent and committed management teams, along with accessible capital, are key factors for good corporate investment decisions. Additionally, high-quality financial reporting and robust corporate governance practices, as highlighted by Chen et al. (2017), contribute to enhancing investment efficiency.

Gender diversity on corporate boards and top positions has been a topic of increasing interest and research globally, including in Europe. Indeed, it has been a focus of regulatory efforts in Europe. The European Union (EU) has taken steps to address gender imbalances in corporate leadership positions. One of the key initiatives is the Directive 2014/95/EU on non-financial reporting that encourages companies to disclose information about their policies and outcomes related to diversity, including gender diversity. Moreover, the EU is looking to achieve a greater gender balance on corporate boards. By 2026, the members of the underrepresented gender should hold, at least, 40% of the non-executive directors or 33% of the executive and non-executive director positions of the listed companies (European Commission, 2022).[2]

The persistent gender imbalance in top-tier corporate roles remains a focal point, despite the increasing number of highly qualified women graduating from European universities. Although qualified, women encounter barriers such as parental responsibilities, limiting their access to equal opportunities. Recent data (European Commission, 2019)[3] starkly reveals that 73.3% of board members in European listed companies are male. Only 6.7% and 6.5% of women hold the positions of Chairman of the Board and Chief Executive Officer (CEO), respectively. This underrepresentation emphasizes the untapped potential within the qualified female workforce.

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[2] Refer to https://www.consilium.europa.eu/en/policies/gender-balance-corporate-boards/.
[3] Refer to
https://ec.europa.eu/info/sites/info/files/aid_development_cooperation_fundamental_rights/annual_report_ge_2019_en_1.pdf

Extant literature underscores the psychological aspect in investment decisions, where women, according to various studies, exhibit a risk-averse approach, opting for cautious and calculated strategies. Faccio et al. (2016) assert that women in top management roles tend to make less risky financing and investment decisions compared to men. This study explores the intersection of gender diversity in top management and investment efficiency in European listed companies, contributing to the discourse on corporate governance and financial decision-making.

We use data from Moody's Orbis database spanning 2012 to 2018, focusing on European listed companies within the European Union. The final sample comprises 11,730 firm-year observations from 15 industries and 14 countries. To gauge investment efficiency, the study employs a modified Biddle et al. (2009) model enhanced by previous research (Chen et al., 2011; Cherkasova and Rasadi, 2017; Wang et al., 2015). The model considers variables such as Chairman, CEO, and CFO, representing women in top management positions. We use fixed effects by sector and year to account for country and sector differences and potential temporal influences. The empirical approach involves estimation for the investment model and Pooled data for the efficiency model, examining over- and underinvestment perspectives.

This paper dissects the influence of gender on investment efficiency in executive and non-executive roles, revealing nuanced dynamics. Non-executive positions, particularly when chaired by women, exhibit reduced investment efficiency, resonating with the notion of an "old boys club". Conversely, executive roles, notably the CEO position, show a positive association with investment efficiency, supporting the premise that female CEOs tend to opt for less risky financial and investment strategies. The study challenges the conventional wisdom regarding crisis mitigation, indicating a negative impact of women in top management during economic crises on investment efficiency. Robustness analysis, excluding French-based companies, reinforces the consistency of prior findings.

In supplementary analyses involving equity ownership and gender reassignment among top managers, the study underscores established literature trends. However, regarding gender changes in managerial roles, especially from male to female, the Chairperson variable loses significance, suggesting that having a female Chairperson may indicate investment inefficiency, but this evidence is inconclusive during years of gender changes. These insights deepen our understanding of the nuanced impact of gender in top management on investment efficiency, shedding light on the complex interplay of gender dynamics in executive decision-making within corporate structures.

This paper contributes significantly to the existing literature on gender diversity and its impact on investment efficiency in European listed companies. Firstly, the research enriches the discourse by dissecting the influence of gender on investment efficiency in both executive and non-executive roles. The nuanced findings reveal that non-executive positions, particularly when led by women, exhibit reduced investment efficiency. This insight challenges prevailing assumptions and adds granularity to our understanding of gender dynamics in corporate decision-making, highlighting the relevance of considering specific roles in top management. The identification of a negative impact associated with women in non-executive roles, often associated with oversight and policy formulation, adds a layer of complexity to the ongoing discussion.

Secondly, the study provides valuable insights into the role of female executives, particularly in the CEO position, shedding light on their positive association with investment efficiency. By aligning with existing literature that suggests female CEOs tend to adopt less risky financial and investment strategies, the paper reinforces the idea that leadership attributes influence financial decision-making. This finding has practical implications for corporate governance, emphasizing the importance of diverse leadership teams and challenging stereotypical notions about risk aversion among female executives. The nuanced understanding of executive roles

adds depth to the literature, moving beyond a generic view of women in top management to acknowledge the variations in impact across specific positions.

Thirdly, the research contributes to the ongoing discussion about crisis management and gender dynamics by revealing an unexpected result. The negative impact of women in top management during economic crises on investment efficiency challenges conventional wisdom. This finding prompts a revaluation of the assumed impacts of gender diversity in crisis situations, highlighting the need for a more nuanced understanding of the intersection between gender, leadership, and crisis response. Such insights are essential for policymakers, practitioners, and scholars aiming to enhance corporate decision-making and crisis resilience in the context of diverse leadership teams.

Lastly, the robustness analysis, excluding French-based companies, adds credibility to the study's findings. The consistency of results across different subsets of the sample reinforces the validity of the identified associations between gender in top management and investment efficiency. These results enhance the reliability of the study's contributions and underscore the importance of considering the contextual influence of geographical diversity in future research on gender dynamics in corporate decision-making. Overall, this research significantly advances our understanding of the intricate relationships between gender, top management roles, and investment efficiency in European listed companies, providing valuable insights for both academia and practitioners in the field of finance and corporate governance.

2. Literature review and hypotheses development

As the success or failure of a business depends on its leadership, having gender diversity may increase the likelihood of success, and the discussion on gender diversity in top management has shifted from social justice to a focus on improving performance (Kebede, 2017). Companies with diverse boards and leadership teams are often associated with better corporate

governance practices. Effective governance can contribute to transparency, accountability, and responsible decision-making, all of which are critical for efficient resource allocation and value creation.

The differences between genders in terms of values, behaviour, and cognitive ability can affect and benefit the decision-making process. Female leaders are considered less assertive, less aggressive, less overconfident, more risk averse, more ethical, and more detailed in their analysis than their male counterparts, characteristics that suggest a more conservative mindset and a lower propensity to engage in managerial opportunism (Ho et al., 2015; Palvia et al., 2015; Shin et al., 2020; Ullah et al., 2019).

In terms of investment decisions, gender diversity, by bringing a variety of perspectives to the decision-making process, can lead to more comprehensive analyses of investment opportunities, considering a broader range of factors and potential risks and so more informed and well-rounded choices, potentially improving the efficiency of resource allocation. Corporate finance literature on gender diversity has mainly focused on the effects on corporate governance and firm performance. Literature on board gender diversity suggests that firms with female directors are better governed (Adams and Ferreira, 2009; Schwartz-Ziv, 2017) and performed better (Adams and Ferreira, 2009; Chen et al., 2018; Ullah et al., 2019). Yet, studies that explore gender diversity and investment efficiency are still scarce (Yu, 2023) and, so far, evidence is unclear (Farooq et al., 2023).

In an ideal world, firms are expected to invest efficiently by undertaking projects with positive net present values (Modigliani and Miller, 1958). Inefficient investments, overinvestment (higher than the optimal level of investment), or underinvestment (lower than the optimal level of investment), are essentially caused by agency problems, information asymmetry, and financial constraints (Jensen and Meckling, 1976; Myers and Majluf, 1984). Managers may

overinvest in order to engage in empire building or underinvest due to financial constraints or to avoid extreme risk.

Agency problems and information asymmetry result in moral hazard and adverse selection, leading to suboptimal investment decisions (Jensen, 1986; Jensen and Meckling, 1976; Myers and Majluf, 1984). Strong corporate governance mechanisms and information transparency mitigate these problems, improving investment efficiency (T. Chen et al., 2017; Cheng et al., 2013). There is also evidence that high-quality financial reporting can improve investment efficiency by reducing information asymmetry that causes market friction, such as moral hazard and adverse selection (Biddle et al., 2009; Cheng et al., 2013).

In this sense, female leaders may reduce both agency problems and information asymmetry by having, not only a more conservative and risk-averse behaviour and a lower propensity to engage in management opportunism, but also by playing an active monitoring role and strengthening governance mechanism (Adams and Ferreira, 2009; Chen et al., 2018; Frye and Pham, 2018). Indeed, prior literature suggests that firms with female directors tend to reduce excess free cash flows through the dividends (J. Chen et al., 2017), mitigating agency costs, and having lower information asymmetry (Gul et al., 2013; Nadeem, 2020). Additionally, there is evidence that female leaders improve financial reporting quality (Chen et al., 2018; Gonçalves et al., 2019; Gull et al., 2018; Lakhal et al., 2015), enhance information environment and more likely to communicate to stakeholders about the availability of profitable investments (Nadeem, 2020).

Farooq et al. (2023) argue that during board meetings, female directors are more likely to ask questions about firm-level investments, fully scrutinise the performance of prior investments, compare firm investment practises with its industry peers and investigate future investment opportunities. Indeed, they find that UK female directors improve corporate governance and investment efficiency, thereby increasing firm value. In the context of Chinese firms, Ullah et

al. (2021) find that female CEOs, by improving governance and disciplining management, play an important role in efficient investment decisions. Also, Gul et al. (2011) suggest that female leaders improve investment decisions, enhance financial disclosure, improve stock price informativeness, and increase shareholder value.

Based on this discussion, we propose the following hypothesis:

Hypothesis 1. The presence of females in top positions is positively associated with investment efficiency.

Incentives behind overinvestment and underinvestment differ and, therefore, the relation between the presence of female leaders and the two scenarios of investment inefficiency may be different. Indeed, there is evidence that the effect of board gender diversity is more pronounced for overinvestments than underinvestment (Shin et al., 2020; Yu, 2023) or even that there is no effect at all on the underinvestment (Ullah et al., 2021).

Based on the previous arguments that female leaders are less overconfident in making investment decisions, and since overconfidence is normally considered a reason for empire-building incentives leading to overinvestment, as well as their risk-aversion and conservative behaviour, we can expect that the positive effect of female leadership will be more pronounced for overinvestment than underinvestment. Moreover, underinvestment often comes from financial constraints, and, at least, female attributes have a limited effect on a firm´s financial constraints (Yu, 2023). Thus, our second hypothesis is stated as follows:

Hypothesis 2. The positive relationship between the presence females in top positions and investment efficiency is more pronounced for overinvestment.

3. Methodology

3.1. Sample

The financial data and details on gender and management were retrieved from the Moody's Orbis database for the period 2012 to 2018. The sample selection criteria started with all European listed companies belonging to the European Union. Excluded are financial institutions, real estate companies, public sector institutions, and also government-related companies that conduct extraterritorial activities.

To ensure representativeness, countries, and industries with less than 10 observations were also excluded from the sample. The sample was also narrowed by removing firms exhibiting negative equity. The gender male is set as default for firms with inconclusive data. To control the influence of outliers, the tails of distributions were polished with the exclusion of extreme outliers.

Table 1 – Sample Composition by Country and Sector

Country	N	%	Sector	N	%
Austria	268	2%	A – Agriculture, animal husbandry, hunting, forestry, and fishing	141	1%
Belgium	472	4%	B – Mining and quarrying industries	235	2%
Denmark	521	4%	C – Manufacturing Industries	5,864	50%
Finland	602	5%	D – Electricity, gas, steam, hot and cold water and cold air	344	3%
France	2,563	22%	E – Water collection, treatment, and distribution; sanitation; Waste management and depollution	91	1%
Germany	2157	18%	F – Construction	378	3%
Greece	822	7%	G – Wholesale and retail trade; Repair of motor vehicles and motorcycles	970	8%
Ireland	220	2%	H – Transport and storage	394	3%
Italy	983	8%	I – Accommodation, food service and similar	170	1%
Luxemburg	179	2%	J – Information and communication activities	1,823	16%
Netherlands	476	4%	M – Consulting, scientific, technical, and similar activities	511	4%
Portugal	230	2%	N – Administrative and support services activities	292	2%
Spain	563	5%	Q – Human health and social support activities	163	1%
Sweden	1,674	14%	R – Artistic, entertainment, sports, and recreational activities	227	2%
			S – Other Service Activities	127	1%
Total	11,730	100%	Total	11,730	100%

The final sample consists of 11,730 firm-year observations belonging to 15 industries according to the Nace Rev. 2 criteria, and these firms are headquartered in 14 different countries. Table 1 presents the sample distribution by geographical location of headquarters. France leads the sample with 22%, followed by Germany (18%) and Sweden (14%). Regarding industries, our sample conveys a sizeable share represented by Manufacturing (50%), followed by Information and Communication Activities (16%).

3.2. Gender

Following the existing literature, the gender of top management is analysed through three angles (Adams and Ferreira, 2009; Arun et al., 2015; Francis et al., 2015; Gonçalves et al., 2019; Ho et al., 2015). Chairman is a dummy variable that takes the value of 1 if the CEO is female, and 0 otherwise, while CEO takes the value of 1 if the CEO is female, and 0 otherwise. CFO is also a dummy variable, which takes the value of 1 if the CFO is female, and 0 otherwise.

3.3. Investment Efficiency Measurement

To measure investment efficiency Biddle et al. (2009) predict investment as a function of growth opportunities, measured by sales growth, adjusted for Chen et al. (2011), Wang et al. (2015), and Cherkasova and Rasadi (2017) modifications. We follow the same methodology already tested and stabilized in the existing literature.

Investment inefficiencies are considered as under and overinvestment. While under-investment refers to negative deviations from the expected investment as defined by the revised Biddle et al. (2009) model, i.e., meaning that the investment made falls short, overinvestment is characterized by positive deviations against expectations. The estimated model is as follows:

$$
\begin{aligned}
\text{Investment}_{i,t} = {} & \beta_0 + \beta_1 \text{Investment}_{i,t-1} + \beta_2 \Delta\text{Sales}_{i,t-1} + \beta_3 \text{Negative } \Delta\text{Sales}_{i,t-1} \\
& + \beta_4 \Delta\text{Sales}_{i,t-1} \times \text{Negative } \Delta\text{Sales}_{i,t-1} + \beta_5 \text{Size}_{i,t-1} + \beta_6 \text{ Age}_{i,t-1} \\
& + \beta_7 \text{Leverage}_{i,t-1} + \beta_8 \text{Cash}_{i,t-1} + \beta_9 \text{ROA}_{i,t-1} + \varepsilon_{i,t}
\end{aligned} \tag{1}
$$

where *Investment* relates to the net investment in R&D, property, plant machinery and equipment of firm *i* in year *t*. It is measured as the annual change in total fixed assets plus depreciation and amortization expenses in year *t*, divided by total assets in year *t*-1. *ΔSales* is the rate of sales growth of from year *t*-2 to year *t*-1, while *Negative ΔSales* comprises a dummy variable that takes the value of 1 for firms exhibiting negative figures on sales growth. *Size* is the log of total assets, while *Age* is the log of the age of firm, considering the date firm was founded to year *t*-1. *Leverage* comprises the financial leverage of firm, given by the ratio of total liabilities over total assets, *Cash* refers to cash holdings, the ratio between cash and total assets, and *ROA* is the return on assets of firm as net income over total assets. Most variables are lagged to account for the expected time lag to influence the investment level.

The equation (1) is estimated using the ordinary least squares (OLS) method (Biddle et al., 2009). The residuals of the model (1) are then used as a proxy to indicate whether there are deviations in the expected investment level. The variable allows for grouping overinvestment and underinvestment. Thus, whenever the residuals are negative it associates with underinvestment and, on the contrary, overinvestment is set for positive residuals (Biddle et al., 2009; Chen et al., 2011). Additionally, negative residuals (underinvestment) were multiplied by -1 so that high values indicate lower investment efficiency (Cherkasova and Rasadi, 2017).

3.4. Empirical Model

This study aims to understand the relationship between women in top management positions and investment efficiency. The empirical model considers the modified model of (Biddle et al., 2009) with the expansions made by Chen et al. (2011), Wang et al. (2015), and Cherkasova and Rasadi (2017):

$$\begin{aligned} \text{Efficiency}_{i,t} = {} & \beta_0 + \beta_1 \text{Chairman}_{i,t-1} + \beta_2 \text{CEO}_{i,t-1} + \beta_3 \text{CFO}_{i,t-1} + \beta_4 \text{Investment}_{i,t-1} \\ & + \beta_5 \Delta \text{Sales}_{i,t-1} + \beta_6 \text{Negative } \Delta \text{Sales}_{i,t-1} \\ & + \beta_7 \Delta \text{Sales}_{i,t-1} \times \text{Negative } \Delta \text{Sales}_{i,t-1} + \beta_8 \text{Size}_{i,t-1} + \beta_9 \text{ Age}_{i,t-1} \\ & + \beta_{10} \text{Leverage}_{i,t-1} + \beta_{11} \text{Cash}_{i,t-1} + \beta_{12} \text{ROA}_{i,t-1} + \varepsilon_{i,t} \end{aligned} \quad (2)$$

where *Efficiency* represents the investment efficiency of firm, as the absolute values of the residuals obtained in equation (1), which translates into overinvestment if the residuals are positive, or underinvestment if the residuals are negative. *Chairman* is given by a dummy variable that has the value of 1 if the CEO is a woman, and 0 otherwise, while *CEO* is a dummy variable that takes the value of 1 if the CEO is female, and 0 otherwise. *CFO* is also a dummy variable that takes the value of 1 when the CFO of firm is female, and 0 otherwise.

Controls follow previous empirical evidence (Adams and Ferreira, 2009; Arun et al., 2015; Biddle et al., 2009; Chen et al., 2011; Cherkasova and Rasadi, 2017; Ho et al., 2015; Shin et al., 2020; Wang et al., 2015). Specifically, these controls encompass factors previously explicated that are anticipated to exert an influence on both investment efficiency and the gender composition of upper-level managerial positions, as detailed earlier.

To account for differences across countries and sectors and the possible effect of time influences on the investment efficiency, equation (2) was controlled with a fixed effect specification per sector and year (Arun et al., 2015; Chen et al., 2011; Cherkasova and Rasadi, 2017; Wang et al., 2015). Model (2) was estimated using the least squares method (Pooled OLS). Variables definition and descriptive statistics are in Table 2 and Table 3. To assess the second research hypothesis, we also considered alternative perspectives of investment efficiency, looking in particular to over- and underinvestment.

Table 2 – Variables Definition

Variable	Definition	Previous Studies
Dependent Variables		
Efficiency	Investment Efficiency	(Biddle et al., 2009; Chen et al., 2011; Cherkasova and Rasadi, 2017; Shin et al., 2020)
Over	Overinvestment	(Biddle et al., 2009; Chen et al., 2011; Cherkasova and Rasadi, 2017; Shin et al., 2020)
Under	Underinvestment	(Biddle et al., 2009; Chen et al., 2011; Cherkasova and Rasadi, 2017; Shin et al., 2020)
Independent Variables		
Chairman	Dummy: 1 if the Chairman is female, and 0 otherwise	(Adams and Ferreira, 2009; Arun et al., 2015; Shin et al., 2020; Srinidhi et al., 2011)
CEO	Dummy: 1 if the CEO is female, and 0 otherwise	(Faccio et al., 2016; Ho et al., 2015)
CFO	Dummy: 1 if the CFO is female, and 0 otherwise	(Arun et al., 2015; Francis et al., 2015; Ho et al., 2015)
Control Variables		
Investment	Annual change in total fixed assets plus depreciation and amortization expenses in year t, divided by total assets in year t-1	(Cherkasova and Rasadi, 2017; Shin et al., 2020; Wang et al., 2015)
ΔSales	Sales growth of from year t-2 to year t-1	(Arun et al., 2015; Biddle et al., 2009; Chen et al., 2011; Cherkasova and Rasadi, 2017; Wang et al., 2015)
NegativeΔSales	Dummy: 1 for firms exhibiting negative ΔSales, and 0 otherwise	(Chen et al., 2011; Cherkasova and Rasadi, 2017)
Size	The log of total assets	(Arun et al., 2015; Chen et al., 2011; Cherkasova and Rasadi, 2017; Naeem and Li, 2019; Shin et al., 2020; Wang et al., 2015)
Age	The log of the age at t-1	(Chen et al., 2011; Cherkasova and Rasadi, 2017; Shin et al., 2020; Wang et al., 2015)
Leverage	Total liabilities over total assets	(Arun et al., 2015; Chen et al., 2011; Cherkasova and Rasadi, 2017; Shin et al., 2020; Wang et al., 2015)
Cash	Cash over total assets	(Cherkasova and Rasadi, 2017; Naeem and Li, 2019; Wang et al., 2015)
ROA	Net income over total assets	(Arun et al., 2015; Cherkasova and Rasadi, 2017; Shin et al., 2020)
Crisis	Dummy: 1 for periods of crisis, and 0 otherwise	
Crisis Gender	Dummy: 1 for periods of crisis if the top management position (Chairman, CEO or CFO) is held by female, and 0 otherwise	

Table 3 – Descriptive Statistics

Variables	N	Mean	Median	Std	Min	Max
Dependent						
Efficiency	11,730	-0.108	-0.128	0.356	-6.985	14.192
Over	3,174	0.206	0.114	0.477	0.000	14.192
Under	8,556	0.224	0.196	0.198	0.000	6.985
Independent						
Chairman	11,730	0.032	0.000	0.175	0.000	1.000
CEO	11,730	0.041	0.000	0.198	0.000	1.000
CFO	11,730	0.061	0.000	0.239	0.000	1.000
Crisis	11,730	0.259	0.000	0.438	0.000	1.000
Crisis Gender	11,730	0.051	0.000	0.220	0.000	1.000
Control						
Investment	11,730	0.586	0.574	0.325	0.005	14.791
ΔSales	11,730	0.241	0.040	9.865	-11.056	986.455
NegativeΔSales	11,730	0.349	0.000	0.477	0.000	1.000
Sales×NegativeΔSales	11,730	-0.045	0.000	0.198	-11.056	0.000
Size	11,730	19.469	19.273	2.370	11.928	26.769
Age	11,730	3.523	3.434	0.916	0.000	6.480
Leverage	11,730	0.554	0.565	0.191	0.003	1.000
Cash	11,730	0.135	0.092	0.144	-0.005	2.283
ROA	11,730	0.021	0.030	0.111	-1.045	2.501

Key statistics in Table 3 highlight that investment efficiency among European listed companies is set as -0.108, skewed towards underinvestment (8,556 observations) over overinvestment (3,174 observations) among European listed companies. Women hold more CFO positions (6.10%) than CEO (4.10%) and Chairman (3.20%) roles. During the 2012 crisis, only 5.10% of top management positions were held by women (Crisis Gender). Sales growth average indicate a 24.1% growth rate. Leverage implies a 55.40% debt financing ratio, while firms present cash holdings of 13.5% of assets. On average, companies generate around 2% profit from owned assets.

Considering prior empirical evidence (Adams and Ferreira, 2009; Arun et al., 2015) the impact of women on boards may elicit ambiguity. As asserted by Adams (2016), the presence of women in boards, if their attributes closely resemble those of men in terms of skills, experiences and preferences, may negate gender diversity differences. However, Shin et al. (2020) finds a positive relationship between the presence of women on boards and investment efficiency, suggesting a mitigating effect on overinvestment relative to underinvestment. This

outcome is attributed to their risk-averse disposition and conservative, prudent nature. Thus, the direction of influence of this variable remains unpredictable.

Regarding the CEO dummy variable, according to Faccio et al. (2016), companies with female CEOs are more likely to avoid risky financing and investment opportunities, exhibit lower leverage levels, and the probability of the company's survival is higher. Thus, it is expected a positive influence of female CEOs and investment efficiency. Female CFOs may increase the degree of conservative accounting (Francis et al., 2015). Given that conservative accounting is positively associated with investment efficiency (Lara et al., 2016) it is possible to expect a positive relationship between investment efficiency and the presence of a female CFO.

Drawing from prior literature (Barbiero et al., 2018; Shin et al., 2020), it is observed that when a company is presented with favourable sales growth opportunities, it tends to alleviate underinvestment rather than exacerbate overinvestment. In a broader context, this variable exhibits a positive association with investment efficiency. This idea is supported by Biddle et al. (2009), who state that sales growth is more positively associated with underinvestment than with overinvestment. Consequently, it is conceivable to anticipate a positive sign for the sales growth variable. Conversely, for the negative sales growth dummy variable, predicting the sign remains indeterminate, while a positive association is anticipated for the sales growth variable.

According with Naeem and Li (2019), the size variable serves as a significant metric, given that larger firms typically find it easier to secure external financing. Contrarily, Wang et al. (2015) finds that larger firms are more likely to overinvest. However, Cherkasova and Rasadi (2017) contend that firm size exhibits a positive association with underinvestment and a negative association with overinvestment. Chen et al. (2011), however, assert a negative relationship between firm size and both over- and underinvestment, while Biddle et al. (2009) argue that investment decreases with firm size. Consequently, predicting the sign of this variable proves challenging.

As for the Age variable, Biddle et al. (2009) and Cherkasova and Rasadi (2017) suggest a negative association with overinvestment and a positive association with underinvestment. That is, the Age variable will likely be positively associated with underinvestment and negatively association with overinvestment.

Leverage assesses the financial condition of the firm. According to Wang et al. (2015) and Shin et al. (2020), leverage exhibits a negative association with overinvestment and a positive association with underinvestment. Biddle et al. (2009) further contribute to this discussion by asserting that highly leveraged firms are prone to encountering issues from excessive leverage, consequently leading to a propensity for underinvestment. In contrast, Barbiero et al. (2018) found that investment efficiency diminishes with escalating levels of leverage, resulting in a tendency toward overinvestment.

According to Cherkasova and Rasadi (2017), the cash variable is expected to be positively associated with overinvestment and a negative association with underinvestment. This aligns with the findings of Biddle et al. (2009), who propose that firms possessing substantial cash reserves and lower leverage are more prone to engaging in overinvestment practices.

The Return on Assets (ROA) ratio, as outlined by Biddle et al. (2009), is indicated to have a negative association with investment efficiency. Conversely, Arun et al. (2015) suggest a positive correlation between ROA and the presence of women in key roles such as the board of directors, CEO, or CFO. Shin et al. (2020) similarly contends that ROA demonstrates a positive association with investment efficiency, positing that the company's profitability level reflects its investment practices. Consequently, predicting the directional impact of the variable in question also remains elusive.

An additional analysis over the crisis period is also conducted, to assess whether the relationship between the gender of top managers and company's investments undergoes

changes in economic crisis contexts. The equation (2) of the empirical model is extended as follows:

$$\begin{aligned}
\text{Efficiency}_{i,t} = {} & \beta_0 + \beta_1 \text{Chairman}_{i,t-1} + \beta_2 \text{CEO}_{i,t-1} + \beta_3 \text{CFO}_{i,t-1} + \beta_4 \text{Investment}_{i,t-1} \\
& + \beta_5 \Delta \text{Sales}_{i,t-1} + \beta_6 \text{Negative } \Delta \text{Sales}_{i,t-1} \\
& + \beta_7 \Delta \text{Sales}_{i,t-1} \times \text{Negative } \Delta \text{Sales}_{i,t-1} + \beta_8 \text{Size}_{i,t-1} + \beta_9 \text{ Age}_{i,t-1} \\
& + \beta_{10} \text{Leverage}_{i,t-1} + \beta_{11} \text{Cash}_{i,t-1} + \beta_{12} \text{ROA}_{i,t-1} + \beta_{13} \text{Crisis}_{i,t-1} \\
& + \beta_{14} \text{Crisis Gender}_{i,t-1} + \varepsilon_{i,t}
\end{aligned} \tag{3}$$

in which crisis takes the value 1 in periods of crisis, and 0 otherwise. The year 2012 is set as the crisis year considering the time frame of our sample. The Gender Crisis variable comes from an interaction term that takes the value 1 for periods of crisis if the top management position (Chairman, CEO or CFO) is held by female, and 0 otherwise.

4. Empirical Results

4.1. *The Impact of Gender of Senior Managers on Investment Efficiency*

To assess whether investment efficiency is shaped by the gender of executive and non-executive members, equations (2) and (3) are disentangled in Table 4, which incorporates categorical dummy variables for the year, sector and country of headquarters. This study distinguishes between executive positions (CEO and CFO) and non-executive positions (Chairman) concerning the presence of women in top management. According to Barone (2023), the distinction lies in the nature of executive directors as company employees involved in management, while non-executive directors, part of the Board of Directors, lack managerial responsibilities because they are not involved in the day-to-day management of the organisation, but rather focus on oversight and policy formulation.

The findings reveal noteworthy differences related to the presence of women in top management positions. Non-executive positions exhibit a reduction in investment efficiency, when the board is led by a Chairwoman, implying a negative impact on investment efficiency.

This association aligns with the concept of the "old boys club", suggesting that women in the Chairman position mirror their male counterparts in skills, experiences and preferences (Adams, 2016).

Conversely, executive positions demonstrate a positive association with investment efficiency, particularly the CEO position, which significantly influences investment efficiency. This aligns with Faccio et al. (2016), suggesting that female CEO tend to avoid risky financing and investment opportunities, resulting in lower leverage and a higher likelihood of survival. Francis et al. (2015) propose that female CFO increase conservative accounting, associated with improved investment efficiency, although we only find evidence for the CEO position. Therefore, hypothesis 1, positing a positive impact of women in top management on investment efficiency, is supported solely for the CEO position.

The Crisis Gender variable's coefficient suggests that the presence of women in top management during the economic crisis negatively influences investment efficiency. This contradicts the general trend of crisis mitigation in investment inefficiency but aligns with Darrah (2018) arguments, on the changing relationship between senior managers' gender and investment efficiency during crises, both in situations of overinvestment and underinvestment.

Control variables exert varying effects on the investment efficiency. While most variables exert positive effects, notably, higher sales growth increases the likelihood of investment inefficiency. Larger firms find it easier to access external finance, reducing investment efficiency, which is consistent with prior research. Older and more leveraged firms tend to improve investment efficiency, reducing over- and under-investment situations. The ROA variable indicates that firms with a high ROA reduce the level of investment inefficiency, supported by Arun et al. (2015) and Shin et al. (2020).

Table 4 – Base Model for the Investment Efficiency

	(1)	(2)	(3)	(4)	(5)	(6)
Chairman	0.028*	0.028*	0.020	0.019		
	(0.017)	(0.017)	(0.016)	(0.016)		
CEO	-0.032**	-0.032**			-0.027*	-0.027*
	(0.015)	(0.015)			(0.014)	(0.014)
CFO	-0.013	-0.013			-0.013	-0.013
	(0.012)	(0.012)			(0.012)	(0.012)
Investment	0.098***	0.098***	0.098***	0.098***	0.098***	0.098***
	(0.010)	(0.010)	(0.010)	(0.010)	(0.010)	(0.010)
ΔSales	0.006***	0.006***	0.006***	0.006***	0.006***	0.006***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
NegativeΔSales	-0.098***	-0.098***	-0.098***	-0.098***	-0.098***	-0.098***
	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)
ΔSales× NegativeΔSales	0.579***	0.579***	0.579***	0.579***	0.579***	0.579***
	(0.015)	(0.015)	(0.015)	(0.015)	(0.015)	(0.015)
Size	0.028***	0.027***	0.027***	0.027***	0.028***	0.027***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Age	-0.089***	-0.089***	-0.089***	-0.089***	-0.089***	-0.089***
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
Leverage	-0.088***	-0.087***	-0.087***	-0.086***	-0.087***	-0.087***
	(0.016)	(0.016)	(0.016)	(0.016)	(0.016)	(0.016)
Cash	0.027	0.027	0.026	0.026	0.027	0.027
	(0.022)	(0.022)	(0.022)	(0.022)	(0.022)	(0.022)
ROA	-0.069**	-0.069**	-0.068**	-0.068**	-0.069**	-0.069**
	(0.027)	(0.027)	(0.027)	(0.027)	(0.027)	(0.027)
Crisis		-0.017		-0.017		-0.018
		(0.012)		(0.012)		(0.012)
Crisis Gender		0.027*		0.027*		0.028*
		(0.015)		(0.015)		(0.015)
Constant	-0.255***	-0.245***	-0.252***	-0.243***	-0.254***	-0.245***
	(0.050)	(0.050)	(0.050)	(0.050)	(0.050)	(0.050)
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Sector FE	Yes	Yes	Yes	Yes	Yes	Yes
Country FE	Yes	Yes	Yes	Yes	Yes	Yes
N	11,730	11,730	11,730	11,730	11,730	11,730
Adjusted R^2	0.2983	0.2984	0.298	0.2982	0.2982	0.2983
F-test	111.8	109.45	116.81	114.25	114.25	111.81

Note: The Table presents models (2) and (3). The dependent variable is measured by *Efficiency*. ***, ** and * correspond to significance levels of 1%, 5% and 10%, respectively.

4.2. Overinvestment and Underinvestment

The Efficiency measures the absolute value of the residuals obtained through the investment efficiency model (1) and comprise our investment in efficiency. The use of the absolute value allows the formulation of two distinct scenarios of investment inefficiency: when the dependent variable's residual exhibits a positive deviation, it signifies overinvestment (Over); or when the

residual shows a negative deviation, as it is multiplied by -1 to indicate a situation of underinvestment (Under). Regressions (1) and (3) in Table 5 correspond to estimations of equation (2) and (3) for the two separate subsamples of investment efficiency.

Table 5 – Over- and Under-Investment

	(1) Over	(2) Over	(3) Under	(4) Under
Chairman	0.087*	0.089*	-0.022***	-0.022***
	(0.051)	(0.051)	(0.008)	(0.008)
CEO	-0.042	-0.041	0.006	0.007
	(0.046)	(0.046)	(0.007)	(0.007)
CFO	-0.021	-0.022	0.002	0.002
	(0.035)	(0.035)	(0.006)	(0.006)
Investment	0.058	0.058	0.011**	0.011**
	(0.044)	(0.044)	(0.005)	(0.005)
ΔSales	0.006***	0.006***	0.006***	0.006***
	(0.000)	(0.000)	(0.001)	(0.001)
NegativeΔSales	-0.040	-0.040	0.053***	0.053***
	(0.027)	(0.027)	(0.003)	(0.003)
ΔSales× NegativeΔSales	-0.522***	-0.524***	-0.586***	-0.586***
	(0.174)	(0.174)	(0.007)	(0.007)
Size	-0.013***	-0.013***	-0.026***	-0.026***
	(0.004)	(0.004)	(0.001)	(0.001)
Age	-0.026***	-0.026***	0.051***	0.051***
	(0.010)	(0.010)	(0.002)	(0.002)
Leverage	0.099**	0.097**	0.096***	0.097***
	(0.049)	(0.049)	(0.008)	(0.008)
Cash	0.138**	0.137**	0.038***	0.038***
	(0.060)	(0.060)	(0.012)	(0.012)
ROA	0.147	0.149*	0.077***	0.077***
	(0.090)	(0.090)	(0.013)	(0.013)
Crisis		-0.042		0.009
		(0.035)		(0.005)
Crisis Gender		0.070		-0.015*
		(0.045)		(0.008)
Constant	0.559***	0.553***	0.446***	0.452***
	(0.121)	(0.121)	(0.031)	(0.030)
Year FE	Yes	Yes	Yes	Yes
Sector FE	Yes	Yes	Yes	Yes
Country FE	Yes	Yes	Yes	Yes
N	3,174	3,174	8,556	8,556
Adjusted R²	0.0715	0.0711	0.572	0.5719
F-test	6.31	6.4	249.53	254.92

Note: The Table presents models (2) and (3) restricted for the samples of under- and overinvestment. ***, ** and * correspond to significance levels of 1%, 5% and 10%, respectively.

In the scenario of overinvestment (Over), results suggest that the presence of women in non-executive positions exacerbates investment inefficiency. The Chairman variable presents a negative association with underinvestment (Under), indicating that the presence of women as

Chairperson contributes to the improvement of investment inefficiency, mitigating underinvestment. Results for the executive positions are inconclusive. Overall, we find support for the second research hypothesis exclusively related to the non-executive positions held by female board members.

Examining the presence of women in top management during the 2012 economic crisis, it is found weak support that such representation fosters investment efficiency.

The results show a positive association between higher sales growth and increased inefficiency, while larger and older firms demonstrate a capacity to mitigate inefficiency. Higher leverage and increased cash holdings are linked to deviations from optimal investment levels, especially in the overinvestment scenario. Significantly, the cash variable attains statistical significance, suggesting a connection between elevated cash holdings and a proclivity for investment inefficiency decisions, contrary to the findings of the base model. Moreover, firms with higher profitability display a tendency toward overinvestment rather than underinvestment. Overall, in the context of underinvestment, most control variables seem to diminish investment efficiency.

4.3. Robustness Analysis

The study sample has a concentration over companies headquartered in France, a country renowned for being in the forefront in gender diversity (Ounaha and Levavasseur, 2022; Zenou et al., 2017). To assess whether the results from the previous sections are influenced by this subset, all French-based companies were excluded from the sample. The outcomes are presented in Table 6, where the coefficients of the Chairman, CEO, and CFO variables across all proxies for investment efficiency remain relatively unchanged. This collective consistency reinforces the robustness of the previous findings.

Table 6 – Robustness Checks

	(1) Efficiency	(2) Efficiency	(3) Over	(4) Over	(5) Under	(6) Under
Chairman	0.034*	0.033*	0.064**	0.062**	-0.013	-0.013
	(0.020)	(0.020)	(0.031)	(0.031)	(0.012)	(0.012)
CEO	-0.034*	-0.034*	-0.031	-0.032	0.032***	0.032***
	(0.018)	(0.018)	(0.030)	(0.030)	(0.010)	(0.010)
CFO	-0.008	-0.008	-0.006	-0.005	-0.006	-0.006
	(0.014)	(0.014)	(0.024)	(0.024)	(0.008)	(0.008)
Investment	0.332***	0.332***	0.100***	0.100***	-0.476***	-0.476***
	(0.011)	(0.011)	(0.017)	(0.017)	(0.009)	(0.009)
ΔSales	0.324***	0.324***	0.323***	0.323***	-0.196***	-0.196***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.012)	(0.012)
NegativeΔSales	0.315***	0.315***	0.201***	0.202***	-0.280***	-0.280***
	(0.008)	(0.008)	(0.014)	(0.014)	(0.005)	(0.005)
ΔSales× NegativeΔSales	0.679***	0.679***	0.220***	0.225***	-0.790***	-0.790***
	(0.016)	(0.016)	(0.084)	(0.084)	(0.014)	(0.014)
Size	0.047***	0.047***	0.022***	0.022***	-0.043***	-0.043***
	(0.002)	(0.002)	(0.003)	(0.003)	(0.001)	(0.001)
Age	0.058***	0.059***	0.031***	0.031***	-0.060***	-0.060***
	(0.004)	(0.004)	(0.006)	(0.006)	(0.002)	(0.002)
Leverage	0.091***	0.091***	0.063*	0.065**	-0.100***	-0.100***
	(0.020)	(0.020)	(0.033)	(0.033)	(0.011)	(0.011)
Cash	-1.092***	-1.092***	-0.545***	-0.548***	0.840***	0.840***
	(0.027)	(0.027)	(0.069)	(0.069)	(0.014)	(0.014)
ROA	-2.268***	-2.268***	-1.403***	-1.402***	2.095***	2.095***
	(0.032)	(0.032)	(0.059)	(0.059)	(0.021)	(0.021)
Crisis		-0.016		-0.060***		0.008
		(0.014)		(0.021)		(0.009)
Crisis Gender		0.037*		0.068**		-0.004
		(0.019)		(0.032)		(0.011)
Constant	-1.212***	-1.205***	-0.227***	-0.165*	1.372***	1.372***
	(0.062)	(0.062)	(0.087)	(0.087)	(0.040)	(0.040)
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Sector FE	Yes	Yes	Yes	Yes	Yes	Yes
Country FE	Yes	Yes	Yes	Yes	Yes	Yes
N	9,167	9,167	4,926	4,926	4,241	4,241
Adjusted R^2	0.9922	0.9922	0.9939	0.9939	0.9123	0.9122
F-test	26,476.31	25,895.95	18,207.33	17,816.09	1,002.85	980.37

Note: The Table presents the robustness analyses, and the dependent variable is defined either as *Efficiency* or under- and overinvestment. ***, ** and * correspond to significance levels of 1%, 5% and 10%, respectively.

4.4. Additional Analyses

The information gathered from the Orbis database also enables two distinct analyses. First, the

focus on the equity ownership, involving three dummy variables that link ownership to the role

played in the company, as follows: *Shareholder Chairman*, *Shareholder CEO*, and *Shareholder*

CFO. These variables take the value of 1 if the positions are held by women who are also

shareholders of the company, and 0 otherwise. Second, the gender reassignment among top managers. The gender change analysis features the variables *Change Chairman*, *Change CEO*, and *Change CFO*, which are also dummy variables. They take the value of 1 if there was a change in the gender of each position from year t-1 to year t, and 0 otherwise.

This enables a distinct examination of whether the presence of women in top management positions, where they are also shareholders, influences investment efficiency, and whether a change in the gender of top managers from one year to the next impacts the company's investment efficiency. The results are presented in Table 7. Columns (1) to (6) present results with the firm's equity variables, where columns (1) and (2) reflect investment efficiency, and columns (3) to (6) pertain to inefficiency. The outcomes of gender change variables among top managers in consecutive years are outlined in columns (7) to (12), covering investment efficiency in columns (7) and (8) and over- and underinvestment scenarios in columns (9) to (12).

The outcomes of these supplementary analyses are in line with established literature and reinforce the coefficients derived from prior analyses. However, in the columns associated with the gender change of senior managers, the Chairman variable loses its significance. In other words, having a female Chairperson is indicative of investment inefficiency, but there is no conclusive evidence during years of gender changes, both moving from male to female and the other way around.

Regarding the added variables of equity participation, the *Shareholder Chairman*, *CEO* or *CEO* do not yield conclusive results. Analysing the added variables of gender change among top managers, the results for the Change Chairman variable suggest that a gender change in the Chairperson from one year to the next tends to lead to investment inefficiency, especially in the case of overinvestment.

Table 7 – Additional Analyses

	(1) Efficiency	(2) Efficiency	(3) Over	(4) Over	(5) Under	(6) Under	(7) Efficiency	(8) Efficiency	(9) Over	(10) Over	(11) Under	(12) Under
Chairman	0.034*	0.033*	0.095*	0.093*	-0.017*	-0.016*	0.004	0.003	0.034	0.031	-0.016	-0.015
	(0.018)	(0.018)	(0.054)	(0.054)	(0.009)	(0.009)	(0.020)	(0.020)	(0.060)	(0.060)	(0.010)	(0.010)
CEO	-0.035**	-0.035**	-0.042	-0.043	0.009	0.008	-0.032*	-0.032*	-0.028	-0.030	0.007	0.007
	(0.016)	(0.016)	(0.050)	(0.050)	(0.008)	(0.008)	(0.018)	(0.018)	(0.056)	(0.056)	(0.009)	(0.009)
CFO	-0.012	-0.012	-0.013	-0.013	0.002	0.002	-0.018	-0.018	-0.018	-0.019	0.002	0.002
	(0.013)	(0.013)	(0.036)	(0.036)	(0.006)	(0.006)	(0.019)	(0.019)	(0.056)	(0.056)	(0.010)	(0.010)
Chairman Shareholder	-0.031	-0.031	-0.091	-0.090	-0.022	-0.022						
	(0.041)	(0.041)	(0.173)	(0.173)	(0.019)	(0.019)						
CEO Shareholder	0.020	0.019	-0.004	-0.004	-0.011	-0.011						
	(0.039)	(0.039)	(0.126)	(0.126)	(0.019)	(0.019)						
CFO Shareholder	-0.038	-0.038	-0.155	-0.155	-0.004	-0.004						
	(0.057)	(0.057)	(0.139)	(0.139)	(0.033)	(0.033)						
Chairman Turnover							0.049**	0.050**	0.121*	0.123*	-0.014	-0.014
							(0.023)	(0.023)	(0.069)	(0.069)	(0.012)	(0.012)
CEO Turnover							-0.002	-0.001	-0.037	-0.036	-0.002	-0.002
							(0.026)	(0.026)	(0.081)	(0.081)	(0.013)	(0.013)
CFO Turnover							0.005	0.006	-0.004	-0.001	0.001	0.000
							(0.019)	(0.019)	(0.055)	(0.055)	(0.010)	(0.010)
Investment	0.098***	0.098***	0.058	0.058	0.011**	0.011**	0.098***	0.098***	0.058	0.057	0.011**	0.011**
	(0.010)	(0.010)	(0.044)	(0.044)	(0.005)	(0.005)	(0.010)	(0.010)	(0.044)	(0.044)	(0.005)	(0.005)
ΔSales	0.006***	0.006***	0.006***	0.006***	0.006***	0.006***	0.006***	0.006***	0.006***	0.006***	0.006***	0.006***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.001)	(0.001)	(0.000)	(0.000)	(0.000)	(0.000)	(0.001)	(0.001)
NegativeΔSales	-0.098***	-0.098***	-0.041	-0.040	0.053***	0.053***	-0.098***	-0.098***	-0.041	-0.040	0.053***	0.053***
	(0.006)	(0.006)	(0.027)	(0.027)	(0.003)	(0.003)	(0.006)	(0.006)	(0.027)	(0.027)	(0.003)	(0.003)
ΔSales× NegativeΔSales	0.580***	0.580***	-0.523***	-0.521***	-0.586***	-0.586***	0.579***	0.579***	-0.521***	-0.520***	-0.586***	-0.586***
	(0.015)	(0.015)	(0.174)	(0.174)	(0.007)	(0.007)	(0.015)	(0.015)	(0.174)	(0.174)	(0.007)	(0.007)
Size	0.028***	0.027***	-0.013***	-0.013***	-0.026***	-0.026***	0.027***	0.027***	-0.013***	-0.013***	-0.026***	-0.026***
	(0.001)	(0.001)	(0.004)	(0.004)	(0.001)	(0.001)	(0.001)	(0.001)	(0.004)	(0.004)	(0.001)	(0.001)
Age	-0.089***	-0.089***	-0.025***	-0.026***	0.051***	0.051***	-0.089***	-0.089***	-0.026***	-0.026***	0.051***	0.051***
	(0.003)	(0.003)	(0.010)	(0.010)	(0.002)	(0.002)	(0.003)	(0.003)	(0.010)	(0.010)	(0.002)	(0.002)
Leverage	-0.088***	-0.087***	0.096*	0.098**	0.097***	0.096***	-0.087***	-0.087***	0.097**	0.099**	0.096***	0.096***
	(0.016)	(0.016)	(0.049)	(0.049)	(0.008)	(0.008)	(0.016)	(0.016)	(0.049)	(0.049)	(0.008)	(0.008)
Cash	0.027	0.026	0.137**	0.139**	0.038***	0.038***	0.026	0.026	0.137**	0.138**	0.038***	0.038***
	(0.022)	(0.022)	(0.060)	(0.060)	(0.012)	(0.012)	(0.022)	(0.022)	(0.060)	(0.060)	(0.012)	(0.012)
ROA	-0.069**	-0.069**	0.146	0.144	0.077***	0.077***	-0.068**	-0.068**	0.148	0.147	0.076***	0.076***
	(0.027)	(0.027)	(0.090)	(0.090)	(0.013)	(0.013)	(0.027)	(0.027)	(0.090)	(0.090)	(0.013)	(0.013)
Crisis		-0.017		-0.042		0.009		-0.017		-0.043		0.009
		(0.012)		(0.035)		(0.005)		(0.012)		(0.035)		(0.005)
Crisis Gender		0.027*		0.070		-0.015*		0.028*		0.072		-0.015*
		(0.015)		(0.045)		(0.008)		(0.015)		(0.045)		(0.008)
Constant	-0.255***	-0.245***	0.555***	0.561***	0.452***	0.447***	-0.254***	-0.245***	0.557***	0.564***	0.451***	0.446***
	(0.050)	(0.050)	(0.121)	(0.121)	(0.030)	(0.031)	(0.050)	(0.050)	(0.121)	(0.121)	(0.031)	(0.031)
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Sector FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	11,730	11,730	3,174	3,174	8,556	8,556	11,730	11,730	3,174	3,174	8,556	8,556
Adjusted R2	0.2982	0.2983	0.0706	0.0711	0.5718	0.5719	0.2984	0.2985	0.0712	0.0716	238.98	234.24
F-test	104.81	102.76	6.02	5.95	239.02	234.28	104.92	102.87	6.07	6.00	0.5718	0.5719

Note: The Table presents the results for the additional analyses, and the dependent variable is defined either as *Efficiency* or under- and overinvestment. ***, ** and * correspond to significance levels of 1%, 5% and 10%, respectively.

5. Conclusions and Contribution

Throughout the years, a consistent trend prevails, where top-tier management roles—Chairman of the Board, CEO, and CFO—are predominantly occupied by males. Despite this, a growing awareness has emerged regarding the imperative to augment female representation in these pivotal positions. Concurrently, the European Commission initiated quotas regulation as a proactive measure to address gender disparities in top echelons, aiming to attain a 40% female presence on boards. Robust research posits that women, generally characterized by a lower risk appetite and a commitment to ethical standards, exhibit a proclivity towards conservative investment strategies (Ho et al., 2015).

This study substantively contributes to the investment literature, addressing a conspicuous void in the literature concerning the impact of women in upper echelons on the investment efficiency of European publicly traded firms. Findings illuminate a nuanced relationship between female presence in non-executive roles and investment efficiency, perpetuating the dynamics of the "old boys club" in such positions. In contrast, the presence of women in executive positions emerges as a mitigating factor against investment inefficiency, averting scenarios of both overinvestment and underinvestment. Noteworthy is the inclination of female CEOs to eschew risky financial and investment ventures (Faccio et al., 2016), and the propensity of female CFOs to endorse conservative accounting practices (Francis et al., 2015), although statistically, only the CEO role attains significance.

Amid economic crises, our scrutiny reveals a counterintuitive trend, where the presence of women in top-tier management positions amplifies investment inefficiency. This anomaly can be attributed to women making riskier financing and investment decisions during crises, propelling companies into situations of both overinvestment and underinvestment (Darrah, 2018).

Our study identifies a statistically significant impact when women assume the role of Chairman of the Board, enhancing investment efficiency in underinvestment scenarios but leading to overinvestment in overinvestment scenarios during crises. Conversely, executive positions exhibit a proclivity towards underinvestment when occupied by women, although CEO and CFO variables lack statistical significance. The variable "Gender Crisis" intimates that the presence of women in top management positions during crises tends to mitigate investment inefficiency in underinvestment scenarios.

The robustness analysis affirms the consistency of results across samples, even upon the exclusion of the French dataset. Noteworthy is the positive impact on investment efficiency brought about by changes in the gender composition of the Chairman and CFO roles, particularly when occupied by women who are also shareholders, as well as shifts in CEO gender, although statistical significance is confined to the variable "Change Chairman".

This paper significantly contributes to the existing literature on gender diversity and its impact on investment efficiency in European listed companies. Firstly, the research enriches the discourse by dissecting the influence of gender on investment efficiency in both executive and non-executive roles, challenging prevailing assumptions and adding granularity to our understanding of gender dynamics in corporate decision-making. The identification of a negative impact associated with women in non-executive roles, often associated with oversight and policy formulation, adds a layer of complexity to the ongoing discussion.

Secondly, the study provides valuable insights into the role of female executives, particularly in the CEO position, shedding light on their positive association with investment efficiency. This finding has practical implications for corporate governance, emphasizing the importance of diverse leadership teams and challenging stereotypical notions about risk aversion among female executives.

This research holds significant implications for policymakers, practitioners, and scholars. The nuanced insights offer actionable information for corporate leaders aiming to enhance decision-making processes and crisis resilience within diverse leadership structures. Policymakers can leverage these findings to tailor regulations and initiatives that promote gender balance in key executive positions, fostering efficient resource allocation and value creation. Additionally, the study's robustness across different samples reinforces the validity and generalizability of the identified associations, emphasizing the relevance of considering geographical diversity in future research on gender dynamics in corporate decision-making.

Despite these significant contributions, the study confronts limitations, primarily stemming from the dearth of literature directly linking gender diversity in top management to investment efficiency. Caution in interpretation is advised due to the limited number of women in the sampled positions. The impact of gender on investment efficiency may be influenced by additional factors not accounted for in the current analysis. Moreover, the study's focus on European listed companies may limit the generalizability of findings to other regions or unlisted firms. These limitations underscore the need for further research and exploration of the multifaceted relationship between gender dynamics in top management and investment efficiency.

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